JOSH GREEN, M.D.
GOVERNOR
KE KIA'ĀINA

EDWIN H. SNIFFEN
DIRECTOR
KA LUNA HO'OKELE

Deputy Directors
Nā Hope Luna Ho'okele
DREANALEE K. KALILI
TAMMY L. LEE
CURT T. OTAGURO
ROBIN K. SHISHIDO

STATE OF HAWAI'I | KA MOKU'ĀINA 'O HAWAI'I
DEPARTMENT OF TRANSPORTATION | KA 'OIHANA ALAKAU
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

HWY-K 4.250384

January 9, 2026

VIA ELECTRONIC: https://planning.hawaii.gov/erp/submittal-form/

TO: JAMES KUNANE TOKIOKA, DIRECTOR
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT AND TOURISM

THROUGH: MARY ALICE EVANS, DIRECTOR
OFFICE OF PLANNING AND SUSTAINABLE DEVELOPMENT

FROM: EDWIN H. SNIFFEN
DIRECTOR OF TRANSPORTATION

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT (DEA) AND ANTICIPATED FINDING OF NO SIGNIFICANT IMPACT (FONSI) FOR
KUHIO HIGHWAY INTERSECTION IMPROVEMENTS
TEMPORARY BYPASS ROAD SOUTH TERMINUS
DISTRICT OF PUNA, COUNTY OF KAUAI, STATE OF HAWAII
FEDERAL-AID PROJECT NO. NH-056-1(066)

The Hawaii Department of Transportation has reviewed the attached DEA and FONSI determination for the proposed Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road Southern Terminus Project on the island of Kauai for publication in the next available edition of *The Environmental Notice.*

In accordance with the requirements for Hawaii Revised Statutes (HRS) Chapter 343, we are providing this DEA electronically via the "*Submittal Form for HRS Chapter 343 Publications in the Periodic Bulletin*". This submittal includes a **searchable PDF** file of the DEA and a **.zip file** containing a shapefile of the project area boundary.

If you have any questions, please contact Eric Fujikawa, Highways Kauai District Engineer at (808) 241-3006 or by email at eric.i.fujikawa@hawaii.gov.

Attachment

From: dbedt.opsd.erp@hawaii.gov
To: DBEDT OPSD Environmental Review Program
Subject: New online submission for The Environmental Notice
Date: Monday, April 6, 2026 8:53:06 AM

Action Name

Kūhiō Highway Intersection Improvements at Temporary Kapaʻa Bypass Road Southern Terminus

Type of Document/Determination

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

HRS §343-5(a) Trigger(s)

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

Judicial district

Kawaihau, Kauaʻi

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

(4) 4-3-010:001, (4) 4-3-010:005, Roadway Right-of-Way (ROW) for Kūhiō Highway, Papaloa Road, and Kapaʻa Bypass Road [(4) 4-3-001:999; (4) 4-3-002:999; and (4) 4-3-010:999]

Action type

Agency

Other required permits and approvals

Endangered Species Act Section 7 Consultation (with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service); Essential Fish Habitat Consultation; Section 106 of the National Historic Preservation Act; Farmland Conversion Impact Rating Form; CZM Federal Consistency Review; National Pollutant Discharge Elimination System Permit; HRS Chapter 6E Historic Preservation Review; Noise Permit and Noise Variance; and County of Kauai Department of Public Works Grading, Grubbing, and Stockpiling Permit.

Proposing/determining agency

Hawaiʻi Department of Transportation

Agency jurisdiction

State of Hawaiʻi

Agency contact name

Joel Bautista

Agency contact email (for info about the action)

joel.o.bautista@hawaii.gov

Email address for receiving comments

KuhioKapaaIntersection@wsp.com

Agency contact phone

(808) 241-3015

Agency address

1720 Haleukana Street
Lihue, Hawaii 96766
United States
Map It

Is there a consultant for this action?

Yes

Consultant

WSP USA

Consultant contact name

Dennis Silva Jr.

Consultant contact email

KuhioKapaaIntersection@wsp.com

Consultant contact phone

(808) 566-2274

Consultant address

1001 Bishop Street Suite 2400
Honolulu, HI 96813
United States
Map It

Action summary

The Hawai'i Department of Transportation (HDOT) proposes to realign the southern terminus of Kapa'a Bypass Road at Kūhiō Highway with the existing intersection of Kūhiō Highway and Papaloa Road. The realignment would consolidate the two existing T- intersections into a single full-access intersection. In addition to consolidating the intersections, the realignment would provide the opportunity to allow left turns from Papaloa Road onto Kūhiō Highway. Installation of approximately 30-foot tall, safety standard-compliant highway lights is also proposed as a part of this project. The purpose of these intersection improvements is to improve roadway safety and intersection operations in the area.

Reasons supporting determination

Please see Chapter 5- Anticipated Finding of No Significant Impact.

Attached documents (signed agency letter & EA/EIS)

- HWY-K-4.250384_Kuhio-Hwy-Intersection-Improvements_DEA_combined-toERP1.pdf
- HWY-K-4.250384_HRS-343_Kuhio-Hwy-Intersection_Imp.-Temp-Bypass-Road-DraftEATransm-ADA2.pdf

Action location map

- ProjectAPE2.zip

Compliance certification (HRS §368-1.5):

The authorized individual listed below certifies that documents submitted are unlocked, searchable, and compliant with the Hawaii Electronic Information Technology Disability Access Standards (including, but not limited to transcripts, captions, and other descriptions accompanying audio/video files). The individual acknowledges that the submitter retains the responsibility for compliance after documents have been published and any compliance queries will be directed back to the agency and/or applicant.

Authorized individual
Isabella McRae
Authorized individual email
KuhioKapaaIntersection@wsp.com
Authorized individual phone
(808) 566-2235
Authorization
• The above named authorized individual hereby certifies that he/she has the authority to make this submission.

KŪHIŌ HIGHWAY INTERSECTION IMPROVEMENTS

AT TEMPORARY KAPA‘A BYPASS ROAD SOUTHERN TERMINUS

Federal Aid Project No. NH-056-1(066)

DISTRICT OF KAPA‘A
ISLAND OF KAUA‘I

DRAFT ENVIRONMENTAL ASSESSMENT

KŪHIŌ HIGHWAY INTERSECTION IMPROVEMENTS

FEDERAL-AID PROJECT NO. NH-056-1(066)

KŪHIŌ HIGHWAY INTERSECTION IMPROVEMENTS AT TEMPORARY KAPAʻA BYPASS ROAD SOUTHERN TERMINUS

DISTRICT OF KAPAʻA

ISLAND OF KAUAʻI

APRIL 2026

DRAFT ENVIRONMENTAL ASSESSMENT
Kūhiō Highway Intersection Improvements at Temporary Kapa‘a Bypass Road Southern Terminus
Federal-Aid Project No. NH-056-1(066)
Kapa‘a, Island of Kaua‘i

Prepared Pursuant to the Hawai‘i Environmental Policy Act, Chapter 343, Hawai‘i Revised Statutes, and Title 11, Chapter 200.1, Hawai‘i Department of Health Administrative Rules by the:

Department of Transportation, Kaua‘i District
State of Hawai‘i

The following person may be contacted for additional information concerning this document:

Joel Bautista, Project Manager
Department of Transportation, Highways Division, Kaua‘i District
1720 Haleukana Street
Lihue, HI 96766
(808) 241-3015
joel.o.bautista@hawaii.gov

This Draft Environmental Assessment (EA) discloses the foreseeable primary, secondary, and cumulative environmental impacts that could result from the proposed project’s implementation and commits to specific measures to avoid, minimize, or mitigate adverse impacts to the environment. This EA also contains a record of consultation activities conducted to date as part of project planning. The Hawai‘i Department of Transportation (HDOT) proposes to realign the southern terminus of Kapa‘a Bypass Road at Kūhiō Highway with the existing intersection of Kūhiō Highway and Papaloa Road. The realignment would consolidate the two existing T-intersections into a single full-access intersection. In addition to consolidating the intersections, the realignment would provide the opportunity to allow left turns from Papaloa Road onto Kūhiō Highway. Installation of approximately 30-foot tall, safety standard-compliant highway lights is also proposed as a part of this project. The purpose of these intersection improvements is to improve roadway safety and intersection operations in the area.

HDOT anticipates that the project is not likely to have a “significant” adverse effect in accordance with Hawai‘i Revised Statutes (HRS) Chapter 343 and Hawai‘i Administrative Rules (HAR) Chapter 11-200.1-13. HDOT anticipates issuing a “Finding of No Significant Impact” (FONSI) for the project, which is documented in Chapter 5 of this EA.

TABLE OF CONTENTS

Section Page

Chapter 1 Description of the Proposed Action 1-1
1.1 Introduction 1-1
1.2 Purpose of this Document 1-1
1.3 Organization of this Document 1-4
1.4 Naming Conventions Used in this Document 1-4
1.5 Project Purpose and Need 1-5
1.5.1 Improve Intersection Operations 1-6
1.5.2 Improve Safety 1-6
1.6 Proposed Action: Two-Lane Roundabout 1-7
1.7 Other Alternatives Considered 1-11
1.7.1 No Action Alternative 1-11
1.7.2 Turbo Roundabout 1-12
1.7.3 Signalized Intersection 1-13
1.8 Project Cost 1-16
1.9 Project Schedule 1-16
1.10 Permits and Approvals 1-16

Chapter 2 Affected Environment, Potential Impacts, and Proposed Mitigation 2-1
2.1 Physical Geography and Soils 2-1
2.1.1 Existing Conditions 2-1
2.1.2 Potential Impacts 2-2
2.1.3 Avoidance, Minimization, and Mitigation Measures 2-4
2.2 Land Use 2-4
2.2.1 Existing Conditions 2-4
2.2.2 Potential Impacts 2-5
2.2.3 Avoidance, Minimization, and Mitigation Measures 2-10
2.3 Historic and Archaeological Resources 2-10
2.3.1 Regulatory Context 2-10
2.3.2 Existing Conditions 2-11
2.3.3 Potential Impacts 2-17
2.3.4 Avoidance, Minimization, and Mitigation Measures 2-17
2.4 Cultural Resources 2-17
2.4.1 Existing Conditions 2-17
2.4.2 Potential Impacts 2-18
2.4.3 Avoidance, Minimization, and Mitigation Measures 2-19

2.5 Biological Resources 2-19
2.5.1 Regulatory Context 2-19
2.5.2 Existing Conditions 2-19
2.5.3 Potential Impacts 2-24
2.5.4 Avoidance, Minimization, and Mitigation Measures 2-28
2.6 Surface Water Resources and Wetlands 2-29
2.6.1 Existing Conditions 2-29
2.6.2 Potential Impacts 2-32
2.6.3 Avoidance, Minimization, and Mitigation Measures 2-32
2.7 Parks and Recreational Resources 2-33
2.7.1 Existing Conditions 2-33
2.7.2 Potential Impacts 2-33
2.7.3 Avoidance, Minimization, and Mitigation Measures 2-33
2.8 Visual and Aesthetic Resources 2-35
2.8.1 Existing Conditions 2-35
2.8.2 Potential Impacts 2-35
2.8.3 Avoidance, Minimization, and Mitigation Measures 2-35
2.9 Transportation Infrastructure and Traffic 2-41
2.9.1 Existing Conditions 2-41
2.9.2 Potential Impacts 2-43
2.10 Natural Hazards and Sea-Level Rise 2-45
2.10.1 Existing Conditions 2-45
2.10.2 Potential Impacts 2-49
2.10.3 Avoidance, Minimization, and Mitigation Measures 2-52
2.11 Public Services, Utilities and Infrastructure 2-52
2.11.1 Existing Conditions 2-52
2.11.2 Potential Impacts 2-52
2.11.3 Avoidance, Minimization, and Mitigation Measures 2-53
2.12 Noise 2-53
2.12.1 Existing Conditions 2-53
2.12.2 Potential Impacts 2-53
2.12.3 Avoidance, Minimization, and Mitigation Measures 2-54
2.13 Air Quality 2-54
2.13.1 Existing Conditions 2-54
2.13.2 Potential Impacts 2-56
2.13.3 Avoidance, Minimization, and Mitigation Measures 2-56
2.14 Social and Economic Conditions 2-57
2.14.1 Existing Conditions 2-57
2.14.2 Potential Impacts 2-59
2.14.3 Avoidance, Minimization, and Mitigation Measures 2-60

2.15 Hazardous Materials and Solid Waste Management 2-60
2.15.1 Existing Conditions 2-60
2.15.2 Potential Impacts 2-60
2.15.3 Avoidance, Minimization, and Mitigation Measures 2-62
2.16 Environmental Justice 2-62
2.16.1 Existing Conditions 2-62
2.16.2 Potential Impacts 2-63
2.16.3 Avoidance, Minimization, and Mitigation Measures 2-63
2.17 Secondary and Cumulative Impacts 2-63
2.17.1 Secondary Impacts 2-63
2.17.2 Cumulative Impacts 2-64

Chapter 3 Consistency with Government Plans and Policies 3-1
3.1 State of Hawai‘i Plans and Controls 3-1
3.1.1 Hawai‘i State Plan 3-1
3.1.2 Hawai‘i Coastal Zone Management Program 3-1
3.1.3 Federal-Aid Highways 2035 Transportation Plan for the District of Kaua‘i 3-1
3.1.4 Hawai‘i 2050 Sustainability Plan 3-2
3.1.5 Bike Plan Hawai‘i 3-2
3.2 County of Kaua‘i Plans 3-3
3.2.1 Kaua‘i County General Plan 3-3
3.2.2 East Kaua‘i Community and Circulation Plan 3-3
3.2.3 Comprehensive Zoning Ordinance 3-3

Chapter 4 Comments and Coordination 4-1
4.1 Pre-Assessment and Early Consultation 4-1
4.2 Public Meeting 4-3
4.3 Regulatory Coordination 4-4
4.3.1 Federal Coordination 4-5
4.3.2 State and Local Coordination 4-7

Chapter 5 Anticipated Finding of No Significant Impact 5-1

Chapter 6 References 6-1

APPENDICES

Appendix A Pre-Draft Environmental Assessment Coordination and Consultation and Regulatory Correspondence

Appendix A.1 ..... Pre-Draft Environmental Assessment Coordination and Consultation
Appendix A.2 ..... Pre-Draft Environmental Assessment Public Meeting Items
Appendix A.3 ..... Regulatory Coordination and Correspondence

Appendix B Alternatives Analysis Report

Appendix C Archaeological Literature Review and Field Inspection Report

Appendix D Cultural Impact Assessment

Appendix E Flora and Fauna Survey Report

Appendix F Hawai‘i Coastal Zone Management Program, Chapter 205(A), HRS

Appendix G Kaua‘i County General Plan, Kaua‘i County Planning Department

Appendix H Hawai‘i State Plan

LIST OF FIGURES

Figure 1-1: Project Location Map 1-2
Figure 1-2: Project Area Map with TMK Parcels 1-3
Figure 1-3: Existing Intersection Conditions 1-5
Figure 1-4: Proposed Action: Two-Lane Roundabout 1-10
Figure 1-5. Turbo-Lane Roundabout 1-14
Figure 1-6: Signalized Intersection Alternative 1-15
Figure 2-1: Soils in the Project Area Map 2-3
Figure 2-2: State Land Use District Map 2-6
Figure 2-3: County Zoning Map 2-7
Figure 2-4: Special Management Area Map 2-8
Figure 2-5: Agricultural Lands of Importance to the State of Hawai‘i 2-9
Figure 2-6: Area of Potential Effects and *Ahupua‘a* Map 2-12
Figure 2-7: Previous Archaeological Studies Map (Keala Pono) 2-14
Figure 2-8: Historic Properties and Possible Archaeological Features 2-16
Figure 2-9: NMFS ESA Critical Habitat Map 2-23
Figure 2-10: Essential Fish Habitat Map 2-25
Figure 2-11: Streams and Watersheds Map 2-30
Figure 2-12: Wetlands in the Project Area 2-31
Figure 2-13: Parks and Recreation Map 2-34
Figure 2-14: Site Photos 2-36
Figure 2-15: Flood Insurance Rate Map 2-47
Figure 2-16: Tsunami Evacuation Zone Map 2-48
Figure 2-17: Sea-Level Rise Exposure Area Map 2-50
Figure 2-18: Fire Risk Map 2-51
Figure 2-19: Hazardous Materials Map 2-61

LIST OF TABLES

Table 1-1: Tax Map Key Parcels and Use of Land 1-9
Table 1-2: Alternatives Comparison 1-11
Table 1-3: List of Permits and Approvals by Agency 1-16
Table 2-1: Possible Archaeological Features Identified During the Field Inspection 2-15
Table 2-2: Section 7 and 195D Species and Migratory Birds of Conservation Concern that May Occur in the Vicinity of the Project Area 2-22
Table 2-3: LOS for Existing and Year 2043 No Action Alternative Conditions 2-43
Table 2-4: LOS for Proposed Action: Two-Lane Roundabout 2-44
Table 2-5: Noise Levels of Common Construction Equipment 2-54
Table 2-6: National and State Ambient Air Quality Standards 2-55
Table 2-7: Demographic Conditions 2-58
Table 2-8: Income in the Past 12-Months (In 2023 Inflation-Adjusted Dollars) 2-59

Table 2-9: Language English Proficiency Conditions 2-63
Table 4-1: Summarized Comments and HDOT Responses to Pre-Assessment Consultation Letters 4-2
Table 4-2: Summary of Public Meeting Comments and HDOT Responses 4-4

ABBREVIATIONS AND ACRONYMS

AAQS	Ambient Air Quality Standards
ALISH	Agricultural Lands of Importance to the State of Hawai‘i
AMP	Archaeological Monitoring Plan
APE	Area of Potential Effects
BMP	Best Management Practice
CatEx	Categorical Exclusion
CDP	Census Designated Place
CFR	Code of Federal Regulations
CIA	Cultural Impact Assessment
CZM	Coastal Zone Management
CZO	Comprehensive Zoning Ordinance
DAR	Division of Aquatic Resources
dBA	A-weighted decibels
DLNR	Department of Land and Natural Resources
DOFAW	Division of Forestry and Wildlife
DOW	Department of Water
EA	Environmental Assessment
EFH	Essential Fish Habitat
EKCCP	East Kaua‘i Community and Circulation Plan
EPA	Environmental Protection Agency
ESA	Endangered Species Act of 1973
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
General Plan	Kaua‘i County General Plan
HAR	Hawai‘i Administrative Rules
HDOH	Hawai‘i Department of Health
HDOT	Hawai‘i Department of Transportation
HEER	Hazard Evaluation and Emergency Response
HRHP	Hawai‘i Register of Historic Places

HRS	Hawai‘i Revised Statutes
iHEER	HEER’s online database of hazardous material release sites
IPaC	Information for Planning and Consultation
LEP	Limited English Proficiency
Leq	energy level equivalent
LOS	Level of Service
LRFI	Archaeological Literature Review and Field Inspection
MBTA	Migratory Bird Treaty Act
mph	miles per hour
msl	mean sea level
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resource Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
OPSD	Office of Planning and Sustainable Development
PIRO	Pacific Islands Regional Office of the National Marine Fisheries Service
ROW	right-of-way
Section 4(f)	Section 4(f) of the U.S. Department of Transportation Act
Section 106	Section 106 of the National Historic Preservation Act (NHPA)
SHPD	State Historic Preservation Division
SHPO	State Historic Preservation Officer
SIHP	State Inventory of Historic Places
SLR	sea-level rise
SLR-XA	sea-level rise exposure area
SLUD	State Land Use District
SMA	Special Management Area
SWCA	SWCA Environmental Consultants
Title VI	Title VI of the Civil Rights Act

TMK	Tax Map Key
U.S.C.	United States Code
USFWS	U.S. Fish and Wildlife Service

EXECUTIVE SUMMARY

Project Name	Kūhiō Highway Intersection Improvements at Temporary Kapaʻa Bypass Road Southern Terminus
Proposing Agency	State of Hawaiʻi Department of Transportation (HDOT)
Determining Agency	HDOT
Landowner	State of Hawaiʻi, My Kapaʻa LLC
General Location	The project is located in Kapaʻa, East Kauaʻi, Island of Kauaʻi. The project area is the Kūhiō Highway intersection with Papaloa Road and Temporary Kapaʻa Bypass Road, between Wailua and Kapaʻa Town at roughly 22°03'18.4"N, 159°19'46.9"W.
Tax Map Keys	(4) 4-3-010:001, 4-3-010:005, Roadway Right-of-Way (ROW) for Kūhiō Highway, Papaloa Road, and Kapaʻa Bypass Road.
Project Area	The project area is approximately 9.0 acres and is located approximately 0.5 miles east of Wailua River State Park and approximately 0.3 miles north of the Coconut Marketplace shopping center. The project area is approximately 1,100 feet long along the Kūhiō Highway ROW, approximately 200 feet along Papaloa Road makai of Kūhiō Highway, and 720 feet mauka of Kūhiō Highway along Kapaʻa Bypass Road, and extending into undeveloped private property lands.
Existing Uses of the Project Area	The project area currently consists of the roadway ROW—the state-owned Kūhiō Highway ROW, the privately-owned Kapaʻa Bypass Road ROW (with some sections being state-owned to the north of the project), as well as the county-owned Papaloa Road, and the separate but adjacent intersections of Papaloa Road and Kapaʻa Bypass Road with Kūhiō Highway, respectively. The project area also consists of mostly undeveloped private lands, which contain wetland environments. A portion of the private lands comprises facilities for a lessee, Healing Horses of Kauaʻi, which has buildings and horse pens located within the project area.

Proposed Project and Cost	The Proposed Action is the realignment of the southern terminus of Temporary Kapa‘a Bypass Road at Kūhiō Highway to intersect with the existing intersection of Kūhiō Highway and Papaloa Road near the Coconut Marketplace shopping center. The realignment would consolidate the two existing unsignalized T intersections into a single full-access, two-lane roundabout intersection. The total cost of the Proposed Action is estimated at $25 million (in 2024 dollars). These costs will be refined as engineering details are developed.
State Land Use Designation	Agricultural, Urban
County Zoning	County of Kaua‘i Zoning: A (Agricultural), O (Open Space), R-10 (Residential [10 units/acre])
Special Management Area	Papaloa Road and Kūhiō Highway are within the Special Management Area (SMA). The rest of the project area (Tax Map Key [TMK] parcel 4-3-010:001, :005, and the rest of the Kūhiō Highway ROW) sits outside of the SMA. However, the Proposed Action would not require an SMA Permit because the proposed activities do not constitute a development, as defined in Hawai‘i Revised Statutes (HRS) 205A-22(Q).
Anticipated Determination	Finding of No Significant Impact (FONSI) pursuant to HRS Chapter 343.

Anticipated Impacts	• **Land Use** The Proposed Action would relocate the Temporary Kapaʻa Bypass Road to the northeast (Kapaʻa-bound). This would require permanent ROW acquisition of approximately 1 acre of the private property, TMK parcel 4-3-010:005. An additional 2 acres of this parcel may be temporarily used as a construction staging area. Currently, the private property to be acquired is being leased by a nonprofit entity, Healing Horses of Kauaʻi. No other changes to existing land uses are anticipated. The Proposed Action is consistent with land development goals listed in the Kauaʻi General Plan. HDOT is coordinating with the landowner of TMK parcel 4-3-010:005 to mitigate impacts of permanent ROW acquisition and temporary staging on the landowner and lessee. HDOT would follow the process of eminent domain/acquisition and the Uniform Act. With the conversion of agricultural lands into the roadway ROW, FHWA would coordinate with National Resource Conservation Service (NRCS) as well. With proposed mitigation measures, no significant adverse impacts are expected. • **Historic and Archaeological Resources** A Field Inspection completed for the project identified 13 previously unrecorded potentially historic archaeological surface features. Additionally, the multiple historic properties were identified within the project area (i.e., hearth, ʻauwai, and human skeletal remains, human burials, and AT&R railroad remnants). Because of these findings, HDOT anticipates a finding of "Effect, with Proposed Mitigation Measures" under the HRS Chapter 6E-8 review. An Archaeological Monitoring Plan would be implemented to minimize inadvertent discovery of historic, archaeological, and/or cultural resources in the project area. The State Historic Preservation Division (SHPD) is expected to conduct its HRS Chapter 6E-8 review responsibilities in conjunction with Section 106, both of which are still ongoing.

Anticipated Impacts (continued)	• **Cultural Resources** The Proposed Action has a high potential to uncover *iwi kūpuna*. The selected contractor would implement archaeological monitoring during construction to minimize the potential for inadvertent discovery of human burials. With the implementation of an Archaeological Monitoring Plan during construction, no significant impacts to cultural resources are anticipated. • **Biological Resources** Construction would require the clearing of vegetation. However, the project area consists mostly of common nonnative vegetation and has no listed flora species. Other minor and temporary impacts could include construction noise and night lighting during construction. Permanent new street lighting may result in the "take" of protected Hawaiian seabirds that fly over the area, HDOT is consulting with multiple natural resource agencies, including the U.S. Fish and Wildlife Service, and would incorporate measures mandated by federal and state agencies into the project to avoid and minimize impacts to protected Hawaiian seabird species. For example, new lighting would be narrow spectrum, shielded, and directed downward to mitigate seabird fallout. The selected contractor would incorporate Best Management Practices (BMPs) to minimize the introduction and spread of invasive species during construction. Stormwater BMPs would also be incorporated into the project design to minimize the potential for degradation of water quality and impacts to fish and wildlife resources. • **Surface Water Resources and Wetlands** The project would increase paved areas by less than 0.5 acres, thereby increasing impervious pavement and stormwater runoff. This may result in some minor impacts to nearby wetlands and coastal waters. Permanent BMPs would be installed during the project to mitigate the impacts of the increased impervious surfaces.

Anticipated Impacts (continued)	• **Transportation Infrastructure and Traffic** Traffic impacts would include temporary construction-related traffic. Additionally, after the project is complete there would be minor increases in delays for the Kūhiō Highway through movement. In addition, slow-moving queues are also anticipated during the PM peak hours. However, the slowdowns are expected to move more steadily compared to the existing stop-controlled intersection. These impacts are minor in nature; therefore, no significant impacts are anticipated. • **Noise** Construction activities would involve heavy machinery and vehicles that at times may exceed the maximum levels allowed by community noise control regulations. The contractor would obtain a Community Noise Permit and would be required to comply with its terms and conditions. A Community Noise Variance would also be obtained for night, weekend, or holiday construction. No significant impacts are anticipated with adherence to the restrictions in the Community Noise Permit and Community Noise Variance. • **Air Quality** Air quality impacts during construction generally consist of fugitive dust (airborne particulate matter) and mobile source emissions from construction equipment. Airborne, visible fugitive dust generated during construction would be controlled at the project site by the contractor in accordance with the provisions of Hawai‘i Administrative Rules (HAR) Chapter 11-60.1-33, Fugitive Dust. No significant impacts are anticipated.

HAR Chapter 11-200.1-18(d) EA Content Requirements	1. Identification of the applicant or proposing agency. See Section 1.1, Introduction. 2. For applicant actions, identification of the approving agency. This project is an agency action. See “Determining Agency” in this Executive Summary and Section 1.1. 3. List of all required permits and approvals (state, federal, and county) and, for applicants, identification of which approval necessitates Chapter 343, HRS, environmental review. See Section 1.9, Permits and Approvals; Chapter 4, Comments and Coordination; and Appendix A, Pre-Draft Environmental Assessment Coordination and Consultation and Regulatory Correspondence. 4. Identification of agencies, citizen groups, and individuals consulted in preparing the draft EA. See Chapter 4 and Appendix A. 5. General description of the action’s technical, economic, social, cultural, historical, and environmental characteristics. See Chapter 2, Affected Environment, Potential Impacts, and Proposed Mitigation. 6. Summary description of the affected environment, including suitable and adequate regional, location, and site maps, such as Flood Insurance Rate Maps, Floodway Boundary Maps, U.S. Geological Survey topographic maps, or state sea-level rise exposure area maps. See Chapter 2. 7. Identification and analysis of impacts and alternatives considered. See Chapter 2. 8. Proposed mitigation measures. See Chapter 2. 9. Proposing agency or approving agency anticipated determination, including findings and reasons supporting the anticipated FONSI, if applicable. See Chapter 5, Anticipated Finding of No Significant Impact. 10. Written comments and responses to comments received, if any. See Chapter 4; Appendix A.1, Pre-Draft Environmental Assessment Coordination and Consultation; and Appendix A.2, Pre-Draft Environmental Assessment Public Meeting Items.

Chapter 1 Description of the Proposed Action

1.1 Introduction

The State of Hawai‘i Department of Transportation (HDOT), in cooperation with the Federal Highway Administration (FHWA), is proposing the Kūhiō Highway Intersection Improvements at Temporary Kapa‘a Bypass Road Southern Terminus Project (the project) on the Island of Kaua‘i. HDOT is proposing to realign the southern terminus of Temporary Kapa‘a Bypass Road at Kūhiō Highway to match the existing intersection of Kūhiō Highway with Papaloa Road. The realignment would consolidate two existing T intersections into a two-lane roundabout.

The two existing intersections on Kūhiō Highway (State Route 56) are in the East Kaua‘i community of Wailua on the Island of Kaua‘i at roughly 22°03’18.4” N, 159°19’46.9” W. The intersections are bordered by privately owned parcels. The project area contains two parcels on the mauka side of the highway. These parcels are Tax Map Key (TMK) parcel 4-3-010:001, an approximately 356-acre undeveloped lot, and TMK parcel 4-3-010:005, an approximately 26-acre lot (See Figure 1-1 and Figure 1-2).

1.2 Purpose of this Document

The Draft Environmental Assessment (EA) was prepared for the project pursuant to Chapter 343, Hawai‘i Revised Statutes (HRS) and Title 11, Chapter 200.1, Hawai‘i Administrative Rules (HAR). The use of state land and funds requires HRS Chapter 343 review.

The EA discloses the foreseeable primary, secondary, and cumulative environmental impacts that could result from the project’s implementation, and proposes measures to avoid, minimize, or mitigate potential adverse impacts to the environment. Additionally, the EA contains a record of consultation activities that have been conducted to date as part of project planning. Some consultation efforts are ongoing.

HDOT anticipates that the project is not likely to have a “significant” effect in accordance with HRS Chapter 343 and HAR Chapter 11-200.1-13. Therefore, an EA process was selected for the environmental review. If, during the consideration of comments received on the EA, HDOT determines that a significant impact would occur, HDOT will either revise the project to avoid or mitigate the impact’s severity or start preparing an Environmental Impact Statement.

Because federal funds administered by the FHWA will be used to construct the project, the project is also considered a federal action and must comply with the environmental documentation requirements set forth under the National Environmental Policy Act (NEPA), 42 United States Code (U.S.C.) 4332. To comply with NEPA, FHWA anticipates preparing a Categorical Exclusion (CatEx) document that would be consistent with the findings of this Chapter 343 EA. The EA will discuss other applicable federal laws that apply to the proposed project as these regulations have the potential to affect decision-making, including requiring avoidance and mitigation measures.

Figure 1-1: Project Location Map



Source: Hawai‘i Statewide GIS, 2023a, 2025a; ESRI, World Imagery 2026; ESRI, World Hillshade and World Terrain Base 2026.

Figure 1-2: Project Area Map with TMK Parcels



Source: Hawai‘i Statewide GIS 2025; ESRI, World Imagery 2026; ESRI, World Hillshade and World Terrain Base 2026.

1.3 Organization of this Document

The EA is organized as follows:

- Chapter 1 provides an introduction and discusses project alternatives and the purpose for the proposed project.
- Chapter 2 describes existing environmental conditions, potential project impacts, and proposed mitigation measures to reduce the level of potential effects.
- Chapter 3 explains county and state government plans and how the project is consistent with the goals outlined in these documents.
- Chapter 4 discusses the results of early consultation on the project and coordination with state and federal agencies.
- Chapter 5 provides the Anticipated Finding of No Significant Impact (FONSI) statement in accordance with HAR Chapter 11-200.1-18(d)(9).
- Chapter 6 consists of a list of references used in the preparation of the EA.
- Appendices contain records of comments and coordination conducted for this project, as well as various technical reports prepared by specialists and other supporting documents.

1.4 Naming Conventions Used in this Document

The Hawaiian language, also known as *ʻŌlelo Hawaiʻi*, is an important source of knowledge and reference in establishing historical context as well as current definitions of location, setting, and lineage. Consistent with the Council on Environmental Quality's Guidance for Federal Departments and Agencies on Indigenous Knowledge (November 2022), this EA incorporates numerous conventions and terminology used in *ʻŌlelo Hawaiʻi*, most notably the following:

- The EA uses the two Hawaiian diacriticals: the *ʻokina* (ʻ) and the *kahakō* (ā, ē, ī, ō, ū). An *ʻokina* indicates a glottal stop, and a *kahakō* indicates to hold the vowel sound for longer. The use of diacritical marks is based on information from the Hawaiʻi board of geographic names.
- *Makai* (toward the sea) and *mauka* (toward the mountain) generally correspond to the project area's easterly/westerly directions, respectively.
- *Ahupuaʻa* is a traditional land division that typically extends from the top of a mountain along its ridges to the shoreline and into the ocean. An *ahupuaʻa* generally includes a watershed. Each *ahupuaʻa* consists of numerous different ecosystems and habitats that contain all the resources needed for a population to survive.

This EA will use the terminology "toward Līhuʻe" and "toward Kapaʻa" to describe directions in the vicinity of the project area. Kūhiō Highway within the project area is roughly oriented northeast to southwest, so for the purposes of the EA, traffic traveling in the northeast direction will be described as "Kapaʻa-bound" and traffic traveling in the southwest direction will be described as "Līhuʻe-bound". As seen in Figure 1-2, the left side of the project area is in the Līhuʻe direction

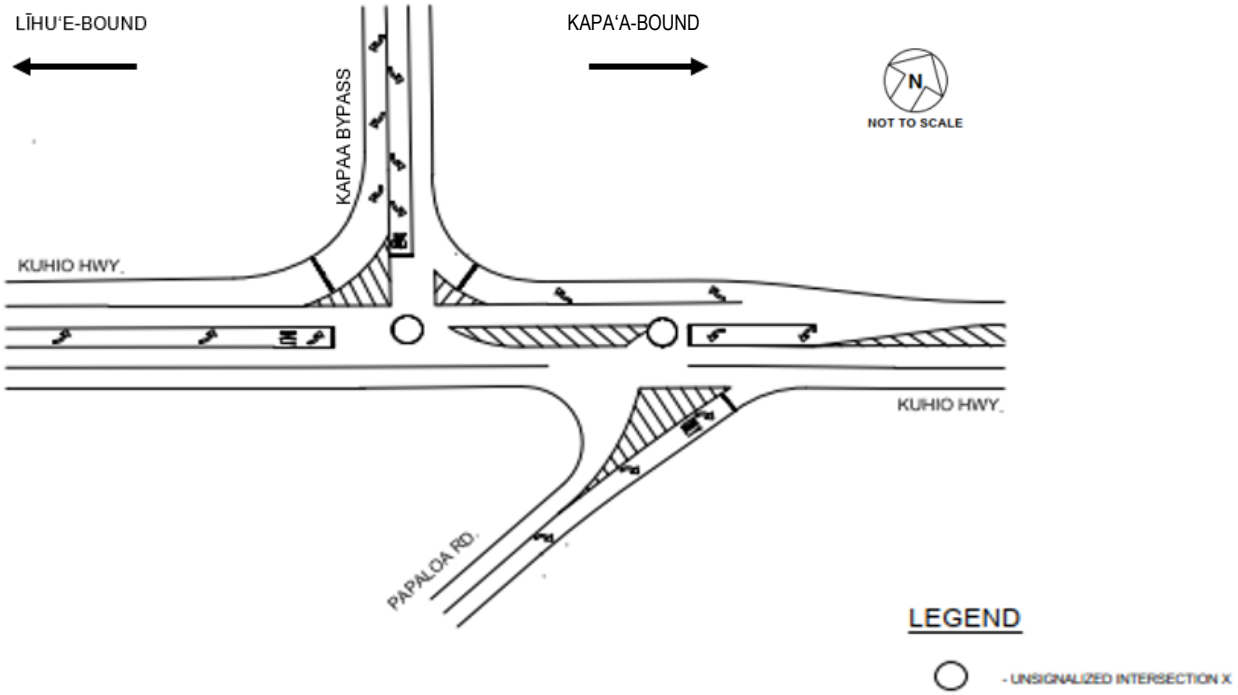
while the right side is the Kapa‘a direction. Papaloa Road has two intersections with Kūhiō Highway, one to the north and one to the south. The project area connects to the northern intersection of Papaloa Road with Kūhiō Highway. For the purpose of this EA, all references to Papaloa Road will refer to the northern intersection. If the southern intersection is referenced, this EA will use the terminology Papaloa Road (south).

Temporary Kapa‘a Bypass Road also has two intersections with Kūhiō Highway, one to the north and one to the south. The project area contains the southern terminus of Temporary Kapa‘a Bypass Road but not the northern terminus. Unless otherwise noted, all references in the EA for Temporary Kapa‘a Bypass Road will refer to its southern terminus and be simplified to Kapa‘a Bypass.

1.5 Project Purpose and Need

Kūhiō Highway is a major thoroughfare that connects Līhu‘e to the northern parts of Kaua‘i. The project area is located in Wailua and contains two unsignalized T intersections. One intersection connects Kūhiō Highway and Papaloa Road — a small road that intersects the highway at an angle from the makai side. Papaloa Road primarily services residents, the Coconut Marketplace, and various resorts and hotels makai of Kūhiō Highway in this area. Roughly 70 feet south is the other intersection at Kūhiō Highway and Kapa‘a Bypass Road, which provides an alternative route to Kūhiō Highway for those who want to avoid slowdowns in Kapa‘a town north of the project area. The southern terminus of Kapa‘a Bypass Road approaches the highway at the project area from the mauka side of Kūhiō Highway (see Figure 1-3).

Figure 1-3: Existing Intersection Conditions



Source: Figure from Austin, Tsutsumi & Associates Inc. 2024; annotations by WSP USA

The project intends to consolidate the two discrete T intersections into one full-access intersection by relocating the southern terminus of Kapaʻa Bypass Road in the Kapaʻa direction. This would align the Kūhiō Highway and Kapaʻa Bypass Road intersection to match up with the intersection of Kūhiō Highway and Papaloa Road. This full-access intersection would improve intersection operations and improve safety in this stretch of Kūhiō Highway, as described further below.

1.5.1 Improve Intersection Operations

The consolidation of the two intersections would improve intersection operations by providing dedicated left-turn movements from Kapaʻa Bypass Road onto Kūhiō Highway Kapaʻa-bound, facilitating left-turn movements from Kūhiō Highway Kapaʻa-bound onto Kapaʻa Bypass Road, and allowing left-turn movements from Papaloa Road onto Kūhiō Highway Līhuʻe-bound (see Figure 1-4).

An Alternatives Analysis Report was completed for the project that assessed existing traffic conditions for the year 2023 and evaluated expected traffic conditions for 2043 (Austin, Tsutsumi, and Associates Inc. 2024). According to this report, all intersection movements currently operate adequately except for the eastbound left-turn movement from Kapaʻa Bypass onto Kūhiō Highway Kapaʻa-bound. In 2043, this movement is anticipated to exceed capacity, making the movement harder to complete with lengthy delays for those who would like to turn left. Installing a two-lane roundabout would improve this movement, reducing lengthy intersection delays (see Appendix B, Alternatives Analysis Report).

Additionally, this Alternatives Analysis Report stated that in 2043, increased Līhuʻe-bound traffic on Kūhiō Highway is anticipated to result in increased delays for cars turning from Kūhiō Highway Kapaʻa-bound onto Kapaʻa Bypass. It is estimated that these increased delays would result in average left-turn queues of approximately 300 feet. However, some queues could extend beyond the designated left-turn pocket and into the Kūhiō Highway Kapaʻa-bound through lane during PM peak traffic hours. In extreme cases, these queues could extend to Papaloa Road (south) roughly 2,000 feet toward Līhuʻe from the Kapaʻa Bypass intersection (see Figure 1-1). Consolidating the intersections into one full-access intersection would provide dedicated left-turn movements, reducing queuing for cars traveling toward Kapaʻa.

Consolidating the intersections would also allow cars from Papaloa Road to turn left onto Kūhiō Highway. Previously, cars in the Papaloa Road area were only allowed to turn left onto Kūhiō Highway from Lanikai Street, a movement that has a poor line of sight (see Section 1.4.2, below, for more details).

1.5.2 Improve Safety

This project intends to improve the safety of the Kapaʻa Bypass and Papaloa Road intersections with Kūhiō Highway by installing a roundabout. Roundabouts contain traffic calming geometries, which are known to reduce fatal and injury crashes by 82 percent compared to two-way stop-controlled intersections and 78 percent compared to a signalized intersection (FHWA n.d.) because

of fewer conflict points and reduced approach speeds. A roundabout would also facilitate multimodal transportation by making pedestrian crossings safer. Sidewalks and crosswalks would be installed in the immediate vicinity of the roundabout, both of which would improve safety.

The only left-turn movement from the Papaloa Road commercial, residential, and resort areas onto Kūhiō Highway Līhuʻe-bound is from a stop-controlled intersection at Lanikai Street on the makai side of the highway near Kintaro Restaurant (see Figure 1-2). This intersection is unsignalized and has limited sight distance. Drivers turning left are required to find a gap within fast-moving highway traffic. Multiple community comments from a public meeting held on September 17, 2025, to discuss alternatives indicated that they believe the left turn from Lanikai Street onto Kūhiō Highway is dangerous and needs to be addressed.

Consolidating the intersection of Kapaʻa Bypass and Kūhiō Highway with Papaloa Road and Kūhiō Highway would create a designated left-turn movement from Papaloa Road. This movement would be safer than the existing left turn from Lanikai Street, as motorists traveling along Kūhiō Highway would be required to slow down at the new consolidated intersection. Additionally, Papaloa Road would have a longer sight distance than Lanikai Street, allowing for a safer left-turn movement onto Kūhiō Highway. This addition of a left-turn movement would allow HDOT to restrict left turns from Lanikai Street and redirect them to Papaloa Road.

1.6 Proposed Action: Two-Lane Roundabout

HDOT plans to realign the southern terminus of Temporary Kapaʻa Bypass Road with the existing intersection of Kūhiō Highway and Papaloa Road near the Coconut Marketplace. The realignment would consolidate these adjacent T intersections into one full-access roundabout consisting of two lanes (see Figure 1-4). The old Kapaʻa Bypass would be removed, hydromulched, and allowed to revegetate naturally.

The two-lane roundabout would have two lanes of Kapaʻa-bound through traffic and one lane of Līhuʻe-bound through traffic along Kūhiō Highway. Līhuʻe-bound through traffic would have only one lane to preserve the existing free right-turn protected lane from Kapaʻa Bypass onto Kūhiō Highway. Comments from the public meeting on September 17, 2025, indicated that this lane configuration was preferred by multiple community members (see Figure 1-4). This alternative would not widen existing lanes or increase the number of lanes in the area. Therefore, roadway capacity is not anticipated to increase. Operationally, this Proposed Action is anticipated to result in minor increases in delays for the Kūhiō Highway through traffic. However, vehicles from Kapaʻa Bypass and Papaloa Road would experience fewer delays. Section 2.9 includes more discussion on traffic analysis.

As part of this project, HDOT would modify the traffic control in this area, such as not allowing left turns from Lanikai Street onto Kūhiō Highway. This left turn traffic at Lanikai Street would be redirected to Papaloa Road to utilize the roundabout instead.

The Kūhiō Highway through lane motion would be designed for WB-67 trucks (trucks with 67-foot distance between front and rear axles). The turning movements from Kapaʻa Bypass and Papaloa Road onto Kūhiō Highway or from Kūhiō Highway onto these two roads would be designed for a WB-50 trucks (trucks with 50-foot distance between the front and rear axles). These design specifications would allow adequate space for commercial vehicles, emergency vehicles, and personal vehicles pulling trailers to negotiate the intersection safely. Surrounding the center of the roundabout would be a truck apron, which would allow larger vehicles to make the turns safely without driving into other lanes.

Permanent highway lighting would be installed at the roundabout and its approaches. The exact location and quantity of lighting installations would be determined during final design per applicable standards and guidelines for motorists and pedestrians. HDOT is also looking into the feasibility of installing bus stops on the makai and mauka sides of Kūhiō Highway on the Kapaʻa side of Papaloa Road fronting the Coconut Marketplace. If installing bus stops is feasible, more details will be provided in the Final EA. The project would also install sidewalks in the immediate vicinity of the roundabout and crosswalks at all roadway crossings. Additionally, roadway signage, guardrails, and drainage features would be installed as part of the intersection. The roundabout would be designed with appropriate drainage features to prevent flooding under normal conditions. Details of drainage features will be determined during the final design.

The total project area is approximately 9 acres and includes the Kūhiō Highway right-of-way (ROW) [4-3-001:999; 4-3-002:999; and 4-3-010:999] and two privately owned TMK parcels mauka of the highway [4-3-010:001 and :005]. The southern terminus of Kapaʻa Bypass Road would be relocated toward Kapaʻa, which would move it into the existing parcel 4-3-010:005. Approximately 5 acres of this parcel is currently leased by the Healing Horses Kauaʻi property and located within the project area. HDOT would permanently acquire approximately 1 acre of leased Healing Horses Kauaʻi property for the new Kapaʻa Bypass ROW. Temporary staging would also occur on approximately 2 acres of this property. This potential staging area would be returned to its preconstruction condition, as much as practicable once construction is completed. The land to be used for permanent ROW acquisition and temporary construction staging is summarized in Table 1-1.

Note that the project area is wider than required for the two-lane roundabout alternative, because the project area was identified prior to choosing the two-lane roundabout as the Proposed Action. The wider project area encompasses the land required to build all alternatives as outlined in Section 1.7. The project area also contains approximately 1 acre of privately owned TMK parcel 4-3-010:001, which would be used during construction. No permanent ROW acquisition would occur in this parcel.

A Traffic Control Plan (TCP) would be prepared for this project. The TCP would address the continued safe operation of Kūhiō Highway at these existing and proposed intersections during construction. Lane closures required to complete construction of the roundabout would be

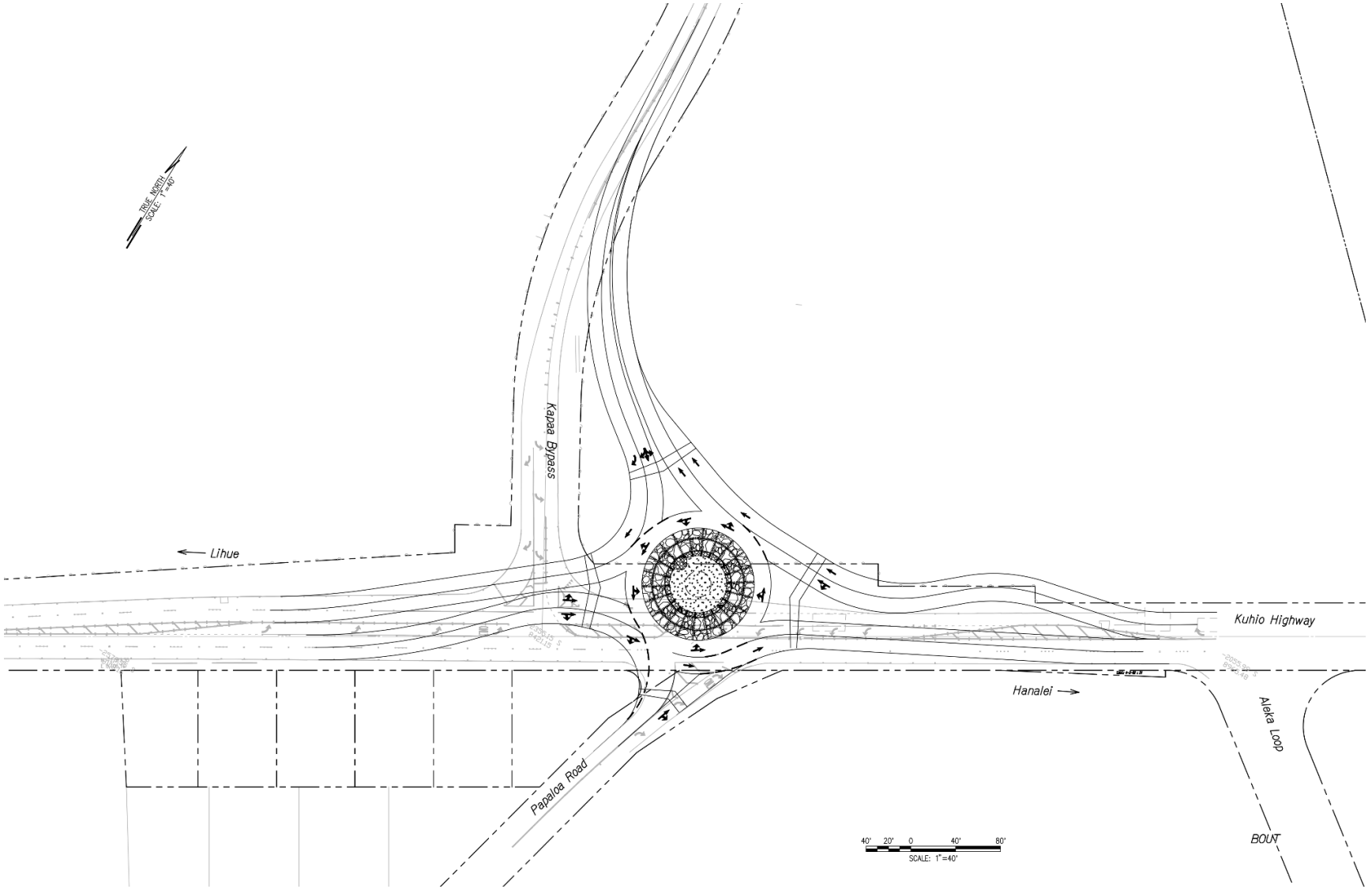
scheduled during off-peak hours to reduce traffic impacts. Nightwork is anticipated to reduce traffic impacts on the surrounding community.

Table 1-1: Tax Map Key Parcels and Use of Land

TMK Parcels (Fee Owner)	Total TMK Parcel Size (acres)	Portion of TMK Parcel in Project Area (acres)	Use of Land
4-3-010:005 (My Kapa‘a LLC – Healing Horses Kaua‘i [Lessee])	25	5	Construction Area
		2	Temporary Staging Area
		1	Permanent ROW Acquisition
4-3-010:001 (My Kapa‘a LLC)	356	1	Construction Area

Source: Acres area approximate and were derived from Hawai‘i Statewide GIS 2025 (Parcels – Hawai‘i Statewide feature layer).
Key: LLC = Limited Liability Company; ROW = right-of-way; TMK = Tax Map Key

Figure 1-4: Proposed Action: Two-Lane Roundabout



Source: WSP USA 2025

1.7 Other Alternatives Considered

Other alternatives were considered to examine the impact of various designs on traffic safety and operations. Each alternative was presented at a Draft EA public scoping meeting on September 17, 2025, and is further described below, including why each was removed from further consideration. The following discussion is based on information presented in the Alternatives Analysis (Austin, Tsutsumi & Associates Inc. 2024). Table 1-2 provides a summary comparison of the Proposed Action and the alternatives considered but not selected.

Table 1-2: Alternatives Comparison

	Proposed Action: Two-Lane Roundabout	No Action	Turbo Roundabout	Signalized Intersection
Satisfies Project Purpose and Need	Yes	No	Yes	Partially
Preserves Protected Right-Turn Lane from Kapa‘a Bypass onto Kūhiō Highway	Yes	Yes	No	Yes
Safety	Most safe	Less safe	Most safe	Less safe
Operational Impact	Small increase in delays along the Kūhiō Highway	N/A	Small increase in delays along the Kūhiō Highway	Travel times are anticipated to remain similar in AM/PM peak hours
Construction Cost (2024)	$25 million	N/A	$25 million	$12 million
Operation and Maintenance Cost (20 Years)	Minimal	Moderate, repaving required	Minimal	$1.2 million
Lifetime	25 years	7–10 years	25 years	10–20 years

Source: Austin, Tsutsumi & Associates Inc. 2024
Key: N/A = not applicable

1.7.1 No Action Alternative

The No Action Alternative would keep the intersection in its current state. This alternative would not satisfy the purpose and need of the project to improve safety and traffic operations in the area. According to the Alternatives Analysis Report, the left-turn movement from Kapa‘a Bypass onto Kūhiō Highway would continue to exceed capacity. Additionally, the increased traffic in the year 2043 would make the Kapa‘a-bound left-turn movement from Kūhiō Highway onto Kapa‘a Bypass increasingly difficult during PM peak traffic. As a result, without any modifications to the roadway system, the traffic queues in the Kūhiō Highway Kapa‘a-bound left-turn lane could back up into the Kapa‘a-bound through lanes.

Also under this alternative, residents and visitors in the Papaloa Road area may continue to make the left turn at Lanikai Street, unless traffic operations are modified at this location to prohibit left turns. Prohibiting left turns from Lanikai Street without any changes to the existing roadway system, would mean that no vehicles would be permitted to take a left turn onto Kūhiō Highway from the Papaloa Road area. Although the primary benefits of this alternative include no construction cost and no construction impacts, this alternative was removed from further consideration because it would not meet the project's purpose and need of improving intersection operations and safety in the area.

1.7.2 Turbo Roundabout

This alternative would consolidate the two T intersections into a single, full-access turbo roundabout intersection. A turbo roundabout is a variation of a multi-lane roundabout that was developed in the Netherlands and has primarily been constructed in Europe, although a few exist in the United States. It is different from a two-lane roundabout because it has lane dividers to discourage lane changes within the roundabout. Additionally, it has a spiral geometry, meaning that for some approaches to the roundabout, (Kūhiō Highway approaches in this area) the inner lane of the roundabout is only accessible by incoming traffic. For drivers, this means that they would be encouraged to choose their lane in advance of entering the roundabout so that they do not switch lanes within the roundabout. This also means that traffic traveling the Līhu‘e and Kapa‘a direction through movement of the roundabout would only need to merge with one lane of traffic as compared to two in the two-lane roundabout. Due to the lane dividers and spiral geometry, approach legs into the roundabout are typically at right angles, which further reduces vehicle speed compared to a two-lane roundabout (see Figure 1-5).

Similar to the two-lane roundabout, the turbo roundabout would be designed for WB-67 vehicles for Kūhiō Highway through movements and WB-50 for remaining movements. Additionally, left turns from Lanikai Street onto Kūhiō Highway would be prohibited.

Similar to the proposed alternative, this alternative would operationally result in minor increases in delays for the Kūhiō Highway through traffic but fewer delays for Kapa‘a Bypass and Papaloa Road compared to the future year 2043 No Action Alternative.

While this alternative has many of the same benefits as the two-lane roundabout, including a safer intersection and satisfying the purpose and need of the project, comments from the public meeting held on September 17, 2025, indicated that residents were concerned about driver confusion. Residents would learn how to use the roundabout with repeated uses. However, community members were concerned that tourists would not learn how the roundabout works, leading to tourists slowing down in the intersection and taking the wrong exit, requiring them to U-turn down the road. Additionally, comments from the meeting indicated that residents wanted to preserve the free right-turn lane from Kapa‘a Bypass Road onto Kūhiō Highway to prevent queuing. This lane configuration is not possible with a turbo roundabout due to its spiral shape. Because of these concerns, HDOT removed the turbo roundabout from consideration.

1.7.3 Signalized Intersection

The Signalized Intersection Alternative would consist of consolidating the intersections into a full-access signalized intersection. The signalized intersection would contain two through lanes for Kūhiō Highway Kapaʻa-bound traffic, two Kūhiō Highway Kapaʻa-bound left-turn lanes to turn onto Kapaʻa Bypass, one through lane of Kūhiō Highway Līhuʻe-bound traffic, one Kūhiō Highway Līhuʻe-bound left turn (to turn onto Papaloa Road), and one Līhuʻe-bound right-turn lane (to turn onto Kapaʻa Bypass). Under this alternative, Kūhiō Highway would need to be widened in the vicinity of the intersection to account for the addition of the second Kūhiō Highway Kapaʻa-bound left-turn lane. Additionally, Kapaʻa Bypass would need to be widened to create an additional receiving lane before eventually merging back to a two-lane road. This alternative would also maintain the dedicated right-turn lane from Kapaʻa Bypass onto Kūhiō Highway. The signalized intersection would require less land acquisition (approximately 0.6 acres) from TMK parcel 4-3-010:005 compared to the roughly 1-acre acquisition for the proposed alternative because the signalized intersection would be narrower than a roundabout (see Figure 1-6).

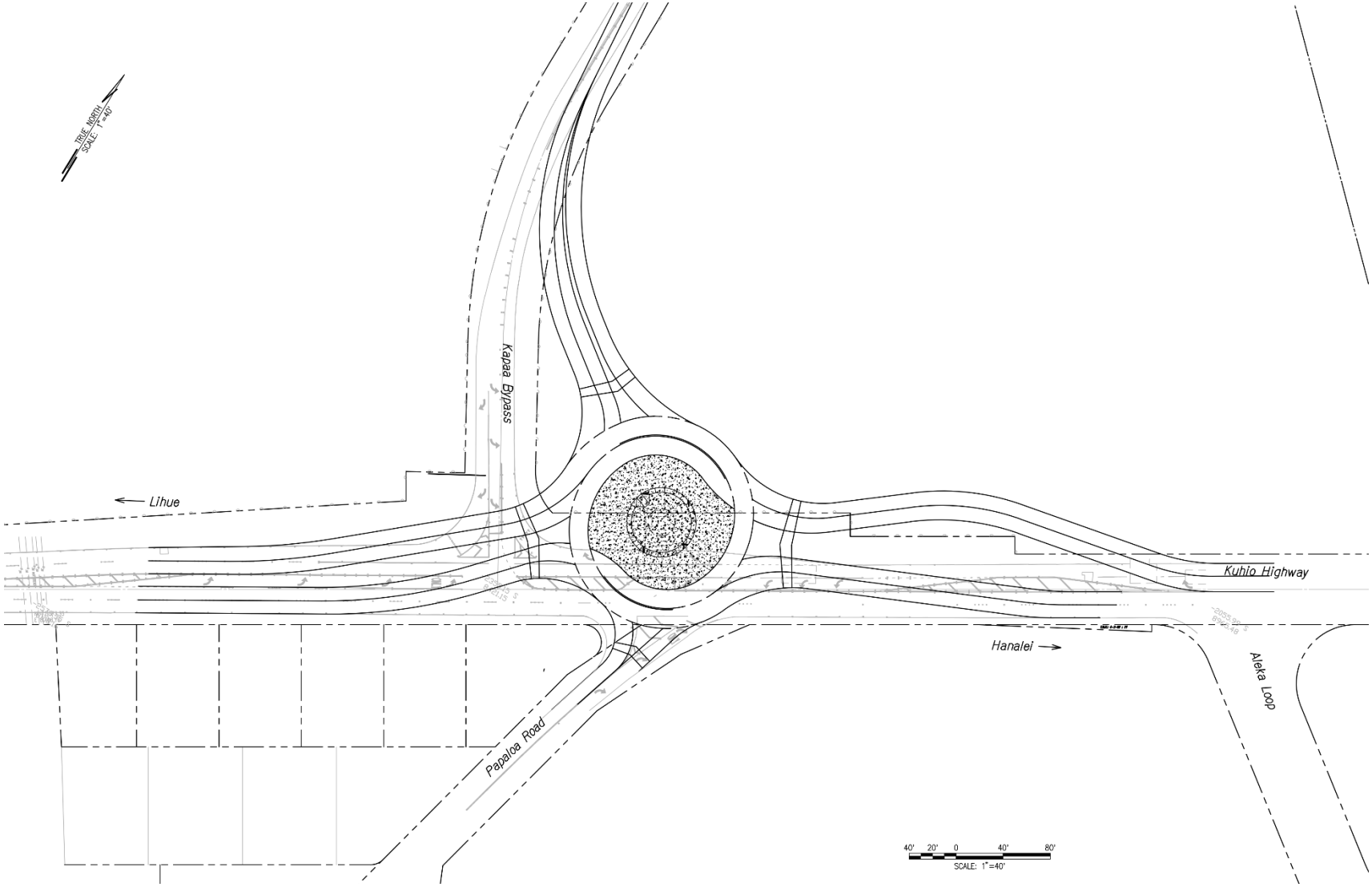
The benefits of a signalized intersection include control over priority movements through light signal timing adjustments. For example, during peak PM hours, where traffic is primarily traveling Kapaʻa-bound, the through-movement light would be longer to prioritize this movement. Operationally, this control of the movement would result in travel times remaining similar to the current conditions. However, queues are still anticipated to form along the mainline approaches since traffic signals require vehicles to come to complete stops compared to the steady flow of traffic that is typical of roundabouts. Under this alternative, left turns from Lanikai Street would also be prohibited and redirected to Papaloa Road.

While this alternative would provide control over priority movements, signalized intersections do not provide the safety that roundabouts deliver. Signalized intersections have more conflict points and do not provide traffic calming speed reduction, which is typical for roundabouts. While drivers approaching a roundabout may slow down to yield to traffic, drivers approaching a signalized intersection may speed up to make a light.

The signalized intersection would have lower construction costs when compared with the roundabout alternatives. However, it would require maintenance costs for electricity and the need to replace various parts. Additionally, traffic signals have a typical lifespan of 10–20 years, which is shorter than that of a roundabout (25 years).

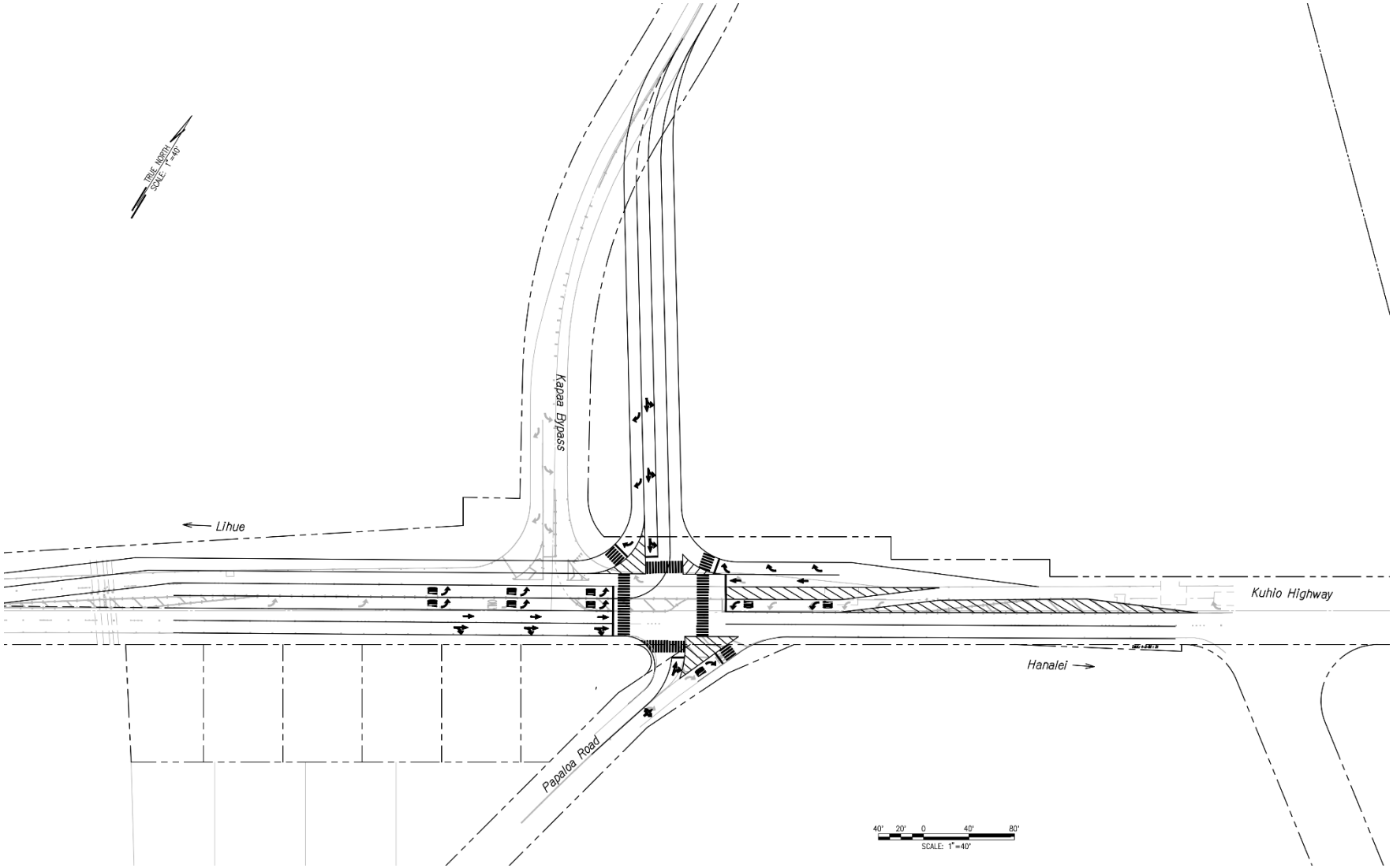
While this alternative would improve the traffic operations by consolidating intersections and allowing left turns from Papaloa Road, it was removed from consideration because it would provide less safety for intersection users. Additionally, community comments from the scoping meeting indicated that the community preferred a roundabout alternative over a signalized intersection.

Figure 1-5. Turbo-Lane Roundabout



Source: WSP USA 2025

Figure 1-6: Signalized Intersection Alternative



Source: WSP USA 2025

1.8 Project Cost

Based on conceptual engineering, the construction cost of the Proposed Action is estimated at $25 million (2024 U.S. Dollars). This cost estimate would be refined as engineering details are developed.

1.9 Project Schedule

The proposed project's schedule milestones are as follows:

- Finish Planning and Design Concepts: Early Summer 2026
- Final Design: Spring 2027
- Advertise Project: Summer 2027
- Construction: Fall 2027 to Fall 2028 (approximately 12 months)

1.10 Permits and Approvals

The approvals and permits that would be required prior to construction of the proposed project coordination are ongoing (see Table 1-3). See Chapter 4, Comments and Coordination, for information on the status of these permits and approvals.

Table 1-3: List of Permits and Approvals by Agency

Agency	Permit or Approval
Federal	
National Marine Fisheries Service	Section 7 Endangered Species Act (ESA)
National Marine Fisheries Service	Essential Fish Habitat (EFH) (Magnuson-Stevens Act)
State Historic Preservation Officer (SHPO)	Section 106 of the National Historic Preservation Act (NHPA)
U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS)	Farmland Conversion Impact Rating form
U.S. Fish and Wildlife Service (USFWS)	Section 7 of the ESA
State of Hawai‘i	
Department of Business, Economic Development & Tourism, Office of Planning and Sustainable Development, Coastal Zone Management (CZM) Program	CZM Consistency Review
Department of Health (HDOH) Clean Water Branch	National Pollutant Discharge Elimination System (NPDES) Permit for storm water discharges related to construction activities
Department of Land and Natural Resources (DLNR) – State Historic Preservation Division (SHPD)	HRS Chapter 6E Historic Preservation review
HDOH Indoor and Radiological Health Branch	Noise Permit Application
HDOH Indoor and Radiological Health Branch	Noise Variance Application

Agency	Permit or Approval
County of Kaua‘i	
County of Kaua‘i, Department of Public Works – Engineering Division	Grading, Grubbing, and Stockpiling Permit

Chapter 2 Affected Environment, Potential Impacts, and Proposed Mitigation

This chapter describes the existing environmental conditions of the project site; potential long-term and short-term construction impacts of the project; and measures to avoid, minimize, or mitigate any potential impacts. Any impact(s) that would likely remain after mitigation is also described. Each section in this chapter is dedicated to analyzing a specific environmental or social discipline.

Existing conditions, potential impacts, and proposed mitigation measures presented in this chapter have been developed through (a) review of existing information related to the project areas (see references in Chapter 6), (b) studies conducted specifically for the project, (c) coordination with regulatory agencies, and (d) consultation with the general public.

2.1 Physical Geography and Soils

2.1.1 Existing Conditions

Topography and Geology

Kaua‘i has some of the most structurally complicated topography compared to the rest of the Hawaiian Islands. It is the oldest of the main eight islands, estimated to have started forming in the early to middle Pliocene epoch (5.3–2.6 million years ago). The island grew from the sea floor as a basaltic shield volcano. Most of the rocks from the island’s formation consisted of olivine basalt, with lower levels of picrite-basalt with little to no olivine (Macdonald et al. 1983).

Kaua‘i had two major volcanic flows during its formation: the Waimea Canyon volcanic series and the Kōloa volcanic series. The Waimea Canyon volcanic series describes the original formation of the shield volcano. A long period of volcanic inactivity followed this series. Waves and streams eroded Kaua‘i’s mountains, carving out canyons and high sea cliffs and leaving behind layers of soil. The Kōloa volcanic series followed, continuing intermittently for a prolonged period, resulting in streams filling with lava flows, weathering and depositing of soil, and refilling with subsequent lava flows. While most rocks on the island are volcanic, there are also sedimentary rocks formed by the erosion and lithification of beach deposits. There are limestone fragments from explosions of volcanic activity throwing buried reef into the air.

The topography of the project area is relatively flat and can be described as a coastal plane with a gentle slope. The topography gradually slopes upward from 0 feet above mean sea level (msl) at the coast to as high as around 60 feet above msl along portion of Kapa‘a Bypass Road. The Proposed Action is proposed at an elevation of around 15 feet above msl. No notable geological formations or terrain exist within the project area.

Soil

The project area consists of three types of soil: Mokulē‘ia fine sandy loam, Līhu‘e silty clay, and Kaloko clay (see Figure 2-1). The Natural Resources Conservation Service (NRCS) provides the following descriptions of these soil types.

Mokulē‘ia fine sandy loam has a typical soil profile consisting of 50 inches of brown loamy sand (NRCS n.d.[a]). Within 12 to 24 inches below the surface, coral sand will start to appear. This soil is soft but slightly hard, porous, contains few chunks of reef limestone, and consists of around 80 percent coral sand. This soil is well drained with slow runoff and moderate permeability. Mokulē‘ia fine sandy loam can be found on coastal planes for Kaua‘i, O‘ahu, and Hawai‘i. It belongs to hydric soil group A, which consists of soils with low runoff potential when thoroughly wet.

Līhu‘e silty clay has a typical soil profile consisting of 60 inches of dusky red, dark reddish brown, and dark red soil (NRCS n.d.[b]). The soil surface is dry, cloddy, hard, firm, sticky, and plastic. This soil is well drained with slow to rapid runoff depending on the slope and moderately rapid permeability. Līhu‘e silty clay can be found in elevations ranging from near sea level to 800 feet above msl for Kaua‘i and Hawai‘i. It belongs to hydric soil group C, which consists of soils with moderately high runoff potential when thoroughly wet.

Kaloko clay has a typical soil profile ranging from dark brown surface soil to a dark greenish gray soil 43 to 60 inches down (NRCS n.d.[c]) The soil surface has fine distinct red mottles and yellowish white specks. This soil is hard, firm, sticky, and plastic. This soil is poorly drained with slow to very slow runoff and slow to moderately slow permeability. Kaloko clay can be found on coastal planes for Kaua‘i, O‘ahu, and Hawai‘i. It belongs to hydric soil groups C and D, which indicates the runoff potential of this soil when thoroughly wet, ranging from moderately high to high.

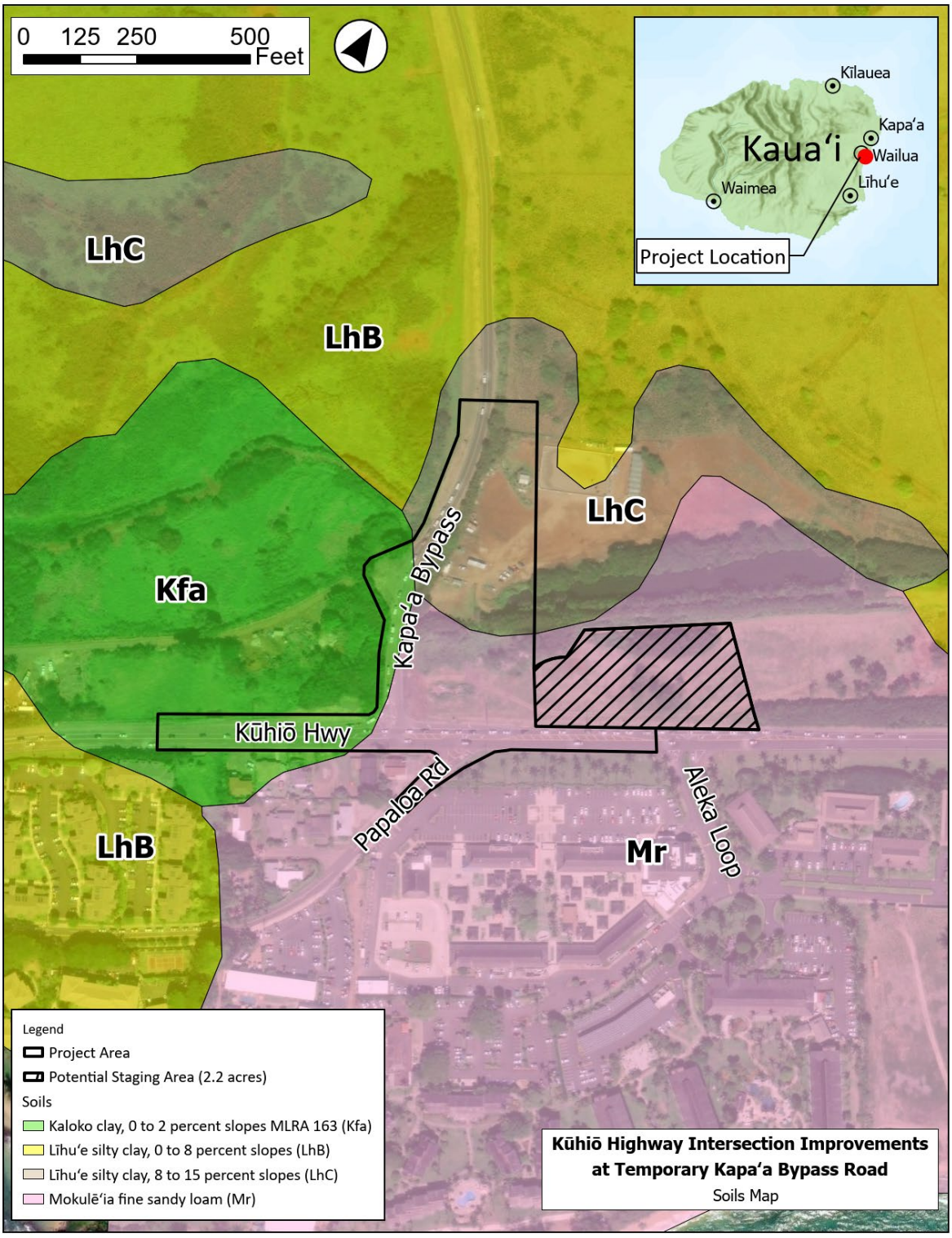
Most of the project area is classified as Agricultural Lands of Importance to the State of Hawai‘i (ALISH). The ALISH and project area partially overlap the established roadway ROW on Kapa‘a Bypass and Kūhiō Highway. See Figure 2-5, and Section 2.2, Land Use, for discussion of the Proposed Action’s impact on farms and agricultural uses.

2.1.2 Potential Impacts

The project would require minor grading of the project site to construct the roadway approaches for the relocation, which would not result in any appreciable changes to overall site elevation. Temporary ground disturbance would reach a depth of approximately 2.5 feet for pavement structures, 3.5 feet for guardrail posts, and 6 feet for streetlight foundations. The headwalls of proposed drainage structures along Kapa‘a Bypass would reach a depth of approximately 5–8 feet below the ground surface. Lighting and other utilities within the intersection would be approximately 4–8 feet deep.

No significant soil impacts are anticipated. Construction-related activities may result in minimal, short-term soil erosion, as soils are cleared and graded to reroute the road and realign the intersection. Disturbed and graded areas would be grassed to minimize and mitigate potential soil erosion impacts.

Figure 2-1: Soils in the Project Area Map



Source: Hawai‘i Statewide GIS Program 2023b; ESRI, World Imagery 2026; ESRI, World Hillshade and World Terrain Base 2026.

2.1.3 Avoidance, Minimization, and Mitigation Measures

During construction, BMPs to control erosion and sediment runoff would be implemented in accordance with the Proposed Action. See Section 2.6.3 for relevant measures of stormwater management BMPs that would also help stabilize disturbed soils. Additional measures that would be implemented to reduce the amount of exposed soil include the preservation of existing plants, hydromulching, and natural revegetation. The contractor would conduct a site-specific assessment to determine what other mitigation measures would be required.

2.2 Land Use

2.2.1 Existing Conditions

The project area is within an urban corridor in East Kaua‘i along Kūhiō Highway, a principal arterial highway for Kaua‘i County. The urban corridor extends from Haleilio Road in Wailua to Kawaihau Road at the northern edge of Kapa‘a Town, the most populated area in Kaua‘i. The project area includes the existing ROWs of Kūhiō Highway, Kapa‘a Bypass, and Papaloa Road, as well as portions of private parcels mauka of Kūhiō Highway. The area mauka of Kūhiō Highway consists mostly of undeveloped land. However, a portion of land to the Kapa‘a side of Kapa‘a Bypass is leased to Healing Horses Kaua‘i, a 501(c)(3) nonprofit organization that provides riding lessons, horsemanship camps, and equine therapy to improve the physical, cognitive, social and emotional well-being of people of all abilities. The area makai of Kūhiō Highway consists of residential properties (west of Papaloa Road) and the Coconut Marketplace (Kapa‘a side of Papaloa Road). Coconut Marketplace is an open-air mall offering a mix of shopping, dining, hula shows, and live music. Coconut Marketplace hosts a local farmers market twice weekly.

According to the State of Hawai‘i Land Use Commission’s State Land Use Districts (SLUDs), the project area is in an Agricultural SLUD, with only a small portion of Papaloa Road in an Urban SLUD. The project area is not within the Conservation District (see Figure 2-2). According to the County of Kaua‘i zoning designations, the area mauka of Kūhiō Highway ROW is zoned for agricultural uses. The areas makai of Kūhiō Highway and on the Līhu‘e side of Papaloa Road are within residential and open space zones, while parcels makai of Kūhiō Highway and on the Kapa‘a-side of Papaloa Road are within resort and open space zones (see Figure 2-3). HRS Chapter 205A places limits on development along the shoreline within a designated Special Management Area (SMA) to protect access to recreation and avoid losses of coastal resources (State of Hawai‘i 1977). Within the project area, the Papaloa Road ROW and the Kapa‘a-side portion of the Kūhiō Highway ROW are within the SMA (see Figure 2-4).

The Farmland Protection Policy Act (FPPA) is intended to minimize the impact of federal programs on the unnecessary and irreversible conversion of farmland to nonagricultural uses. A large portion of the project area is classified as ALISH. The ALISH area is classified as Prime Agricultural Land, which is land best suited for the production of food, feed, forage and fiber crops. These Prime Agricultural Lands overlap the project area along and mauka of the Kūhiō Highway ROW (see Figure 2-5).

2.2.2 Potential Impacts

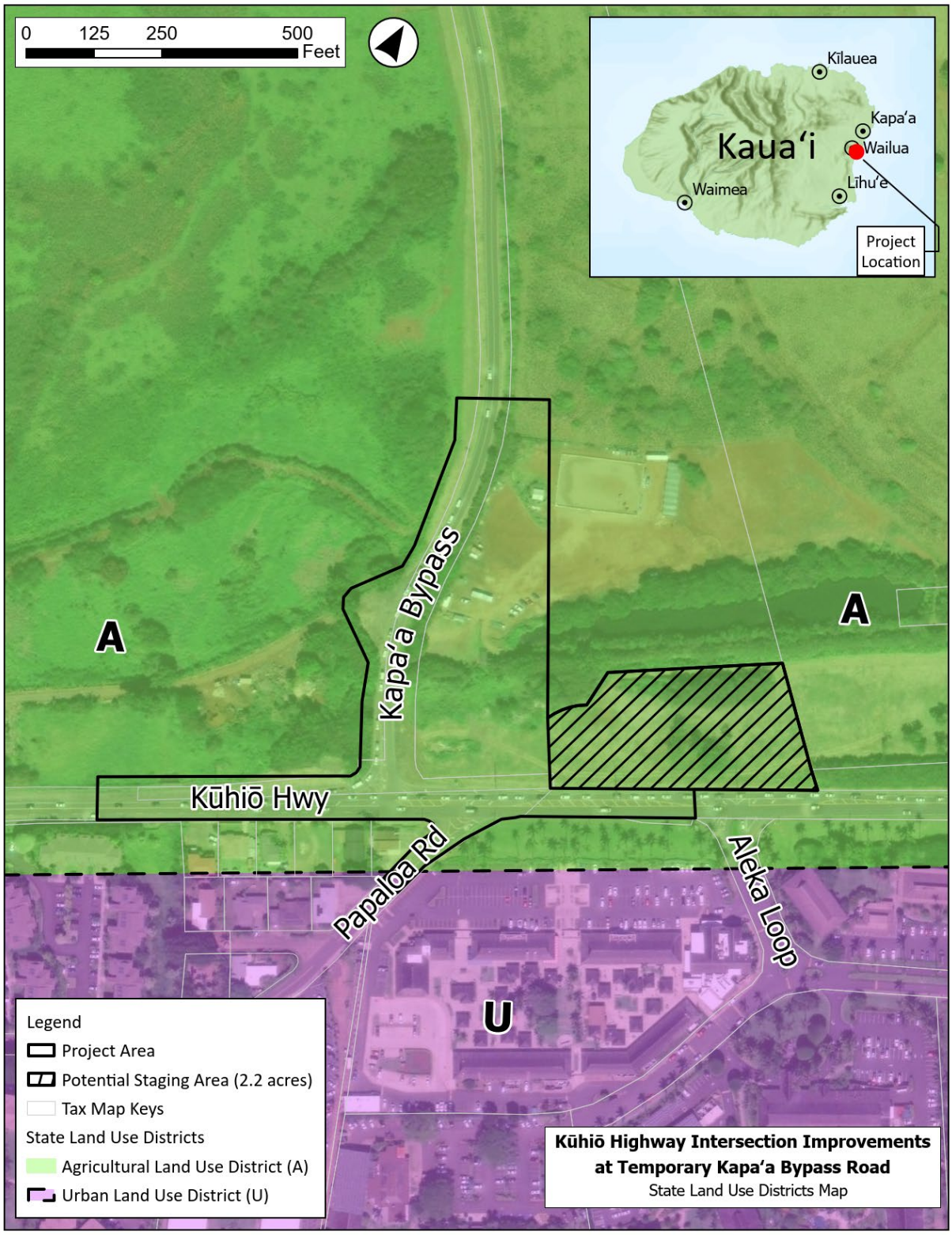
On the mauka side of Kūhiō Highway, HDOT would realign Kapa‘a Bypass to the location of the proposed two-lane roundabout. The southern terminus of Kapa‘a Bypass would shift toward Kapa‘a to intersect Kūhiō Highway directly across from Papaloa Road. A portion of the property mauka of Kūhiō Highway and Aleka Loop may be used temporarily for staging. The Proposed Action would require the permanent acquisition of approximately 1 acre of ROW from the private property (TMK parcel 4-3-010:005) for the realignment of Kapa‘a Bypass. The affected lands are all Prime Agricultural Lands. Since the Proposed Action would convert a portion of Prime Agricultural Lands into ROW for the proposed two-lane roundabout, FHWA will coordinate with NRCS and prepare a Farmland Conversion Impact Rating form according to the FPPA for the Proposed Action.

The project would require the permanent acquisition of 1 acre of land and temporary use of approximately 2 acres of land for staging of TMK parcel 4-3-010:005. Upon coordination and negotiation with the landowner, HDOT would act in accordance with HRS Chapter 101, Eminent Domain, to obtain the space required for the Proposed Action. Under this statute, private property may be acquired by the government for public use. Property owners are entitled to just-compensation, determined by appraisal and negotiated under good faith efforts. Should negotiations fail, a condemnation lawsuit may be filed.

Additionally, since this is a federally funded project, HDOT must adhere to the Uniform Standards of Professional Appraisal Practice and the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended (Uniform Act), as codified in 42 U.S.C. Sections 4601 et seq., and the applicable implementing regulations set forth in Title 49, Code of Federal Regulations (CFR), part 24. The Uniform Act protects the rights of property owners and tenants of the property that is acquired to implement a project. The Uniform Act’s intent is to ensure that individuals do not suffer disproportionate injuries caused by programs and projects designed for the benefit of the public as a whole, and to minimize the hardship of displacement on such persons.

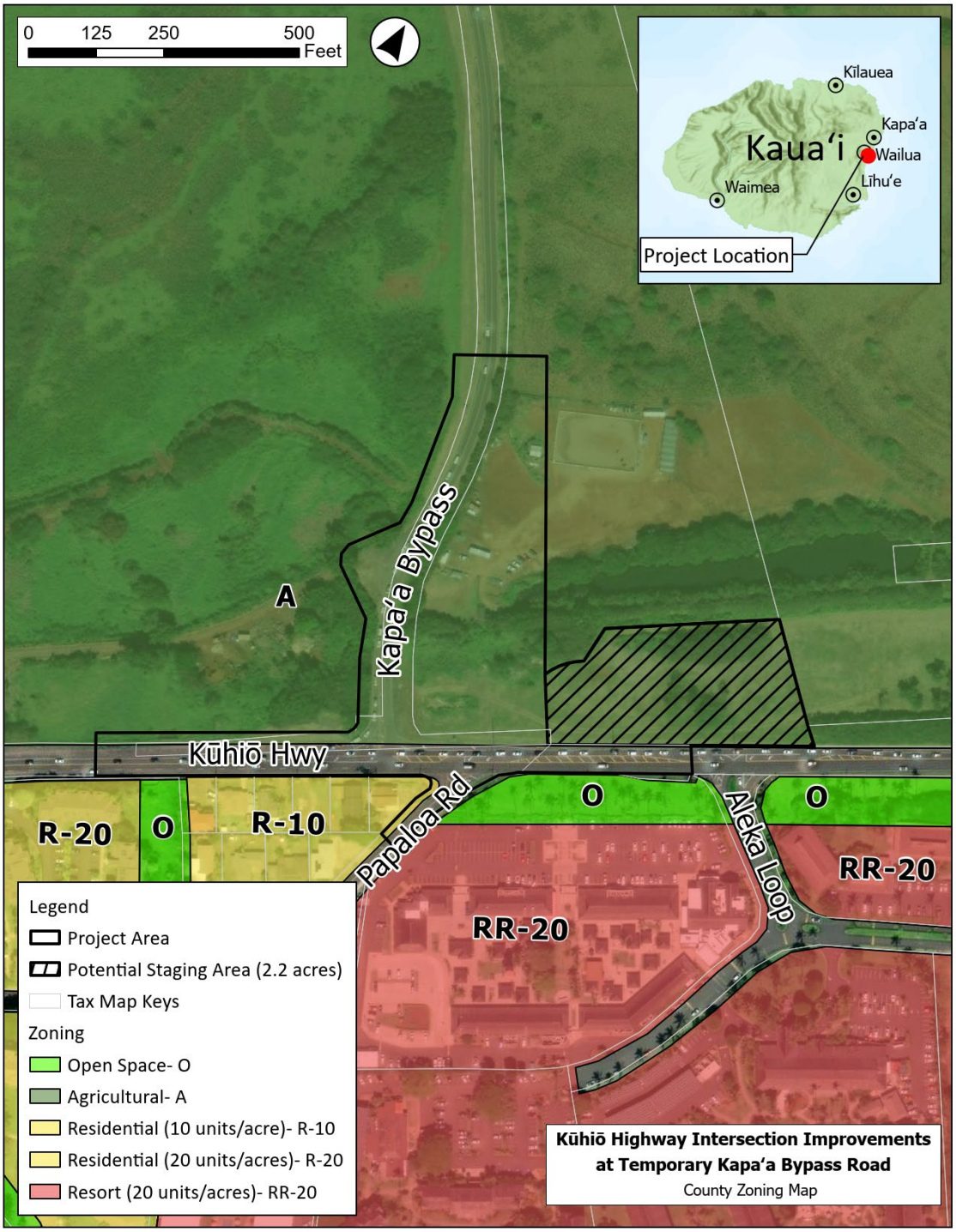
The affected lands are leased to the nonprofit organization, Healing Horses Kaua‘i, which operates on 15 acres of land and has completed improvements within the project area. While their current operations would not be entirely displaced by this project, they would be impacted by the permanent acquisition and temporary use of land. The project area includes maintained horse trails, the point of public access to the riding facilities, and some parking spaces. Some trails would need to be permanently rerouted, and the facility entrance would need to relocate to the realigned Kapa‘a Bypass. Maintained trails within the potential staging area would only be temporarily blocked and require temporary rerouting. Construction may negatively impact the operations of the lessee, Healing Horses Kaua‘i, by making it more difficult to transport horses from the property to the homes, hospitals, and care facilities that engage in equine therapy. Additionally, the potential staging area is located on land that contains horse pasture that would temporarily be unusable during construction. HDOT would coordinate with the landowner and the lessee to minimize any potential disruptions to current operations.

Figure 2-2: State Land Use District Map



Source: Hawai‘i Statewide GIS 2020, 2025a; ESRI, World Imagery 2026; ESRI, World Hillshade and World Terrain Base 2026.

Figure 2-3: County Zoning Map



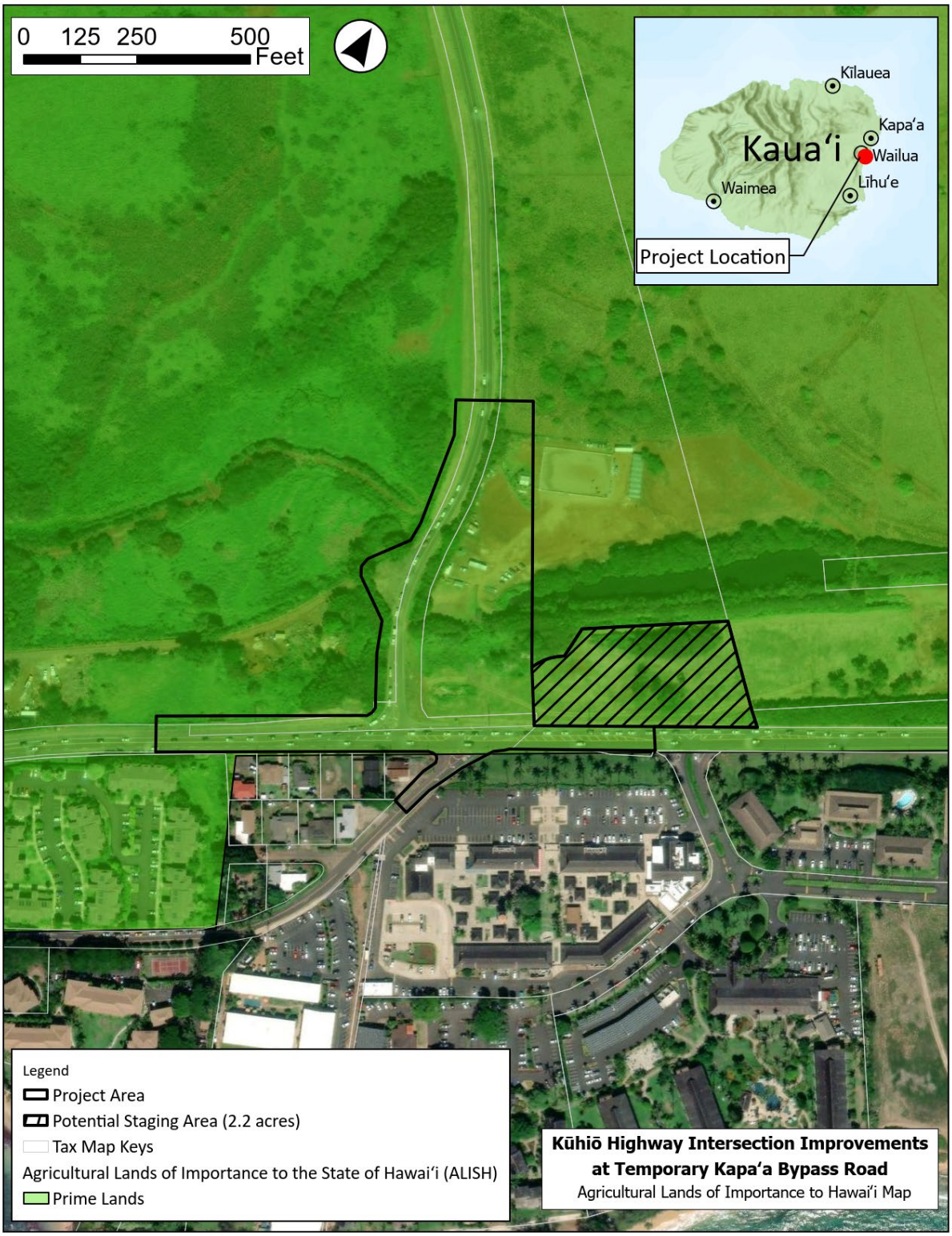
Source: Hawai‘i Statewide GIS 2023c, 2025a; ESRI, World Imagery 2026; ESRI, World Hillshade and World Terrain Base 2026.

Figure 2-4: Special Management Area Map



Source: Hawai‘i State GIS 2024a, 2025a; ESRI, World Imagery 2026; ESRI, World Hillshade and World Terrain Base 2026.

Figure 2-5: Agricultural Lands of Importance to the State of Hawai‘i



Source: Hawai‘i Statewide GIS 2024b; ESRI, World Imagery 2026; ESRI, World Hillshade and World Terrain Base 2026.

The Proposed Action would not affect existing land uses on the makai side of Kūhiō Highway. Construction activities on the makai side of Kūhiō Highway would occur entirely within the county-owned Papaloa Road ROW. HDOT has coordinated with the Kaua‘i County Planning Department to confirm that no SMA Permit would be required for the Proposed Action.

2.2.3 Avoidance, Minimization, and Mitigation Measures

With any change in land ownership, HDOT would follow the process of eminent domain/acquisition and the Uniform Act. HDOT would fairly appraise the privately owned land and provide appropriate payment, determined in collaboration with the owner, for the land as compensation, pursuant to state and federal law. HDOT has been in communication with the affected property owner of TMK parcel 4-3-010:005 to evaluate ways to mitigate impact to the lessee of the land, Healing Horses Kaua‘i. HDOT will continue to coordinate with the landowner on mitigation efforts.

Since the Proposed Action would convert Prime Agricultural Lands into roadway ROW, FHWA would coordinate with NRCS and prepare a Farmland Conversion Impact Rating form for the project. It is anticipated to demonstrate that impacts to agricultural lands from the Proposed Action would not exceed a total evaluation score of 100 points and therefore result in no significant impact on farmlands. Additionally, upon completion of the realigned intersection, the existing Kapa‘a Bypass would be removed, hydromulched and allowed to revegetate to match the surrounding environment.

2.3 Historic and Archaeological Resources

2.3.1 Regulatory Context

Section 106 of the National Historic Preservation Act (NHPA) requires actions that are federally funded, authorized, or implemented to take into account the effect of such actions on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places (NRHP). The Section 106 process involves coordination and consultation with the State Historic Preservation Officer (SHPO) and other agencies and organizations that have an interest in or are mandated to protect historic properties. In addition, the Advisory Council on Historic Preservation (ACHP) is afforded the opportunity to comment on actions that may potentially affect these historic properties.

At the state level, HRS Chapter 6E-8 places similar responsibilities on state agencies to evaluate their projects. Hawai‘i state statute was amended in 2025 to define “historic property” as any building, structure, object, district, area, or site, including heiau and underwater sites, which are over 50 years old and meets the criteria for being entered into the Hawai‘i Register of Historic Places (HRHP). Although the state law has a broader definition than federal law of what is considered a historic property, similar to Section 106, only those historic properties that meet the definition of “significant,” as defined by Chapter 13-275-6(b) of the HAR, are protected by HRS Chapter 6E-8. This document will refer to those properties that are considered eligible for the NRHP or meet the “Significance Criteria” (protected under Section 106 and HRS Chapter 6E-8) as “significant historic properties” to distinguish them from those that are considered historic because they are over 50 years old.

For a district, site, building, structure, or object to be considered a significant historic property under NRHP or HRHP, it must possess integrity of location, design, setting, materials, workmanship, feeling, and association and must meet one of the following Significance Criteria:

> **Criterion a**: associated with events that have made a significant contribution to the broad patterns of our history.
>
> **Criterion b**: associated with the lives of persons significant in our past.
>
> **Criterion c**: embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.
>
> **Criterion d**: have yielded or may be likely to yield information important in prehistory or history.
>
> **Criterion e**: (HAR 13-275 only): The HRHP provides the following additional criterion: has an important value to the Native Hawaiian people or to another ethnic group.

In accordance with regulations provided in 36 CFR 800, the federal sponsoring or regulating agency has the responsibility of conducting a good faith effort to identify whether there are any significant historic properties in the project's Area of Potential Effects (APE) after initiating the Section 106 process. If any significant historic properties are identified within the APE, the federal agency would then assess whether it would be adversely affected by the proposed project.

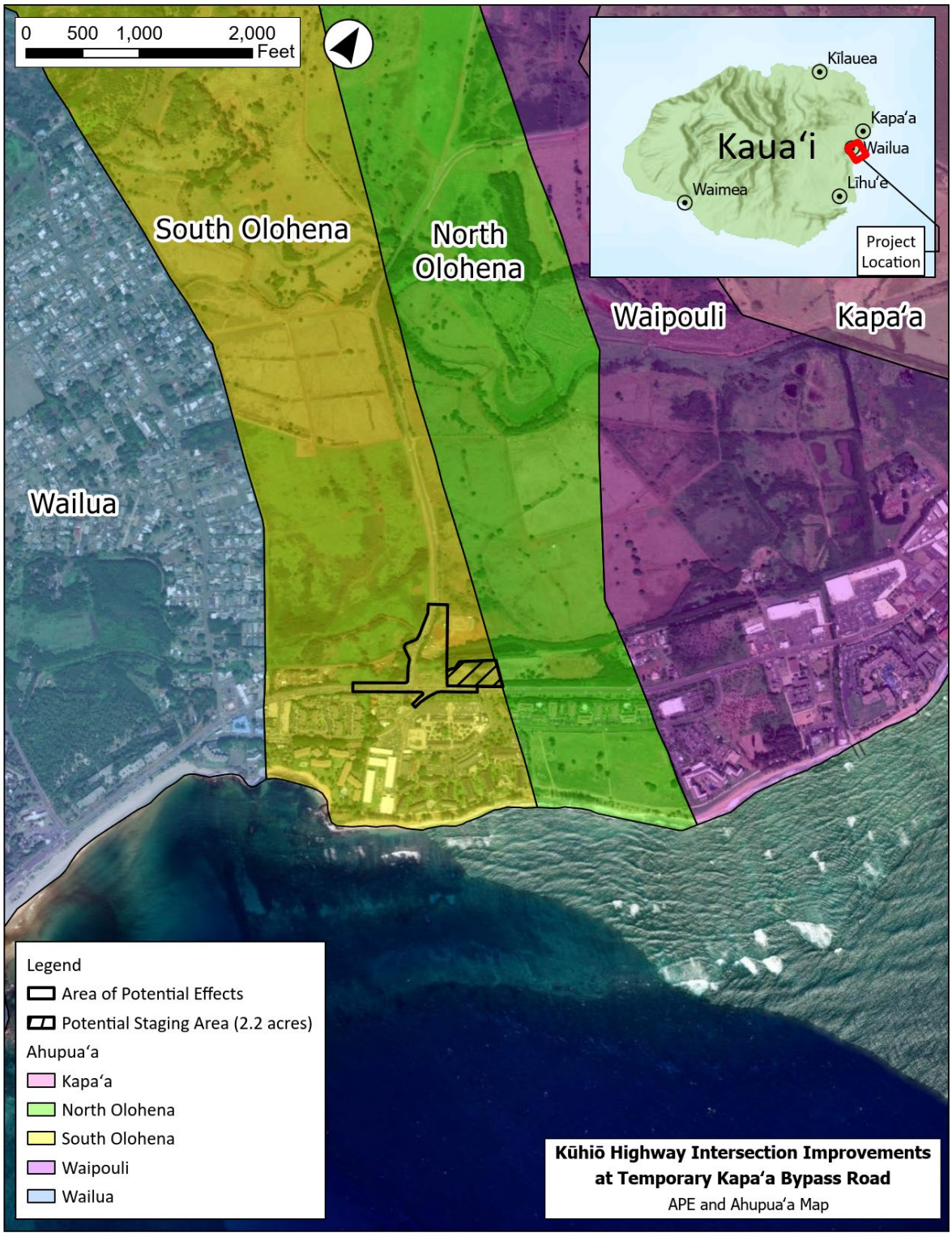
Under NHPA Section 106, the federal agency—in this case, FHWA—is responsible for assessing the effects of the project on all historic properties within the APE. Under state rules, the proposing agency, HDOT, carries the same burden to identify historic properties within the project study area (HAR 13-275-5), assess their significance (HAR 13-275-6), and evaluate the proposed project's impacts (HAR 13-275-7).

The rest of this section discusses the impact to historical and archaeological resources in this regulatory context. In this discussion, the term "project area" is used interchangeably with the term "APE."

2.3.2 Existing Conditions

The project area is located in the *ahupua‘a* of South Olohena in the *moku* (district) of Puna (see Figure 2-6). The *moku* of Puna was an ideal place for habitation and agriculture due to the proximity of Wailua River, with the earliest documented habitation site (State Inventory of Historic Places [SIHP] 50-30-11-1839) located within the South Olohena *ahupua‘a*. The *ahupua‘a* of South Olohena was an area rich in natural resources, relying on the Wailua River and fertile floodplains for the cultivation of sugarcane and rice. The Lihue Plantation Company was later established within the same fertile grounds that are also within the project area.

Figure 2-6: Area of Potential Effects and *Ahupua‘a* Map



Source: Hawai‘i Statewide GIS 2024c; ESRI, World Imagery 2026; ESRI, World Hillshade and World Terrain Base 2026.
Key: APE = Area of Potential Effects

In February 2026, Keala Pono Archaeological Consulting, LLC (Keala Pono) completed an Archaeological Literature Review and Field Inspection (LRFI) for the project (see Appendix C, Archaeological LRFI Report). The LRFI characterized the project area as a mostly built and landscaped environment with minimal to moderate forestation. Based on the findings from the literature review portion, previous archaeological studies have recorded several historic properties in the vicinity of the project area.

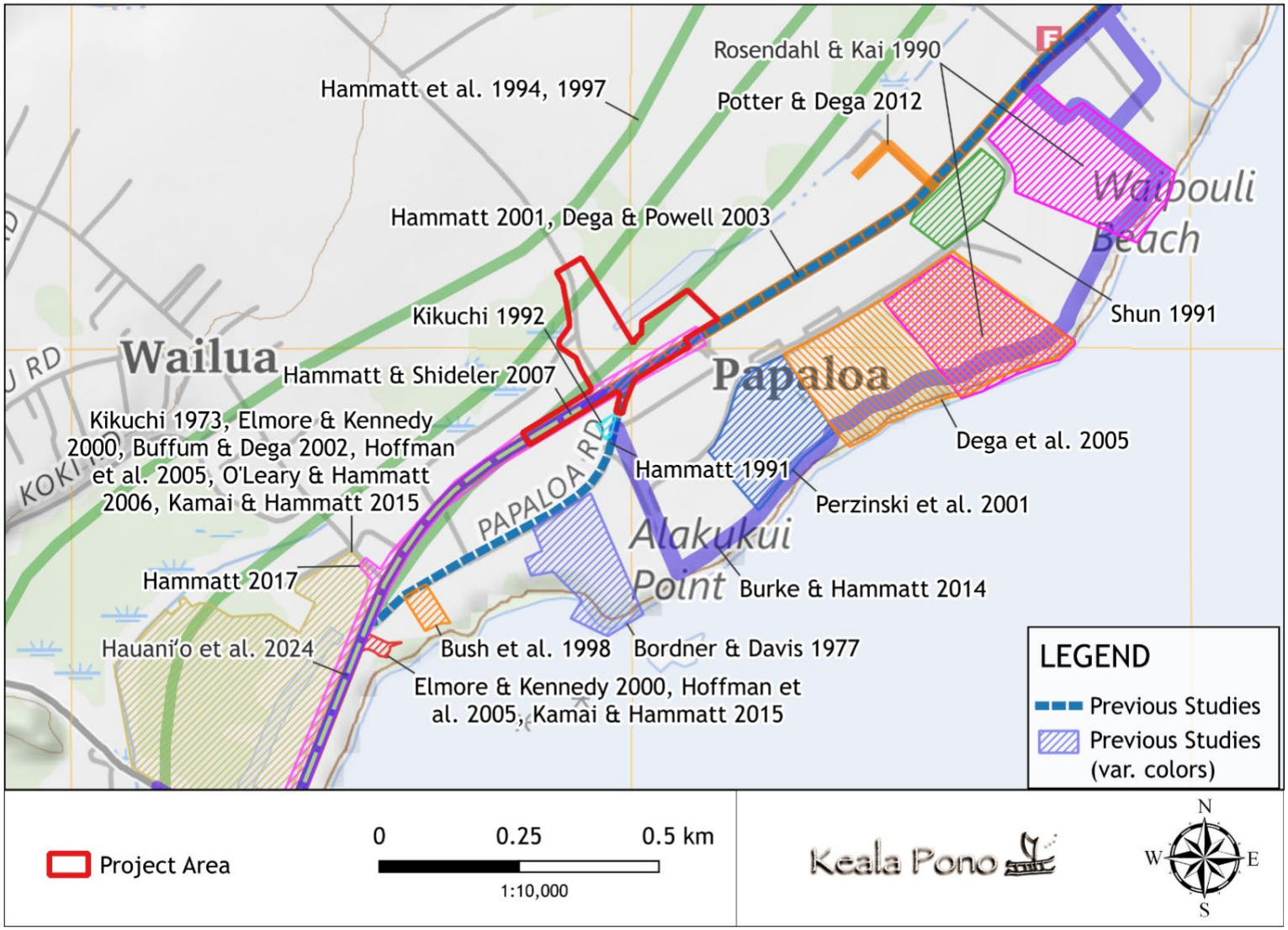
The historic properties identified within the project area include: 1) hearth, ‘auwai, and human skeletal remains (SIHP 50-30-08-00886); 2) one in-situ human burial at the boundary of the current project area that was left in place (SIHP 50-30-08-02420); and 3) a segment of the previously documented AT&R railroad bed (SIHP 00823) (See Figure 2-8 and Appendix C).

Other historic properties identified outisde the project area but within 0.5 km of the project area include historic fishponds, post-contact *auwai* (traditional irrigation systems), human burials, grinding stones, and other historic structures within the grounds of the nearby Coco Palms Resort; the presence of a navigational *heiau*, Kukui Heiau, on the nearby shoreline; three *imu* (traditional underground oven) and plantation-era railroad remnants; and other cultural layers, with some burials located in the vicinity of the project area. Altogether, these findings indicate the overall historic significance of the area. See Appendix C – Figure 13 for a complete representation of historic properties within 0.5 km of the project area.

The field inspection portion identified 13 previously unrecorded surface archaeological features (one feature with two components). Keala Pono characterized these features as “historic” and “possibly historic” features that are all part of a historic infrastructure site. The exact age of these surface archaeological features was undetermined. Due to the extensive changes in landscape and modern development of the project area, it is unlikely that any traditional surface archaeological features remain. However, it is possible that subsurface archaeological features have survived more recent disturbances (see Table 2-1 and Figure 2-8).

A significance assessment was carried out for the historic infrastructure site following the criteria established in HAR Chapter 13-284-6. Under these criteria, a site must meet at least one of the five criteria to be deemed “significant.” In addition, a site must also possess material integrity (i.e., location, design, setting, materials, workmanship, feeling, and association) to be considered “significant.” The historic infrastructure site as a whole retains sufficient material integrity and was evaluated as significant under Criterion d because it yielded important plantation-era infrastructure information. Among the 13 features identified, Features 5 and 12 (mortared rock structures) are considered to be contributing features to the integrity and significance of the historic infrastructure site because they retain their integrity of design, materials, workmanship, and feeling. None of the features retain integrity of setting or association, as the historic sugarcane plantation landscape no longer exists. See Table 2-1 for the complete list of all surface archaeological features:

Figure 2-7: Previous Archaeological Studies Map (Keala Pono)



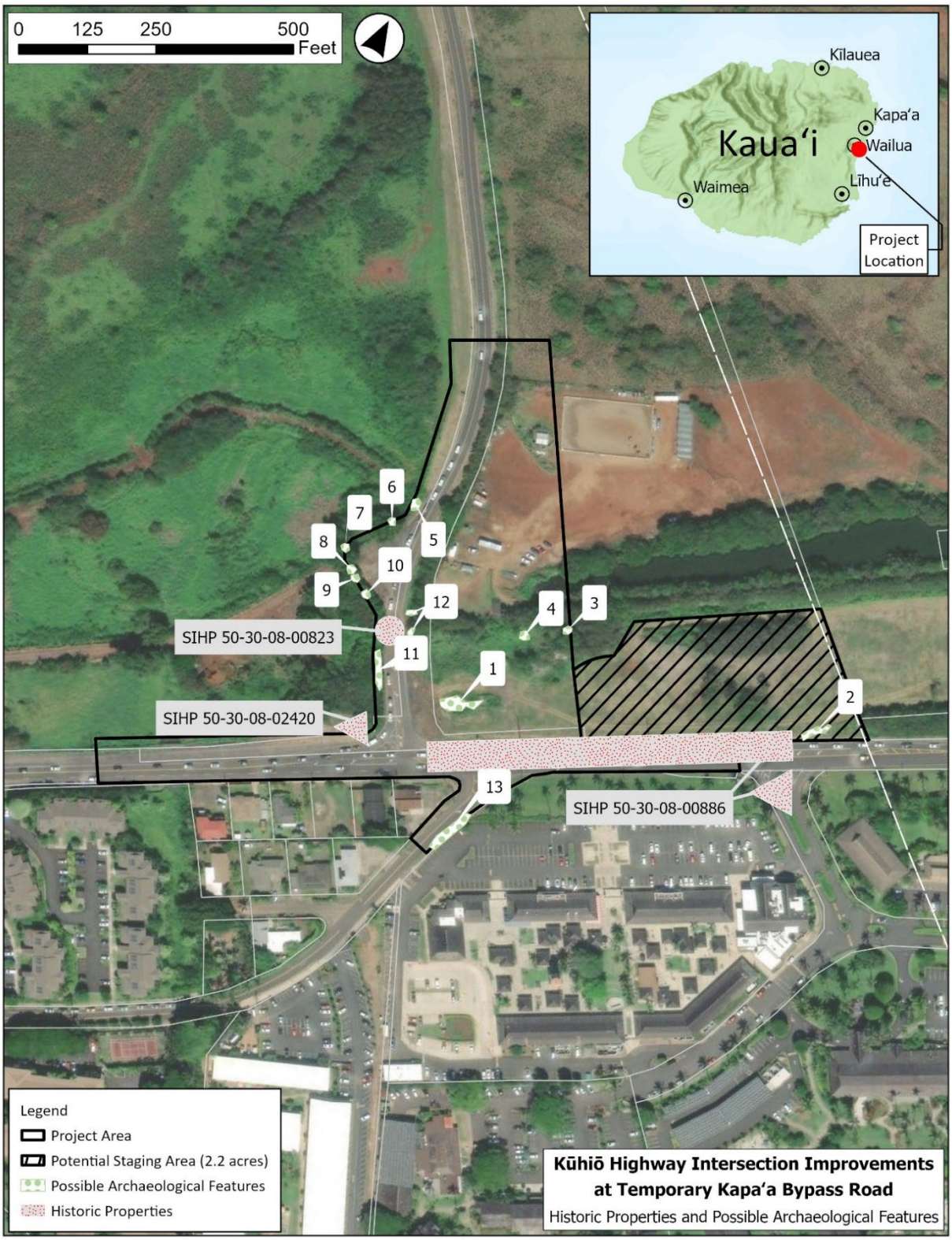
Source: Extracted Figure 12 from LRFI Report, Keala Pono 2026

Table 2-1: Possible Archaeological Features Identified During the Field Inspection

Temporary Feature No.	**Description**	**Age**	**Potentially Significant**
1	Concrete foundation	Possibly historic	No
2	Boulder alignment	Possibly historic	No
3	v-lock concrete block	Possibly historic	No
4	Iron railroad plate	Historic	No
5	Mortared rock wall with attached concrete wall	Possibly historic	**Yes**
6	Two wooden posts	Possibly historic	No
7	Wooden post	Possibly historic	No
8	Concrete post	Possibly historic	No
9	Concrete footing with two wooden posts	Possibly historic	No
10	Railroad track within a concrete block	Historic	No
11	Railroad track and fence	Historic (track), Possibly historic (fence)	No
12	Mortared rock culvert	Possibly historic	**Yes**
13	Concrete sidewalk	Possibly historic	No

Source: LRFI Report, Keala Pono 2026

Figure 2-8: Historic Properties and Possible Archaeological Features



Source: LFRI Report, Keala Pono 2026b; modified map prepared by WSP; ESRI, World Imagery 2026; ESRI, World Hillshade and World Terrain Base 2026.

2.3.3 Potential Impacts

Consultation with State Historic Preservation Division (SHPD) and other Section 106 consulting parties are ongoing. Similarly, the HRS Chapter 6E-8 review process with the SHPD has not yet been completed. The Proposed Action involves construction of a two-lane roundabout that would affect the possible archaeological features identified in the LRFI. The potential impacts to these identified historical features are not yet known, and mitigation recommendations presented below are limited to preliminary findings of the LRFI.

Given the presence of a human burial, density of possible archaeological features found in the vicinity of the project area, and the potential for subsurface features, HDOT anticipates a determination of “Effect, with Proposed Mitigation Measures” under the HRS Chapter 6E-8 review and an “Adverse Effect” under the NHPA Section 106 review.

HDOT anticipates preparing an Archaeological Monitoring Plan (AMP) for SHPD approval prior to any ground-disturbing activities, as described further in the next section. SHPD is expected to conduct its HRS Chapter 6E-8 review responsibilities in conjunction with Section 106 consultation, both of which are still ongoing for this project (see Section 2.3.4; Section 4.3; and Appendix A.3, Regulatory Coordination and Correspondence).

2.3.4 Avoidance, Minimization, and Mitigation Measures

As stated above, given the density of possible archaeological features previously found in the vicinity of the project area, and the potential for subsurface features, HDOT would prepare an AMP for SHPD approval prior to any ground-disturbing activities, and the contractor would conduct archaeological monitoring during construction. If any historic properties are encountered during construction, this AMP would allow proper identification and treatment of any historic properties encountered.

2.4 Cultural Resources

2.4.1 Existing Conditions

In February 2026, Keala Pono prepared a Cultural Impact Assessment (CIA), which consisted of background research and five ethnographic interviews (Keala Pono 2026a) (see Appendix D, CIA). For the CIA, the study area covered a 17-mile portion of Kūhiō Highway from Līhu‘e to Moloa‘a, which includes the project area.

The *ahupua‘a* of South Olohena was identified as a region rich in freshwater resources, coastal flora and fauna, and bountiful fishing grounds. Pre-contact use of the area was largely centered around cultivation at the nearby Wailua River and surrounding floodplains, laden with trails and navigable waterbodies that passed through the district of Puna. Several *heiau* exist along these land and water-based passageways, but none are in the project area. The sandy soils within the project area also made it a customary location for Native Hawaiian burial practices. Numerous past projects in the vicinity have inadvertently encountered *iwi kūpuna* (ancestral remains). One human

burial was previously identified in the project area, as noted in Section 2.3, Historic and Archaeological Resources.

Cultural informants with familial connections to Olohena and its surrounding areas were interviewed, two of whom were lineal descendants of the area, and at least one of whom had direct genealogical ties to Kaua‘i’s *ali‘i*. These interviewees play active roles in their respective communities, such as taking care of existing cultural sites, culturally monitoring sensitive archaeological areas, and advocating for and protecting traditional cultural practices. During the ethnographic interviews as part of the CIA, the presence and protection of *iwi kūpuna* was the greatest concern regarding archaeological sites and cultural practices associated with the area.

Accordingly, the interviewees in the ethnographic survey recommended that archaeological monitoring be conducted during the project. Other recommendations and measures voiced during the interviews include the following:

- *Community trust*: Prepare a presentation to Kaua‘i-Ni‘ihau Burial Council to build connection prior to the start of the project.
- *Alternative use of resources*: Use the financial resources for reclamation of Hawaiian identity instead of building a roundabout.
- *No change*: Withhold support for transportation projects to prevent more development and displacement and keep the two southbound lanes.
- *Design recommendations*: Make the entrance/exit to Kintaro Restaurant safer by installing speed bumps on Kūhiō Highway coming from both sides.
- *Monitoring*: Require archaeological monitoring during the project.

HDOT would implement feasible mitigation measures, which are further described in Section 2.4.3 below.

2.4.2 Potential Impacts

The Proposed Action has a high potential to uncover *iwi kūpuna*, given the history of human burials in the area and the identified burial at the project boundary. Those interviewed for the ethnographic surveys also raised concerns that construction of the roundabout could justify additional housing development in the vicinity. Interviewees also identified specific areas where *iwi kūpuna* had been inadvertently disturbed from previous projects, such as the coastline bike path.

While the area is traditionally known to support land and sea subsistence activities, the area has largely been developed. It is unknown whether such traditional activities are still being practiced today, but these activities would not be impacted by the Proposed Action since the project area is largely within the HDOT ROW. The recommended mitigation measures outlined in the ethnographic survey of the CIA (see Appendix D) were reviewed by HDOT and described in Section 2.4.3. With the implementation of feasible mitigation measures, the Proposed Action

would not significantly or permanently impact traditional customary practices or valued cultural resources.

2.4.3 Avoidance, Minimization, and Mitigation Measures

Because human burials have previously been discovered in the vicinity of the project area, the Proposed Action has a high potential to uncover *iwi kūpuna*. HDOT has reviewed the recommendations outlined in the ethnographic survey of the CIA (see Appendix D) and will implement feasible mitigation measures as part of the Proposed Action. HDOT is currently coordinating with SHPD pending effect determination and mitigation measures.

2.5 Biological Resources

2.5.1 Regulatory Context

Section 7 of the Endangered Species Act (ESA) requires federal agencies to consider impacts on endangered or threatened species and critical habitat of such species. It requires that federal agencies consult with the U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) on the effects of any major construction on federally listed endangered or threatened species or if projects could result in the destruction or adverse modification of designated critical habitat (40 CFR 402). HDOT is coordinating with both USFWS and NMFS in fulfillment of the Section 7 requirements. The federal Migratory Bird Treaty Act (MBTA) also protects migratory bird species by making it unlawful to pursue, hunt, take, capture, possess, sell, purchase, barter, import, export, or transport any migratory bird or any part, nest, or egg of any migratory bird.

Specific to the marine environment, the federal Magnuson-Stevens Fisheries Conservation and Management Act requires federal agencies to consider project impacts to Essential Fish Habitat (EFH), which are defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, and/or growth to maturity,” including open water, wetlands, coral reefs, and submerged structures associated with managed fish species. FHWA has completed coordination with NMFS, which concurred that the proposed project would have no more than minimal adverse effects on EFH.

The state’s counterpart law to the ESA is HRS Chapter 195D, as amended, under which species are similarly protected. Chapter 195D identifies the protection of endangered species as a state responsibility. Projects conducted in the state must coordinate with the Department of Land and Natural Resources (DLNR) to avoid adverse impacts to species protected by HRS Chapter 195D (see Section 4.3, Regulatory Coordination, and Appendix A.3).

2.5.2 Existing Conditions

SWCA Environmental Consultants (SWCA), on behalf of HDOT, prepared a Flora and Fauna Survey Report (2025) for the project to identify vascular plant, bird, mammal, amphibian, gastropod, and arthropod species in the project area and obtain a broader understanding of the biological resources that could be found within the project area (see Appendix E, Flora and Fauna Survey Report). The report characterized the project area, including a review of scientific and

technical literature regarding natural resources in or near the project area. In addition to this literature review, SWCA conducted a survey of the project area in May 2025.

Also, as part of ESA Section 7 consultation, HDOT obtained a USFWS list of threatened and endangered species that may occur in the project area or may be affected by the project. This species list from the USFWS Information of Planning and Consultation (IPaC) online system is addressed in the following discussion (see also Appendix E, which includes the IPaC list).

Flora

The project area is highly disturbed and contains the existing highway ROW and adjacent pasture lands. Some streams and ditches exist within the project area in the privately owned parcels. See Section 2.6 for more details on water resources and wetlands in the area. Most plants identified in the project area were nonnative, and no endangered or threatened species of flora were identified, as described further below.

SWCA identified four vegetation types in the project area: ruderal, nonnative grassland, riparian, and nonnative secondary forest. Ruderal vegetation is commonly found in disturbed areas, such as roadsides, pastures (domestic livestock), or areas involving other activities resulting in nonnative weedy plant types like Guineagrass (*Urochloa maxima*), false ragweed (*Parthenum hysterophorus*), sensitive plant (*Mimosa pudica*), and swollen fingergrass (*Chloris barbata*). Areas with less frequent disturbance along roadsides and adjacent pastures were dominated by nonnative grasslands containing Guineagrass. In riparian areas where streams and ditches are present, the upper banks were dominated by koa haole (*Leucaena leucocephala*) and Java plum (*Syzgium cumini*) while the lower banks had more mixed weedy species like sourbush (*Pluchea carolinensis*) *Strachytarpheta cayennensis*, and umbrella sedge (*Cyperus involucratus*). Nonnative secondary forest primarily occurred in the project area along road edges and in areas where disturbance is less frequent. Nonnative trees in these areas included koa haole, Java plum, Christmas berry (*Schinus terebinthifolius*), and bingabing (*Macaranga tanarius*).

According to the comments of a volunteer at Healing Horses Kaua‘i, the following plant species are located at the southern edge of the ranch: the endangered loulu palm (*Pritchardia maideniana*); “wili wiki”; endangered false ‘ohe (*Polyscias racemosa*); endemic lono mea (*Sapindus oahuensis*); endemic false sandalwood (*Myoporum sandwicense*); and native kou (*Cordia subcordata*). The plant species “wili wiki” could not be verified with the information provided. None of these plants were identified during the biological survey report.

The USFWS IPaC list identified 10 species of threatened or endangered plants that have the potential to be found in the vicinity of the project area. However, none of the plant species identified on the IPaC list were observed during SWCA’s survey of the project area (SWCA 2025). No special status (federally or state threatened, endangered, proposed listed, or candidate species) species of plant were identified in the project area. SWCA identified a total of 32 vascular plant species within the project area. Only one of these plants, the glossy nightshade (*Solanum americanum*), is native to the Hawaiian Islands. For more details, see Appendix E, which includes the IPaC list.

Fauna

SWCA reported that the undeveloped portion of the project area mauka of the roadway ROW contained wet turf, areas of standing water, and surrounding low-growing vegetation that could provide habitat for Hawaiian waterbirds (SWCA 2025). Suitable foraging and nesting habitat for the threatened Hawaiian goose or nēnē also existed in the project area. Additionally, SWCA identified trees taller than 15 feet that may be used by Hawaiian hoary bats as potential roosting habitat. The report also stated that special status seabird species have the potential to fly over the project area when transiting to and from their nesting colonies in the mountains. DLNR Division of Forestry and Wildlife (DOFAW) provided comments that the endemic Hawaiian short-eared owl or pueo (*Asio flammeus sandwichensis*) could potentially nest on the ground year-round in the project area (see Appendix A.1, Pre-Draft Environmental Assessment Coordination and Consultation). The pueo is not federally listed as endangered and is only state listed as endangered on O‘ahu.

The USFWS IPaC list identified one terrestrial mammal, nine birds, and one marine turtle as threatened or endangered species that may occur in the project area or may be affected by the project (USFWS 2025). The IPaC list stated no USFWS designated critical habitat are in or near the project area. See Table 2-2 for a list of protected species that may occur in the project area, as identified by USFWS IPaC and Chapter 195D consultation.

Table 2-2 includes protected marine species that may occur offshore, well beyond the project area. However, the project area is approximately 1,000 feet inland from the shoreline, so no interactions with marine species are anticipated. NMFS Pacific Islands Regional Office (PIRO) has designated the area along the shoreline as critical habitat for the monk seal and proposed critical habitat for the green sea turtle. See Figure 2-9 for a map of the NMFS Critical Habitat.

During fieldwork, SWCA observed six species of bird, one mammal, and one invertebrate species in the project area (SWCA 2025). Only one of these species, the Hawaiian goose or nēnē (*Branta sandvicensis*), has special status. The nēnē is federally listed as threatened and state listed as endangered. The nēnē was seen flying over the project area. Additionally, one endangered Hawaiian gallinule (also known as the Hawaiian moorhen), or ‘alae ‘ula (*Gallinula galeata sandvicensis*), was seen outside of the project area along a waterway with hydrologic connectivity to the project area. One commonly occurring MBTA species, the cattle egret (*Bubulcus ibi*), was also observed in the project area during fieldwork.

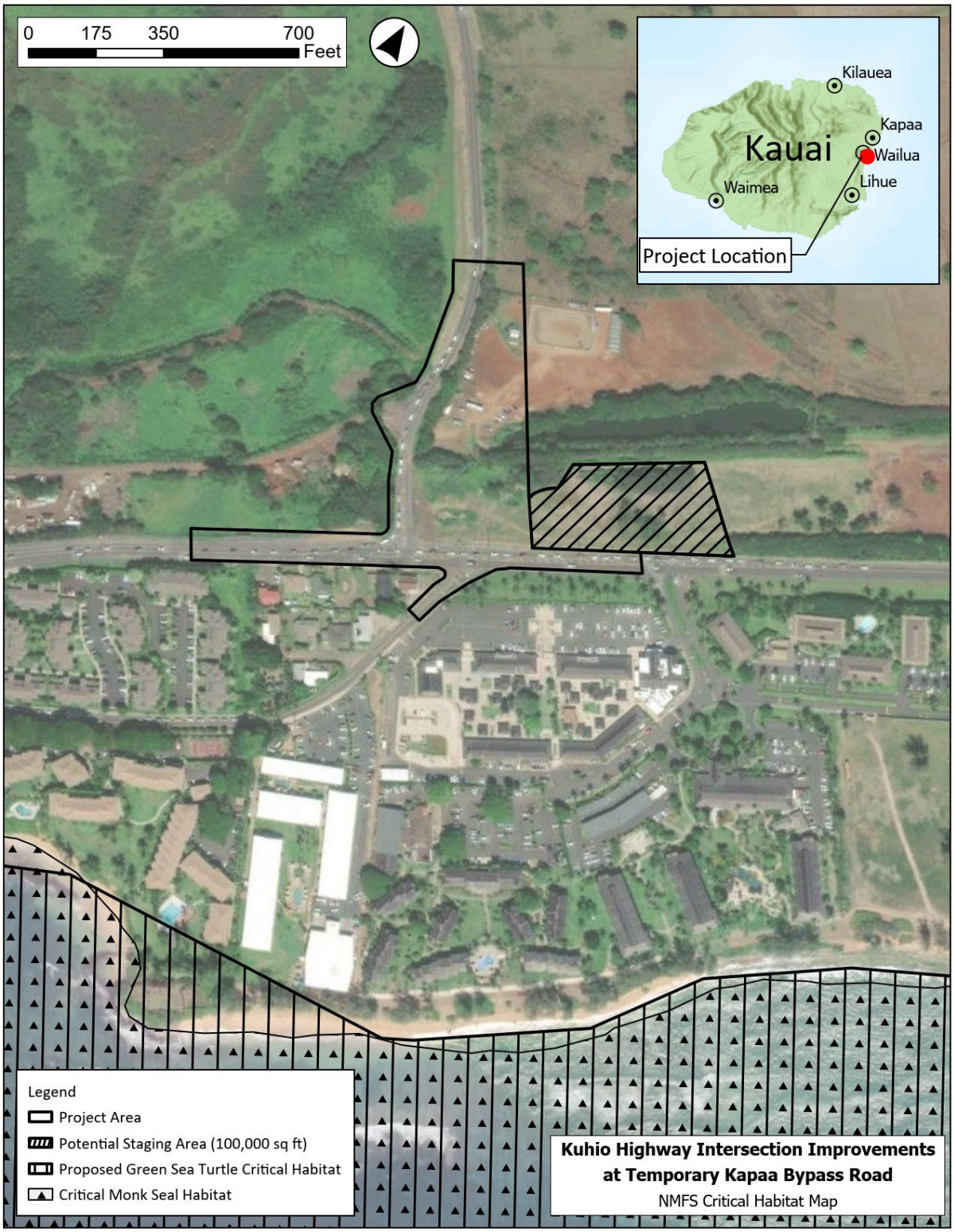
According to the comments of a volunteer at Healing Horses Kaua‘i, the following animal species have been sighted in the southern edge of the ranch: the native black-crowned night heron (*Nycticorax nycticorax hoactli*); the endangered Hawaiian stilt (*Himantopus mexicanus knudseni*), the endangered Hawaiian coot (*Fulica Alai*); the threatened nēnē, and the endangered Hawaiian duck (*Anas wyvilliana*). The black-crowned night heron is not endangered or threatened. Suitable habitat for the endangered and threatened bird species was identified during the biological survey.

Table 2-2: Section 7 and 195D Species and Migratory Birds of Conservation Concern that May Occur in the Vicinity of the Project Area

Common Name	Scientific Name	Federal Status	State Status
Terrestrial Mammals			
Hawaiian hoary Bat (ʻōpeʻapeʻa)	*Lasiurus cinereus semotus*	Endangered	Endangered
Birds			
Band-rumped storm petrel (ʻakēʻakē)	*Hydrobates castro*	Endangered	Endangered
Hawaiian common gallinule (ʻalae ʻula)	*Gallinula galeata sandvicensis*	Endangered	Endangered
Hawaiian coot (ʻalae keʻokeʻo)	*Fulica Alai*	Endangered	Endangered
Hawaiian duck (Koloa Maoli)	*Anas wyvilliana*	Endangered	Endangered
Hawaiian goose (nēnē)	*Branta (=Nesochen) sandvicensis*	Threatened	Endangered
Hawaiian petrel (ʻuaʻu)	*Pterodroma sandwichensis*	Endangered	Endangered
Hawaiian stilt (aeʻo)	*Himantopus mexicanus knudseni*	Endangered	Endangered
Newell's shearwater (ʻaʻo)	*Puffinus newelli*	Threatened	Threatened
Short-tailed albatross	*Phoebastria (=Diomedea) albatrus)*	Endangered	Endangered
Hawaiian short-eared owl (pueo)	*Asio flammeus sandwichensis*	Not listed	Endangered (on Oahu)
Marine Animals			
Hawksbill sea turtle (honuʻea)	*Eretmochelys imbricata*	Endangered	Endangered
Green sea turtle (honu)	*Chelonia mydas*	Threatened	Threatened
Hawaiian monk seal (īlio-holo-i-ka-uaua)	*Monachus schauinslandi*	Endangered	Endangered
Migratory Birds			
ʻApapane	*Himatione sanguinea*	Birds of Conservation Concern	
Black noddy	*Anous minutus melanogenys*		
Black-footed albatross	*Phoebastria nigripes*		
Bulwer's petrel	*Bulweria bulwerii*		
Kauaʻi ʻamakihi	*Chlorodrepanis stejnegeri*		
Laysan albatross	*Phoebastria immutabilis*		
Pomarine jaeger	*Stercorarius pomarinus*		
Red-tailed tropicbird	*Phaethon rubricauda melanorhynchos*		
Sooty shearwater	*Ardenna grisea*		
Sooty tern	*Onychoprion fuscatus*		
Wandering tattler	*Tringa incana*		

Source: USFWS 2025 and NMFS-PIRO 2025

Figure 2-9: NMFS ESA Critical Habitat Map



Source: NMFS-OPR 2025; ESRI, World Imagery, World Hillshade, and World Terrain Base 2026.
Key: NMFS = National Marine Fisheries Service

Essential Fish Habitat

The water column and bottom of the Pacific Ocean around the island of Kaua‘i are designated as EFH and support various life stages for management unit species identified under the Western Pacific Fishery Management Council’s Pelagic and Hawai‘i Archipelago Fishery Ecosystem Plans. The project area is located approximately 1,000 feet from the shoreline and EFH (Western Pacific Fishery Management Council n.d.) (see Figure 2-10).

2.5.3 Potential Impacts

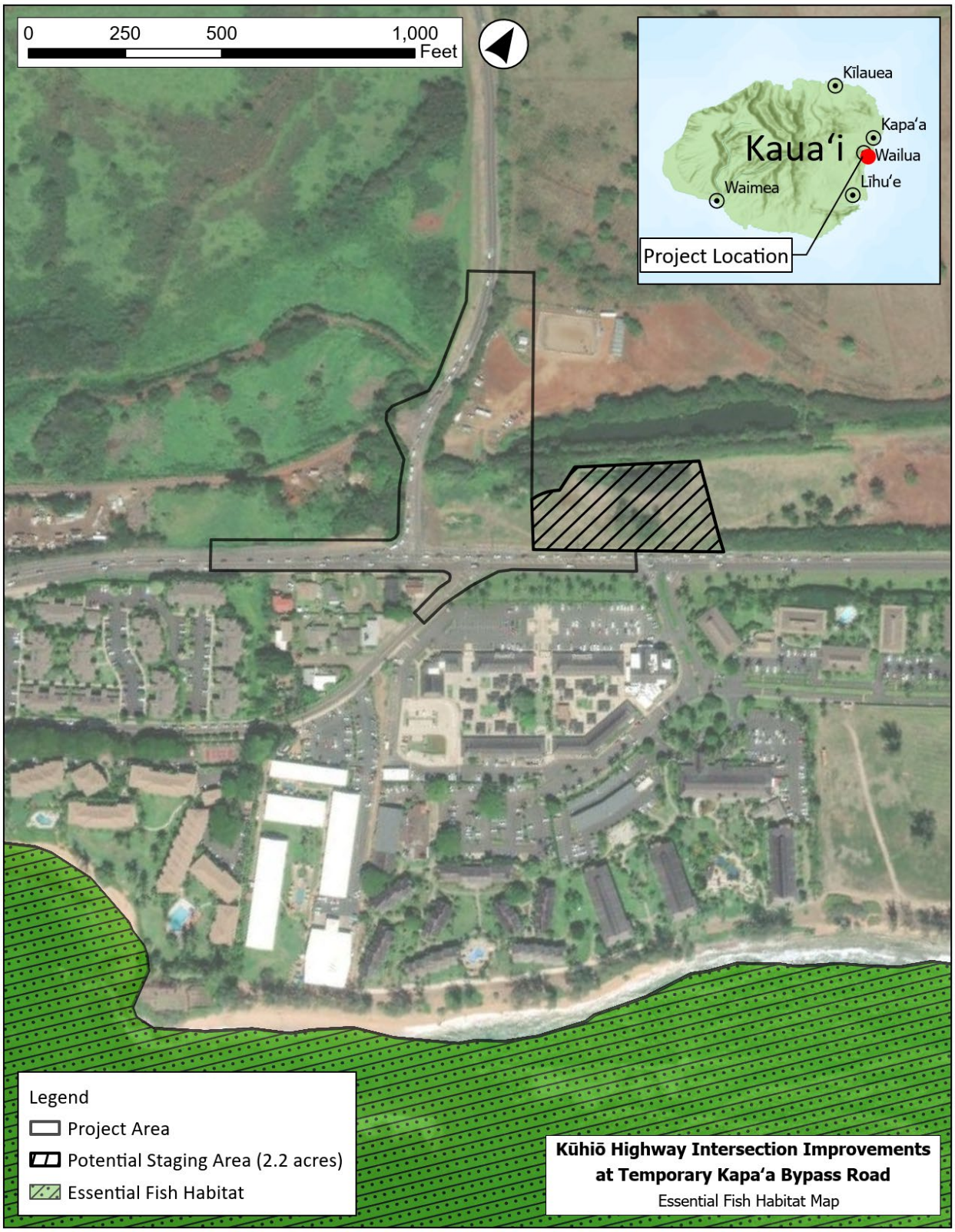
Project actions would include installing new, permanent highway lighting at the proposed roundabout. This additional lighting may result in the “take” (harassment or harm) of Hawaiian seabirds. Other than the installation of permanent highway lighting, no long-term or significant impact on protected plant or animal species are anticipated with the Proposed Action. See Section 2.5.4 for more details. The installation of the roundabout is anticipated to result in less than 0.5 acres of additionally paved surfaces. Permanent stormwater BMPs would be implemented to decrease stormwater runoff and are further described in Section 2.6.3. See Section 2.5.4 below and Appendix A.1 for more information about avoidance and minimization measures.

Temporary construction-related impacts to protected species would include vegetation clearing, light attraction during night work, and noise. HDOT has been consulting with multiple resource agencies including USFWS, NOAA NMFS, DLNR Division of Aquatic Resources (DAR) and DOFAW, and the Office of Planning and Sustainable Development (OPSD) CZM Office to help identify potential impacts of the project to protect biological resources. The following discussion of potential impacts is based on regulatory coordination with these resource agencies to date. See Appendix A for copies of agency correspondence.

Flora

Vegetation clearing and ground disturbance would be required on the Kapa‘a side of Kapa‘a Bypass and mauka of the existing highway. It is anticipated that the potential staging area and the proposed highway ROW will be cleared of vegetation. No botanical resources of concern were identified in the project area during the biological survey, which does not contain suitable habitat for the endangered or threatened flora species identified in the IPaC list. Most of the plants in the project area consisted of weedy species that are widespread, and vegetation clearing would not have a significant decrease in their number or distribution. Therefore, no permanent adverse impacts to threatened or endangered flora are anticipated. The existing Kapa‘a Bypass would be removed, and hydromulch would be sprayed to allow grass growth. Following construction, vegetation similar to existing plant life would be allowed to reestablish in the staging area and the existing Temporary Kapa‘a Bypass ROW.

Figure 2-10: Essential Fish Habitat Map



Source: Western Pacific Regional Fishery Management Council, NOAA Fisheries n.d.; ESRI, World Imagery, World Hillshade, and World Terrain Base 2026.

Project activities would include landscaping within the project area after the roundabout construction is complete. If practicable and appropriate, native plants will be evaluated during final design for landscaping and revegetating areas cleared by construction. When landscaping and revegetating, invasive species will not be planted. Additional details will be provided in the Final EA.

The project would also be designed to minimize potential impacts to existing landscape trees and plants on the steep slope mauka of the lessee Healing Horses Kaua‘i driveway entrance. Additionally, the project will be designed, if possible, to minimize potential impacts to endangered and endemic trees and plants identified by the Healing Horses Kaua‘i volunteer. HDOT will work with the volunteer to pot and relocate the plants identified.

Fauna

Endangered Hawaiian Waterbirds (Hawaiian Common Gallinule, Hawaiian Coot, Hawaiian Duck, and Hawaiian Stilt) and the Black-Crowned Night Heron

Potential endangered waterbird habitat is present in the project area. However, the project would not involve work in water bodies, including streams and wetlands that may be waterbird habitats. Therefore, no permanent impacts to waterbirds are anticipated. Potential impacts to endangered Hawaiian waterbirds during construction would be avoided with the implementation of mitigation measures based on standard guidance from USFWS and DLNR-DOFAW to avoid habitat loss or degradation through construction-related pollution or habitat disturbance. Black-crowned night herons are often found near aquatic habitats. Therefore, mitigation measures that would apply to the endangered Hawaiian waterbirds are anticipated to also minimize impacts to the black-crowned night heron. Therefore, it is anticipated that the project may affect but is unlikely to adversely affect endangered Hawaiian waterbirds or the black-crowned night heron.

Seabirds (Band-Rumped Storm Petrel, Hawaiian Petrel, Newell’s Shearwater, and Short-Tailed Albatross)

The project would install permanent highway lighting in the project area and would require temporary night lighting to support night work. Lighting can act as an attractant to Hawaiian seabirds leading to seabird fallout. Juvenile birds are especially susceptible to lighting and can become disoriented, sometimes resulting in grounding. The exact location and numbers of permanent highway lighting and temporary construction lighting would be determined during final design. The permanent highway lighting would be approximately 30 feet tall, similar to existing highway lighting in the area. These lights will be narrow spectrum, shielded, and directed downward to mitigate seabird fallout. Measures to reduce the impacts of temporary construction lighting on seabirds are outlined in the mitigation section below. With the implementation of these measures, it is anticipated that the construction lighting may affect, but is not likely to adversely affect, Hawaiian seabirds. However, because the installation of permanent highway lighting may result in the “take” of seabirds, it is assumed that formal consultation with USFWS will be required. HDOT will work with USFWS to develop appropriate measures to minimize and mitigate the potential impact of permanent highway lighting on seabirds.

Migratory Birds of Conservation Concern

Minimal impacts to migratory birds of conservation concern are anticipated. The only migratory bird found within the project area was the nonnative cattle egret (*Bubulcus ibis*). Cattle egrets are common on Kaua‘i and other islands, and the project is not anticipated to result in harm to the egret or other migratory bird species. If the project results in the take of a migratory bird, it would be documented and reported in a similar manner as any endangered or threatened species of wildlife listed under the ESA.

Hawaiian Short-Eared Owl (Pueo)

The project area could contain suitable habitat for pueo nests. However, minimal permanent impacts to suitable pueo nesting habitat are anticipated. Pueo nest on the ground year-round. Vegetation clearing or other ground-based disturbance could potentially disturb pueo nests. With the implementation of measures to reduce the project’s impact on pueo described in Section 2.5.4, no impacts to pueo are anticipated.

Hawaiian Goose (Nēnē)

A nēnē was seen flying over the project area during the field survey. Additionally, the survey concluded that the pasturelands present in the project area could support nēnē foraging and nesting. Threats to nēnē include predation and vehicle strikes. With the measures described in Section 2.5.4 to reduce the attraction of predators and risk of vehicle strikes it is anticipated that the project may affect but is unlikely to adversely affect the nēnē.

Hawaiian Hoary Bat

Hawaiian hoary bats roost in trees taller than 15 feet within dense canopy foliage or in the subcanopy when the canopy is sparse, allowing open access for launching into flight. Vegetation trimming and removal during roosting season (June 1 and September 15) could impact juvenile bats that are too small to fly but too large to be carried by a parent. Mitigation measures include avoiding the trimming and removal of trees taller than 15 feet during roosting season. With the measures described in Section 2.5.4, it is anticipated that the project may affect but is unlikely to adversely affect the Hawaiian hoary bat.

Marine Animals

The project area is approximately 1,000 feet from the shore. With the implementation of stormwater BMPs, no permanent or temporary impacts are anticipated to the hawksbill sea turtle, green sea turtle, and Hawaiian monk seal. On November 3, 2025, FHWA determined that the project meets all requirements for the Standard Local Operating Procedures for Endangered Species in Hawaii (HI-waySLOPES) and that the project is not likely to adversely affect species listed under the ESA or their designated critical habitat administered by the NMFS. On November 3, 2025, NMFS concurred with the FHWA determination.

Essential Fish Habitat

Impacts to EFH as a result of construction could include sedimentation as a result of increases in impervious surfaces and vegetation clearing. It is estimated that there would be less than half an acre of additional impervious surface area as a result of the roundabout. Additionally, the use of

construction machinery on land could result in accidental spills or leaks of petroleum or other chemical spills that could travel to the ocean environment. Construction could also result in nutrient loading as a result of impervious surfaces increasing runoff. In consultation with NMFS, FHWA and HDOT have determined that with the implementation of BMPs, adverse effects to the EFH would be no more than minimal (see Appendix A.3). Appendix A includes a full list of BMPs that FHWA and HDOT commit to implementing.

Invasive and Nonnative Species

Construction activities have the potential to spread invasive species through the movement of construction vehicles and materials. Soil and plant material may contain detrimental fungal pathogens (e.g., Rapid ‘Ōhi‘a Death [*Ceratocystis*]), vertebrate and invertebrate pests (e.g., little fire ants [*Wasmannia auropunctata*], coqui frogs [*Eleutherodactylus coqui*]) or invasive plant parts (e.g., African tulip [*Spathodea*], octopus tree [*Heptapleurum actinophyllum*], and trumpet tree [*Tabebuia*], etc.) that could harm Hawaiian native species and ecosystems. HDOT would require contractors to take precautions during construction to avoid the introduction and spread of invasive species. Additionally, DOFAW requested that actions to minimize presence of nonnative predators such as cats, rodents, and mongoose, be implemented. These measures would include not feeding feral cats, removing cats, placing bait stations for rodents and mongoose, and providing covered trash receptacles.

2.5.4 Avoidance, Minimization, and Mitigation Measures

HDOT proposes to implement the following standard conservation measures for protected species during construction. Species-specific mitigation measures developed based on guidance from the USFWS and DLNR-DOFAW will be implemented to reduce the impact of the project on endangered or threatened species. A more complete list of species-specific measures and invasive species biosecurity protocols can be found in the DOFAW consultation in Appendix A.3. USFWS coordination is still ongoing, but will be completed before the Final EA.

For example, a survey of appropriate habitat for waterbird nests would be completed by a biological monitor prior to work. If a nest is discovered, work would cease within a 100-foot buffer, and USFWS and DOFAW would be contacted. Lighting, both temporary and permanent, would be configured to be “dark-sky friendly” (e.g., shielded down and turned off when not in use) to avoid and minimize impacts to seabirds. Nighttime construction would be avoided during seabird fledging season (September 15 through December 15).

In areas where suitable nēnē habitat is observed, reduced speed limits would be implemented. If nēnē are spotted in the area during construction activities, all work within a 100-foot buffer would be ceased until the nēnē leaves on its own accord. Under the nēnē 4(d) rule, some types of take of nēnē are not prohibited under the ESA. The types of take include take by landowners (or their agents) conducting intentional harassment in the form of hazing or other deterrent measures not likely to cause direct injury or mortality; take that is incidental to conducting lawful control of introduced predators or habitat management activities for nēnē; or take by authorized law enforcement officers for the purpose of aiding or euthanizing sick, injured, or orphaned nēnē, disposing of dead specimens, and salvaging dead specimens for scientific study.

Vegetation trimming or removal of trees taller than 15 feet would be avoided during Hawaiian hoary bat roosting season (June 1 through September 15). An observational survey for pueo would be conducted two to three nights during crepuscular hours before the start of construction.

Additionally, stormwater BMPs would be incorporated into the Proposed Action. See Section 2.6 for more details.

The following invasive species biosecurity protocols would be implemented:

- Good housekeeping practices and erosion control device(s) would be employed at the project site to prevent debris and soil from leaving the site.
- Invasive species controls would be maintained to ensure that all materials transported from off-site are free of such species.
- All construction equipment and vehicles would arrive at the work site for the first time in clean conditions and free of: any soil; plants or plant parts, including seeds; insects, including eggs; and reptiles and amphibians, including their eggs. Similarly, all construction equipment and vehicles would also be cleaned after use on the project site and before leaving the site. This is particularly important for equipment movement between the project site and the other islands.
- Invasive species found on stockpiled materials would be removed either chemically or mechanically.
- The contractor would avoid feeding feral cats.
- All trash receptacles would be covered to prevent the attraction of predators.
- The contractor would be notified that they may place bait stations for rodents and mongoose.

2.6 Surface Water Resources and Wetlands

2.6.1 Existing Conditions

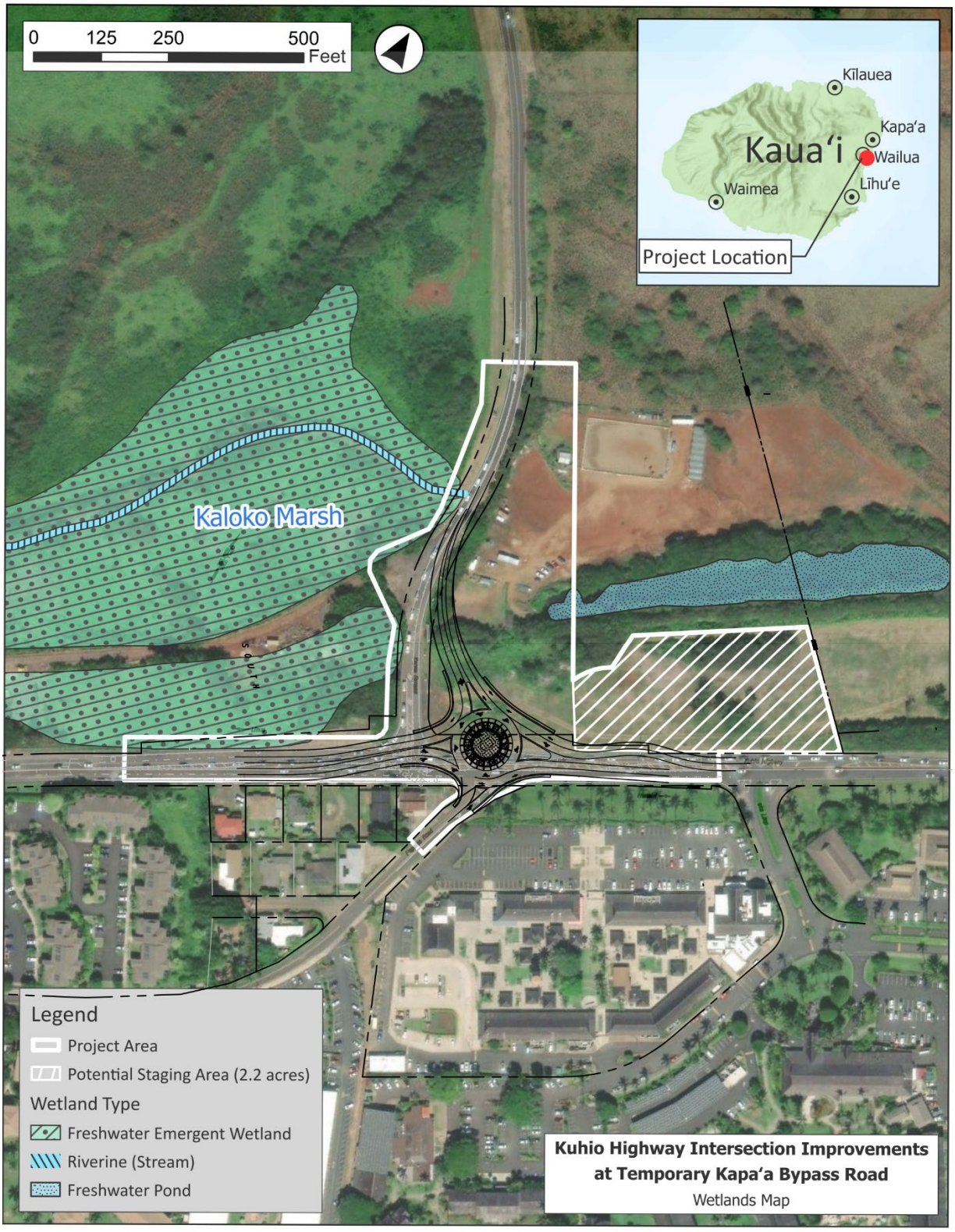
The project area is in the Wailua Watershed (see Figure 2-11). According to the USFWS National Wetlands Inventory (NWI), three different types of wetlands classifications may occur within the project area (see Figure 2-12). These potential wetlands have no identified surface connection to the ocean, which lies approximately 1,000 feet away from the project area. Community input suggests that the nearby Konohiki Stream may run underneath a portion of the project area. According to a water quality survey conducted in 2009 by AECOS Inc., the wetlands in the project area appear to drain “naturally” in the Kapa‘a direction, which coincides with the direction that Konohiki Stream flows toward the ocean. The historical flow of water in the project area was toward Kapa‘a and into the Pacific Ocean at Waipouli. However, a culvert pipe beneath Kapa‘a Bypass Road had been filled with concrete, preventing outflow in that direction (AECOS 2009).

Figure 2-11: Streams and Watersheds Map



Source: Hawai‘i Statewide GIS 2022a, 2024d; U.S. Geological Survey, 2025; ESRI, World Imagery 2026; ESRI, World Hillshade and World Terrain Base 2026.

Figure 2-12: Wetlands in the Project Area



Source: Hawai‘i Statewide GIS 2022b; ESRI, World Imagery 2026; ESRI, World Hillshade and World Terrain Base 2026.

Mauka of Kūhiō Highway and in the Līhuʻe direction of Kapaʻa Bypass is the Kaloko Marsh, which the NWI identifies as a palustrine emergent persistent wetland temporarily flooded with surface freshwater (PEM1A). The marsh is bisected by a dirt road that runs parallel to Kūhiō Highway and intersects Kapaʻa Bypass. Within Kaloko Marsh, the NWI identifies an intermittent riverine wetland (R4SBC) that intersects Kapaʻa Bypass at the location of the concrete-filled culvert pipe that naturally drains the marsh to the northeast. The riverine intersects Kapaʻa Bypass at the location of the concrete-filled culvert pipe. Mauka of Kūhiō Highway and in the Kapaʻa direction of Kapaʻa Bypass is a palustrine unconsolidated bottom wetland (PUBHx) that is flooded year-round and formed from agricultural activity. Only a small portion of each assumed wetland overlaps the project area, but no work is proposed for the intersection realignment and roundabout in these wetlands, as shown in Figure 2-12. Therefore, HDOT did not conduct a wetland delineation.

2.6.2 Potential Impacts

The project is unlikely to affect the existing wetlands in and around the project area. Although small portions of wetlands overlap the project area, the Proposed Action does not encompass the entire project area, and the plans for the two-lane roundabout do not intersect any assumed wetlands. Upon the completion of construction, the contractor would also remove any construction debris to help return the project area to its original condition as much as possible.

Installing a two-lane roundabout would increase paved areas, thereby increasing impervious pavement and stormwater runoff. It is anticipated that new permanent drainage would remain similar to existing drainage patterns, with drainage swales along each side of the roadway. Additionally, permanent BMPs would be installed to further mitigate the increased runoff, with the final design to be determined at a later date, so the Proposed Action would not adversely impact adjacent nearby streams or coastal waters. The roadway runoff is not likely to have any permanent effects on water quality. During construction, appropriate erosion control measures and site-specific temporary BMPs would be implemented to prevent dust, fuel, oil, and cement from discharging or leaching into nearby surface waters and the ocean. With the proposed mitigation measures and project design elements, such as permanent stormwater BMPs discussed in Section 2.6.3, the Proposed Action would not adversely affect water quality.

2.6.3 Avoidance, Minimization, and Mitigation Measures

The selected contractor would implement stormwater BMPs in accordance with An Integrated Storm Water Management Approach and a Summary of Clear Water Diversion and Isolation Best Management Practices for Use in the State of Hawaiʻi, by the Federal Highway Administration, Hawaiʻi Department of Transportation Practitioners Guide (2016) and the Hawaiʻi Department of Transportation Construction Best Management Practices Field Manual (2021). In addition, contractors would be required to follow the HDOT Standard Specifications for Road and Bridge Construction Section 209, Temporary Water Pollution, Dust, and Erosion Control. National Pollutant Discharge Elimination System (NPDES) permit requirements of the Hawaiʻi Department of Health (HDOH) would also be implemented to control erosion and surface runoff. With these mitigation measures, no significant adverse impacts are anticipated to surface water, Therefore, no

other mitigation measures are proposed. In case of any potential natural hazard events, such as hurricanes or flooding occurring during construction, soil erosion mitigation measures would be implemented. These measures include sediment control filters, ground blankets, temporary silt fencing, sandbags, or screens along the limits of grading and near drain inlets to capture sediment-laden runoff and stabilize disturbed soils.

2.7 Parks and Recreational Resources

2.7.1 Existing Conditions

The nearest public park to the project area is the county-owned Wailua Beach Park, located approximately 0.1 miles south and outside the project area. Other nearby parks include the state-owned Wailua River State Park (0.5 miles) and county-owned Lydgate Beach Park (1.4 miles) (see Figure 2-13). The project area does overlap a portion of the Healing Horses Kauaʻi facility, which is a 501(C)(3) nonprofit organization offering recreational horseback riding lessons and equine therapy.

2.7.2 Potential Impacts

There would be no significant adverse impacts to the public parks and recreational areas mentioned above, because they are mostly outside of the project area (except for the leased property, Healing Horses Kauaʻi). Upon project completion, the anticipated improvements to traffic flow along Kūhiō Highway may facilitate access to coastal recreational activities.

However, the Proposed Action would permanently acquire approximately 1 acre of the 15-acre Healing Horses Kauaʻi, a leased property from My Kapaʻa landowner (TMK parcel 4-3-010:005). This permanent acquisition of the Healing Horses Kauaʻi property would affect the daily operations of the lessee Healing Horses Kauaʻi. HDOT is requesting temporary use of approximately 2 acres of the leased Healing Horses Kauaʻi property for construction staging. This proposed staging area would be returned to its preconstruction condition, if use is granted. See Section 2.2 for a discussion of the potential impacts to the leased property, Healing Horses Kauaʻi.

Construction may temporarily affect traffic in the project area, including vehicular access to Healing Horses Kauaʻi from Kapaʻa Bypass Road. Access to parks and beaches outside of the project area would remain unaffected.

2.7.3 Avoidance, Minimization, and Mitigation Measures

No significant adverse impacts to public parks and recreational resources are anticipated. Therefore, no mitigation measures are proposed. However, the Proposed Action would result in permanently acquiring and displacing a portion of the Healing Horses Kauaʻi facility, as well as temporary use during construction and driveway readjustments at this property. These impacts to Healing Horses Kauaʻi as well as proposed minimization and mitigation measures are discussed in Section 2.2.

Figure 2-13: Parks and Recreation Map



Source: Hawai‘i Statewide GIS 2021a; Kaua‘i County Parks and Recreation 2025; ESRI, World Imagery 2026; ESRI, World Hillshade and World Terrain Base 2026.Visual and Aesthetic Resources

2.8 Visual and Aesthetic Resources

2.8.1 Existing Conditions

The project area is within an urban corridor in East Kaua‘i that extends along Kūhiō Highway from Haleilio Road in Wailua to Kawaihau Road, at the northern edge of Kapa‘a Town, the most populated area in Kaua‘i. The makai side of Kūhiō Highway largely consists of hotels, resorts, condominiums, and shopping centers. Coconut trees line Kūhiō Highway in front of Coconut Marketplace However, on the mauka side, the project area consists of undeveloped, vegetated lands. The general topography of this area is mostly flat, with dirt patches and horse trails scattered throughout the area. See Figure 2-14 for photos of the highway corridor in the project area extracted from the LRFI (Keala Pono). The horse pastures described in the site photos pertain to the leased property, Healing Horses Kaua‘i.

2.8.2 Potential Impacts

Anticipated impacts to the visual and aesthetic setting of Kapa‘a involve the existing vegetation surrounding the project area, particularly in the rural area mauka of Kūhiō Highway. The Proposed Action would transform a portion of undeveloped, vegetated land mauka of Kūhiō Highway to realign Kapa‘a Bypass to create the proposed two-lane roundabout. To minimize the reduction of rural areas, the old Kapa‘a Bypass would be removed, hydromulched, and allowed to revegetate naturally.

While the proposed roundabout would be a new visual element in this highway landscape as well as a reduction in rural pastures adjacent to the project area, the Proposed Action would not result in significantly adverse changes to the overall visual and aesthetic character of the project area. Because the project area consists of Kūhiō Highway, a principal arterial highway, its existing intersections, and adjoining residential and commercial developments, the existing visual setting is already defined by roadways and tourism hubs. The Proposed Action would also install permanent highway lighting along Kūhiō Highway. These new lighting installations would increase the amount of nighttime illumination affecting the surrounding community.

2.8.3 Avoidance, Minimization, and Mitigation Measures

Because no significant adverse effects are anticipated, no avoidance, minimization, and mitigation measures are proposed for visual and aesthetic resources.

Figure 2-14: Site Photos



Kuhio Highway, facing west-southwest. Source: Keala Pono, 2024



Source: Keala Pono, 2024

Kuhio Highway, facing northeast.



Source: Keala Pono, 2024

Kapaa Bypass Road and dirt shoulder, facing north.



Source: Keala Pono, 2024

Staging Area, facing southeast



Source: Keala Pono, 2024

Healing Horses Kaua‘i, facing north.



Source: Keala Pono, 2024

Papaloa Road, facing south-southwest.



Source: Keala Pono, 2024

Southwest horse pasture, facing east.



Source: Keala Pono, 2024

Northeast horse pasture, facing south.



Source: Keala Pono, 2024

Vegetation east of Kapa‘a Bypass Road, facing northwest.



Source: Keala Pono, 2024

Riding trail, facing east-northeast.

2.9 Transportation Infrastructure and Traffic

2.9.1 Existing Conditions

Existing Roadway Network

As shown in Figure 1-1 and Figure 1-3, Kūhiō Highway is a main principal arterial, which is generally a two-way, three-to-four-lane highway oriented north to south. Within the project area, Papaloa Road is a two-way, two-lane, northeast–southwest roadway that begins at its intersection with Kūhiō Highway to the southwest (near Haleilio Road) and terminates within the project area in the northeast at its other intersection with Kūhiō Highway. Papaloa Road serves various commercial, residential and resort uses. The roadway has a posted speed limit of 25 mph in the vicinity of the project area.

Kapaʻa Bypass Road is generally a two-way, two-lane, north–south roadway within the study area. Kapaʻa Bypass Road begins to the south at its intersection with Kūhiō Highway in the project area and terminates to the north at its intersection with Kūhiō Highway in Kapaʻa. The northern terminus of Kapaʻa Bypass serves one-way traffic in the southbound direction only. Kapaʻa Bypass Road provides an alternative route to Kūhiō Highway for drivers to avoid slowdowns through Kapaʻa Town caused by the numerous intersections as well as driveways and on-street parking serving commercial businesses. The roadway has a posted speed limit of 35 mph in the vicinity of the project area.

Lanikai Street is a two-way, two-lane road connecting Papaloa Road to Kūhiō Highway near Kintaro Restaurant. Lanikai Street T intersects with Kūhiō Highway roughly 1,200 feet south of the existing Kapaʻa Bypass Road intersection with Kūhiō Highway. Lanikai Street provides the only left-turn opportunity from the Papaloa area onto Kūhiō Highway. The roadway does not have a posted speed limit.

No bicycle infrastructure is currently located in the project area, and sidewalks exist only on the makai side of Kūhiō Highway to the Līhuʻe side of Papaloa Road. According to the Bike Plan Hawaiʻi by HDOT (2022), Kūhiō Highway within the project area is planned to be a signed, shared roadway for bicyclists. Four Kauaʻi County bus routes run through the project area: Hanalei to Līhuʻe (Route 400), Līhuʻe to Hanalei (Route 500), Wailua to Līhuʻe Mainline (Route 800), and Līhuʻe to Wailua Mainline (Route 850). The closest bus stop to the project area for northbound routes (500 and 850) is approximately 150 feet to the Kapaʻa side of Lanikai Street. The closest stop for southbound bus routes (400 and 800) is located approximately 200 feet to the Kapaʻa side of the intersection of Haleilio Road and Kūhiō Highway (see Figure 1-1). Route 800 and 850 routes are commuter buses. They run reduced hours, with route 800 only running its route two times in the morning and route 850 only running three times, once in the middle of the day and twice in the evening.

Existing Traffic Volumes and Patterns

Traffic volume data extracted from September 2023 indicated that peak hours generally occur between 7:00 a.m. to 8:00 a.m. and 4:00 p.m. to 5:00 p.m. In June 2023 (prior to the 2023 traffic volume data collection), HDOT completed the Kūhiō Highway Short-Term Improvements project,

which widened Kūhiō Highway from three lanes to four lanes between Kuamoʻo Road (See Figure 1-1) and the southern terminus of Kapaʻa Bypass Road. This widening resulted in a significant decrease in traffic congestion during peak rush hours. However, congestion still persists north of the study area through Kapaʻa Town.

Existing Crash Data

HDOT traffic division (HWY-T) conducted a traffic crash analysis for the intersections of Kūhiō Highway with Kapaʻa Bypass Road, Kūhiō Highway with Papaloa Road, and Kūhiō Highway with Lanikai Street. The analysis studied the five most recent years of data (2020–2024).

Kūhiō Highway/Kapaʻa Bypass Road

There were six major traffic crashes at the intersection of Kūhiō Highway with Kapaʻa Bypass. These crashes included three broadside collisions (T-bone), one rear end, one sideswipe-same direction, and one angle-opposite direction. None of these crashes involved pedestrians or bicycles or resulted in fatalities or serious injuries. HWY-T recommended installing "intersection ahead" warning signs along the Kūhiō Highway approach to the intersection.

Kūhiō Highway/Papaloa Road

There were three major traffic crashes at the intersection of Papaloa Road with Kūhiō Highway. One crash was a rearend and two crashes involved bicyclists. One bicycle crash was a result of a bicycle traveling southbound on Kūhiō Highway and crossing the roadway improperly, resulting in an impact by a car traveling northbound on Kūhiō Highway. The other bicycle was hit by a vehicle turning right from Papaloa Road onto Kūhiō Highway northbound while traveling southbound along Kūhiō Highway. None of these crashes resulted in fatalities or serious injuries.

Kūhiō Highway/Lanikai Street

There were four major traffic crashes at the intersection of Lanikai Street with Kūhiō Highway. Of these crashes, two were broadside collisions, one was an angle-opposite direction collision, and one was a bicycle vehicle collision as a bicycle turned left from Lanikai Street onto Kūhiō Highway southbound and was hit by a southbound vehicle. None of these crashes resulted in fatalities or serious injuries.

Existing Intersection Operations and Level of Service

For the Alternatives Analysis Report (Austin, Tsutsumi & Associates Inc. 2024) included in this EA as Appendix B, a Level of Service (LOS) analysis was conducted in the project area to evaluate how well the Kūhiō Highway intersections with Kapaʻa Bypass and Papaloa Road handle traffic under the existing and proposed traffic controls. On a scale of A through F, LOS A represents free-flowing traffic and LOS F indicates unstable, stop-and-go conditions at or near traffic breakdown. Most movements at the Kūhiō Highway Kapaʻa Bypass Intersection and the Kūhiō Highway Papaloa Road Intersection operate adequately (LOS A and B). However, the left-turn lane from Kapaʻa Bypass Road onto Kūhiō Highway (Kapaʻa-bound) currently experiences delays, operating at LOS E during AM peak hours and LOS F during the PM peak hours. In 2043, this movement is anticipated to operate at LOS F during peak AM and PM hours. Additionally, in

2043, the left turn from Kūhiō Highway Kapaʻa-bound onto Kapaʻa Bypass is expected to experience increased delays due to less gaps in Līhuʻe-bound traffic on Kūhiō Highway. The increased delays are anticipated to result in average left-turn queues of 300 feet, but in some cases, the queues could extend out of the left-turn pocket and into the Kūhiō Highway Kapaʻa-bound through lane. In the worst cases, these queues could extend beyond the Papaloa Road (south) intersection, roughly 2,000 feet in the Līhuʻe direction of Kapaʻa Bypass (see Table 2-3 and Table 2-4).

2.9.2 Potential Impacts

No Action Alternative

Under the No Action Alternative, the Kapaʻa Bypass Road would not be realigned and the existing stop-control intersections within the project area would be maintained. Based on the 2043 traffic estimations from the traffic analysis report, the project area is expected to experience increased vehicle demand, exceed capacity, and result in lengthy delays. In particular, the left turns from Kūhiō Highway (Kapaʻa-bound) onto Kapaʻa Bypass Road would be more difficult to complete, resulting in queues extending beyond the left-turn lane and blocking adjacent through traffic. In addition, the safety concerns regarding the left turn from Lanikai Street (near Kintaro Restaurant) onto Kūhiō Highway (Līhuʻe-bound) would not be addressed. Without these roadway improvements, the existing transportation infrastructure would not meet the current roadway safety standards and future traffic demands, and ultimately, this could put drivers at risk and make it harder for emergency vehicles to respond quickly. See Table 2-3 for a comparison of the LOS of the existing traffic conditions in comparison to the No Action Alternative.

Table 2-3: LOS for Existing and Year 2043 No Action Alternative Conditions

Intersection	Existing Conditions		No Action Alternative (2043)	
	AM	PM	AM	PM
	LOS	LOS	LOS	LOS
Kūhiō Highway and Papaloa Road				
Right turn from Papaloa Road onto Kūhiō Hwy Kapaʻa-bound	B	B	B	B
Left turn from Kūhiō Highway Līhuʻe-bound onto Papaloa Road	A	B	B	B
Kūhiō Highway and Kapaʻa Bypass Road				
Left turn from Kūhiō Highway Kapaʻa-bound onto Kapaʻa Bypass	A	B	B	C
Left turn from Kapaʻa Bypass onto Kūhiō Highway Kapaʻa-bound	E	F	F	F
Right turn from Kapaʻa Bypass onto Kūhiō Highway Līhuʻe-bound	A	A	A	A

Source: Austin, Tsutsumi & Associates Inc. 2024

Key: AM = morning; LOS = Level of Service; PM = afternoon; LOS A = free-flow traffic; LOS B = reasonably free-flow traffic; LOS C = stable-flow traffic; LOS E = unstable flow/at or near capacity traffic; LOS F = heavily congested, stop-and-go traffic

Proposed Action

The Proposed Action is not anticipated to increase traffic capacity as no additional lanes or widened lanes are proposed. The Proposed Action is expected to operate adequately by Year 2043, with traffic capacity improving at LOS B or better for most movements during peak hours. including the left turn from Kūhiō Highway Kapaʻa-bound onto Kapaʻa Bypass. The Kūhiō Highway Līhuʻe-bound left turn and through movement would perform at LOS C. Operationally, the Proposed Action is anticipated to result in minor increases in delays for the Kūhiō Highway through traffic. This is because the Kūhiō Highway through movement previously had no slowdowns within the project area. The installation of the roundabout would require through traffic to slow down when approaching the intersection and yield to traffic within the roundabout. Vehicles from Kapaʻa Bypass and Papaloa Road approaches would experience fewer delays than existing conditions. This alternative would also allow drivers from Papaloa Road to turn left onto Kūhiō Highway Līhuʻe-bound.

Table 2-4: LOS for Proposed Action: Two-Lane Roundabout

Roundabout Approach	Movement	Proposed Action (2043)	
		AM LOS*	PM LOS*
Kūhiō Highway	Līhuʻe-bound left turn onto Papaloa Road	A	C
Kapaʻa Bypass Road	Left turn onto Kūhiō Highway Kapaʻa-bound	B	B
Papaloa Road	Left turn onto Kūhiō Highway Līhuʻe-bound	A	B
Kūhiō Highway	Kapaʻa-bound left turn onto Kapaʻa Bypass	A	A

*All roundabout movement approaches were examined but only the worst movement LOS results for each approach of the roundabout are reported.
Source: WSP USA and Austin, Tsutsumi & Associates Inc. 2024
Key: AM = morning; LOS = Level of Service; PM = afternoon; LOS A = free-flow traffic; LOS B = reasonably free-flow traffic; LOS C = stable-flow traffic

Although the Proposed Action may result in long, slow-moving queues during PM peak hours, these queues are expected to move more steadily in comparison to the existing stop-controlled intersection that is also assumed in the No Action Alternative. In addition, the proposed roundabout would include a central apron to facilitate movement of commercial vehicles, emergency vehicles, and personal vehicles pulling trailers. While driver confusion may initially occur, operations would likely improve as drivers gain knowledge and experience. Although no fatal and injury crashes have occurred at the intersection in the last five years of data collection, there have been 13 major crashes. The improved traffic flow, fewer conflict points, and reduced intersection speeds as a result of the two-lane roundabout is anticipated to reduce the likelihood of fatal and injury crashes at the intersection.

The Proposed Action does not propose bicycle infrastructure consistent with HDOT's Bike Plan Hawaiʻi. See Section 3.1.4 for more details. HDOT is studying the feasibility of installing bus stops on both sides of Kūhiō Highway on the Kapaʻa side of Papaloa Road and in front of Coconut Marketplace. Sidewalks would be built in the immediate vicinity of the roundabout to connect crosswalks, which would facilitate intersection use by bus riders and other pedestrians.

Based on the foregoing discussion, HDOT has determined that the Proposed Action would result in an overall improvement in intersection operation and safety without causing any significant adverse traffic impacts, compared to the No Action Alternative. Avoidance, Minimization, and Mitigation Measures

The Proposed Action is expected to improve traffic operations and intersection safety by Year 2043. Potential impacts would include minor increases in delays for Kūhiō Highway through traffic but reductions in delays for traffic entering the highway from Kapa‘a Bypass or Papaloa Road. These impacts would be minor. The two-lane roundabout may result in driver confusion due to the novelty of the roundabout in Kaua‘i. This confusion may cause vehicle slowdowns. However, over time, residents would adjust to the roundabout. The following avoidance, minimization, and mitigation measures were considered:

- Metering northbound traffic, such as signal timing adjustments or physical design elements to regulate entry into the roundabout (Austin, Tsutsumi & Associates Inc. 2024) (see Appendix B).
- Installing signage to alert drivers to the upcoming roundabout, guide them on how to navigate it, and reduce speeds to improve safety
- Conducting public education and outreach prior to and during construction to familiarize drivers with roundabout navigation
- Installing entrance/exit speed bumps on the main road adjacent to Kintaro Restaurant for increased safety
- Installing extruded curbs (or plastic delineators) as part of the roundabout design to control traffic from rapid lane changes

A TCP would be prepared for this project to reduce construction-related traffic impacts. The TCP would address the continued safe operation of Kūhiō Highway at these existing and proposed intersections during peak hours to allow traffic flow. Lane closures required to complete construction of the roundabout would be scheduled during non-peak hours to reduce traffic impacts.

2.10 Natural Hazards and Sea-Level Rise

2.10.1 Existing Conditions

Natural hazards that may occur in the vicinity of the project area include flood hazards, earthquakes, hurricanes, and tsunamis. Sea-level rise (SLR) is also affecting the impact of natural hazards.

Flood Hazards

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map, the entire project area falls within Flood Zone X, which are areas determined to be outside the 500-year floodplain. This designation means that the chance of flooding in the project is highly

unlikely. While the project is located in FEMA Flood Zone X, community comments indicate that the area floods during heavy rains. Although severe flooding from surrounding areas could also affect the project area, it is not expected under typical conditions (see Figure 2-15).

Earthquakes

The Hawaiian Islands as a whole are seismically active, especially around the island of Hawaiʻi. However, Kauaʻi is among the least prone to earthquakes compared to other parts of the state due to its location in the northwest of the island chain, farthest away from the volcanic hotspot. The Kauaʻi County Multi-Hazard Mitigation and Resilience Plan (2025) and the 2023 Hawaiʻi State Hazard Mitigation Plan (2023) both identify earthquakes as a potential hazard but rank them as a lower priority for Kauaʻi compared to other natural hazards.

Hurricanes

The Hawaiian Islands are periodically affected by Pacific hurricanes, particularly in the summer and winter months. These tropical cyclones generally travel toward the islands from a southerly or southeasterly direction and can bring large amounts of rain with high winds, resulting in damage to man-made infrastructure and natural features alike. The storms generally contribute to localized flooding and coastal storm surges. The Kauaʻi County Multi-Hazard Mitigation and Resilience Plan identifies hurricanes as a major natural hazard for Kauaʻi. The last hurricane that directly impacted Kauaʻi was Hurricane Iniki in 1992, which was the most destructive and costly hurricane to affect the Island of Kauaʻi on record.

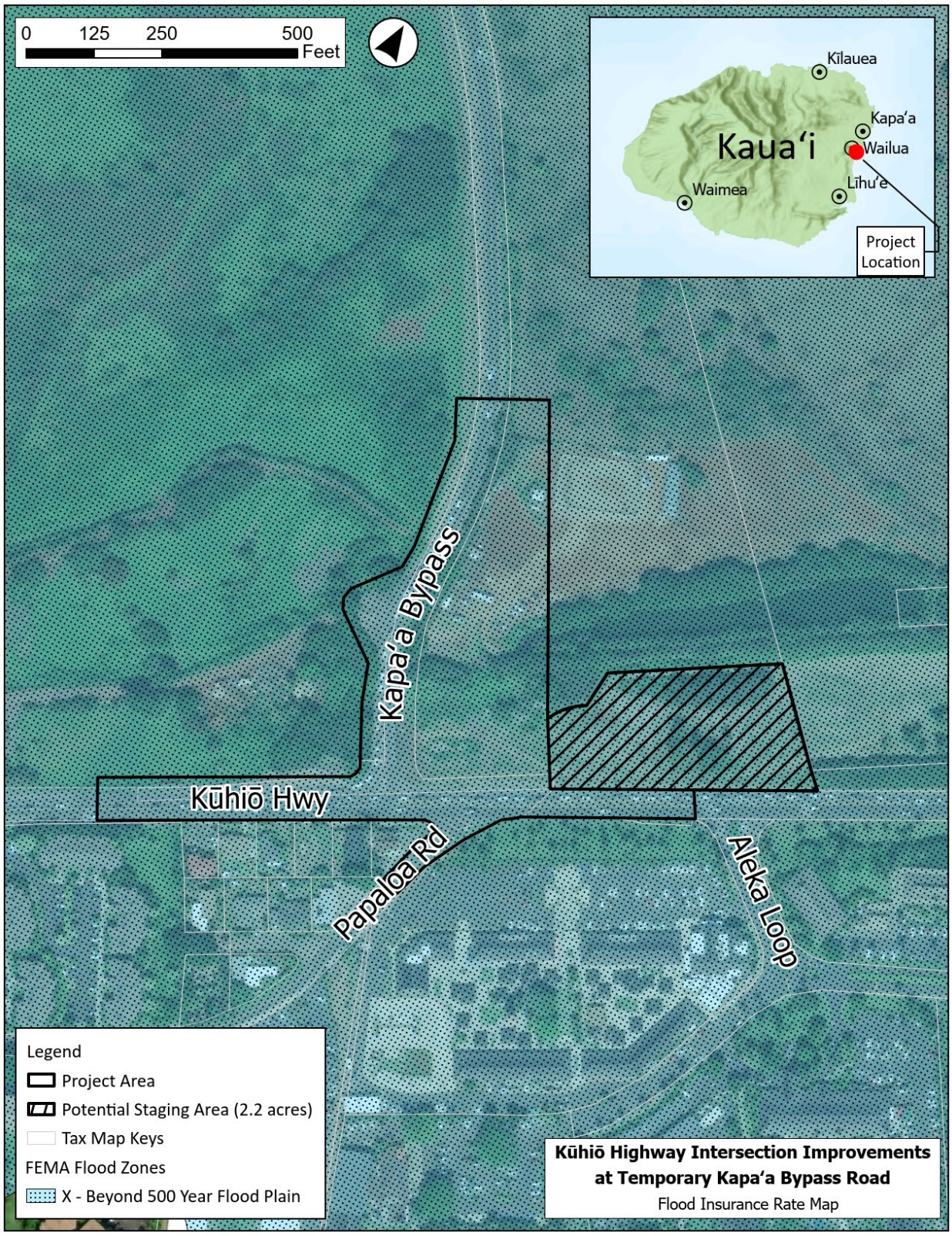
Tsunami

The Hawaiian Islands are vulnerable to tsunami hazards due to their geographic location in the Pacific Ocean as well as the islands' own active volcanic and seismic nature. According to the Tsunami and Extreme Tsunami Evacuation Zones Maps for the island of Kauaʻi, the entire project area falls within the tsunami evacuation zone (see Figure 2-16).

Sea-Level Rise

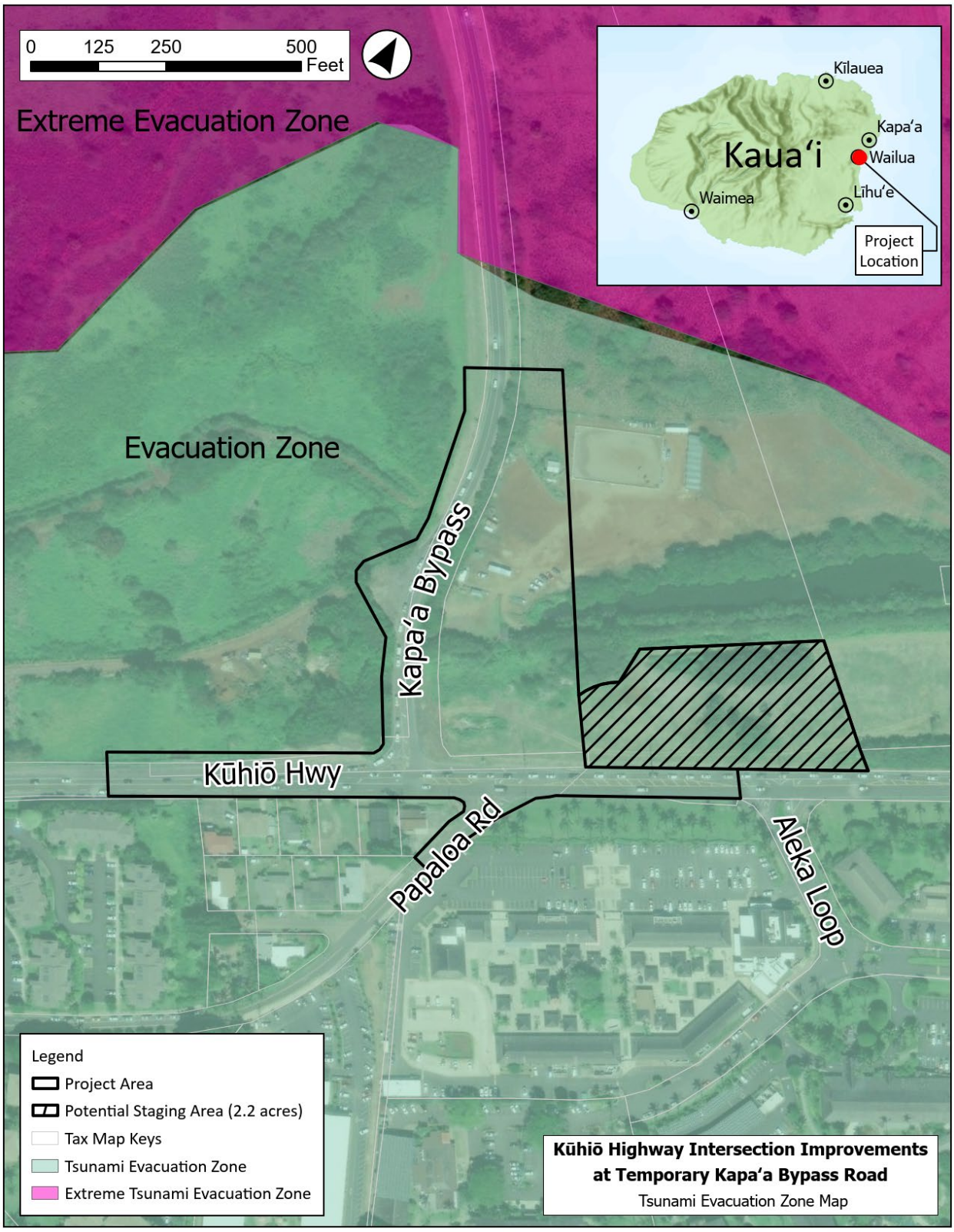
Global climate change and SLR can exacerbate impacts of these natural hazards on all infrastructure in the state, particularly in coastal areas and areas prone to flooding. Coastal areas are expected to experience more frequent and severe flooding episodes, which can exacerbate the impacts of natural hazard events, such as tsunami and hurricanes or other high wind events. Additionally, SLR can cause storm surges to penetrate further inland, increasing the area and population that is vulnerable to hurricane and tsunami hazards. Effective July 2019, the state required all new projects undergoing environmental review pursuant to the Hawaiʻi Environmental Policy Act (also known as HRS Chapter 343) to consider whether projects are likely to have an adverse effect on SLR or be vulnerable to SLR.

Figure 2-15: Flood Insurance Rate Map



Source: Hawai‘i Statewide GIS 2021b ; ESRI, World Imagery 2026; ESRI, World Hillshade and World Terrain Base 2026.
Key: FEMA = Federal Emergency Management Agency

Figure 2-16: Tsunami Evacuation Zone Map



Source: Hawai‘i Statewide GIS 2022c; ESRI, World Imagery 2026; ESRI, World Hillshade and World Terrain Base 2026.

To help identify potential coastal flooding extents for events under projected future SLR conditions, the state developed the web-based State of Hawai‘i SLR Viewer in 2018 (SLR Viewer) to show SLR exposure areas (SLR-XA) in Hawai‘i with varying assumed heights of SLR. The SLR Viewer provides map data illustrating future projections of hazard exposure and evaluates vulnerabilities stemming from SLR. While other SLR scenarios are presented in the SLR Viewer, any references to the SLR-XA in this EA refers to the 3.2-foot SLR scenario, which combines the potential impacts from three chronic hazards: passive flooding, annual high-wave flooding, and coastal erosion. In Hawai‘i, guidance encourages the use of 3.2 feet of global mean SLR as a planning target for 2100, as described in the 2022 Hawai‘i Sea Level Rise Vulnerability and Adaptation Report. Some portions of the project area are in the SLR-XA (see Figure 2-17).

Wildfires

In response to HDOT's request for EA pre-consultation comments, DOFAW commented that the project is located in an arid climate with high fine fuel load (grasses). According to the DOFAW assessment of risk from wildland fires for major populated areas, most of the project area is in a high-risk area (see Figure 2-18).

2.10.2 Potential Impacts

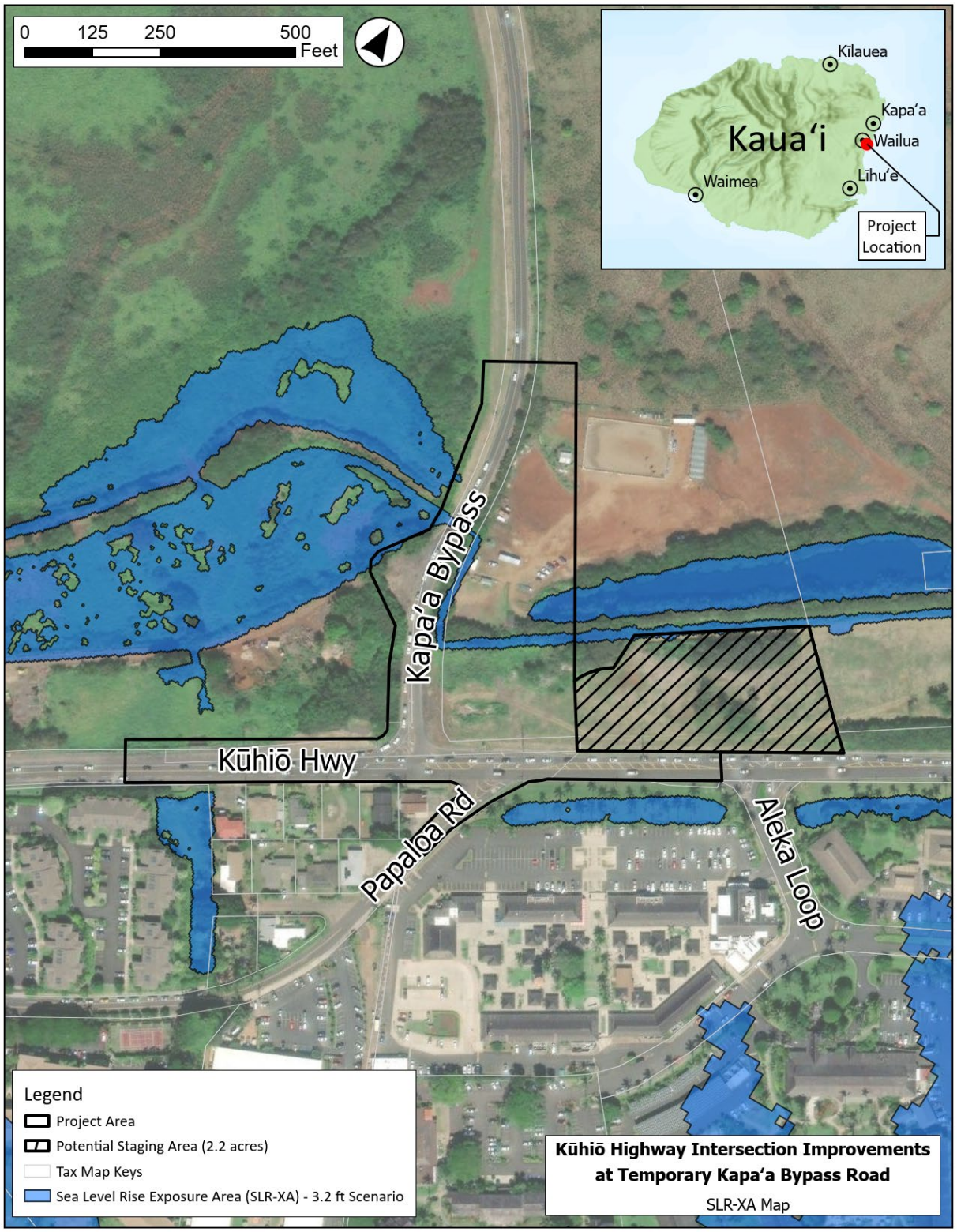
The Proposed Action itself would not have any impact on the likelihood or severity of precipitation patterns and flooding, earthquakes, tsunamis, or SLR. The Proposed Action would also not adversely affect the project area's vulnerability to such natural hazards. The roundabout would be designed with appropriate drainage features to prevent flooding under normal conditions. Due to the increased impervious surfaces at the roundabout, a potential long-term impact is additional stormwater runoff during natural hazard events, such as hurricanes and flooding. However, the Proposed Action itself is not expected to have significant adverse impacts on stormwater because standard erosion control and stormwater BMPs would be integrated into project design, as described in Section 2.6.3 and Section 2.10.3.

Furthermore, the construction of a two-lane roundabout would improve traffic flow and reduce congestion in the region, which would facilitate safer and more efficient evacuation in the event of an emergency. The Proposed Action would also be designed and constructed in accordance with current HDOT and American Association of State Highway and Transportation Officials Standards (2010), both of which account for natural hazard considerations.

The short-term potential impacts during construction that may affect vulnerability to natural hazards include temporary soil erosion during ground disturbance and vegetation clearance activities, especially if a natural hazard event, such as a hurricane or flood, were to occur during construction. Such potential impacts would be avoided, minimized, or mitigated with construction BMPs described in Section 2.1.3 and Section 2.6.3.

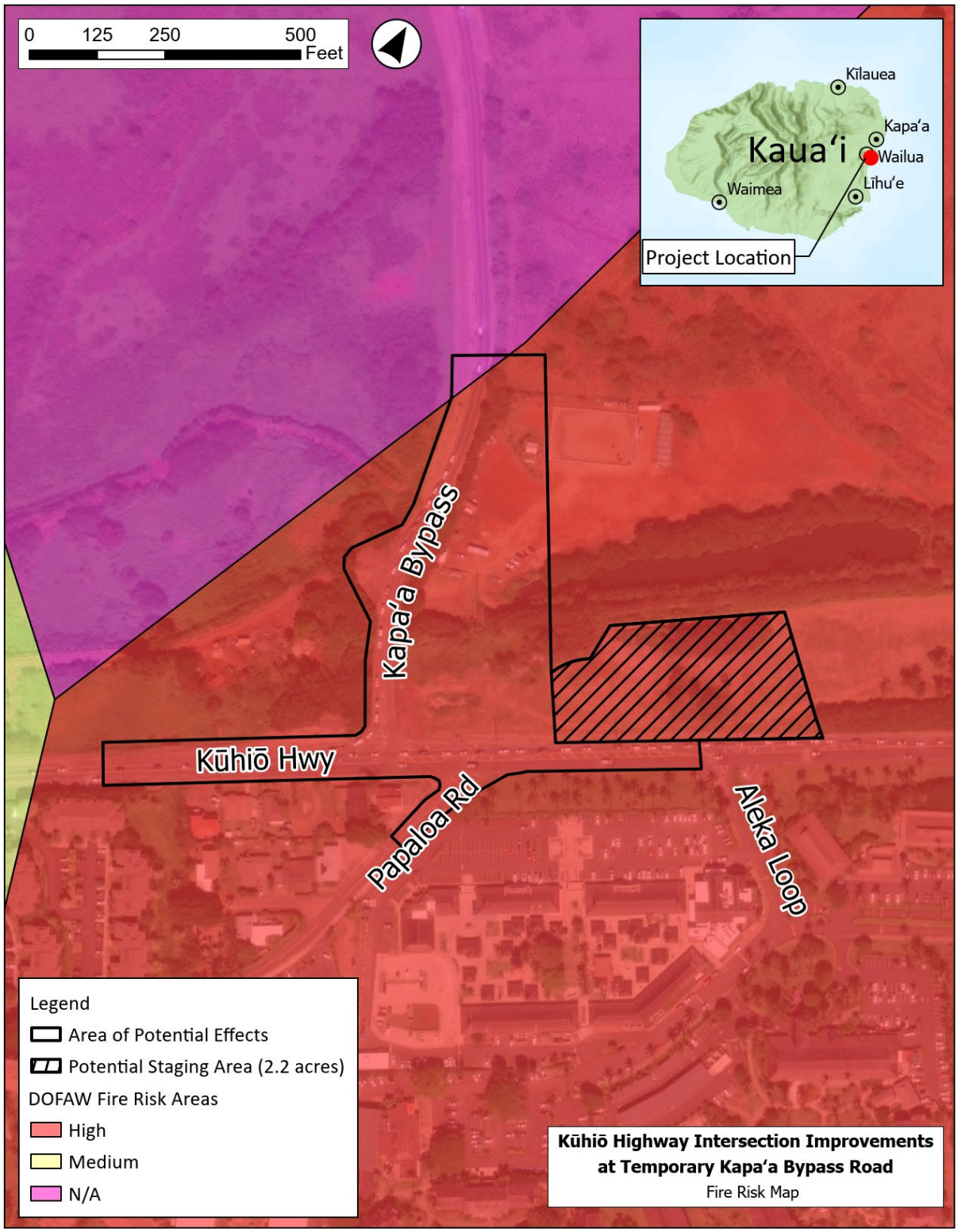
Some construction activities, like welding in or near tall grass, may have the potential to start a wildfire. However, with the implementation of mitigation measures provided by DOFAW, the project is not likely to start a wildfire.

Figure 2-17: Sea-Level Rise Exposure Area Map



Source: Hawai‘i State GIS 2022d; ESRI, World Imagery 2026; ESRI, World Hillshade and World Terrain Base 2026.
Key: SLR-XA = Sea-Level Rise Exposure Area Map

Figure 2-18: Fire Risk Map



Source: Hawai‘i Statewide GIS 2024e; ESRI, World Imagery 2026; ESRI, World Hillshade and World Terrain Base 2026.
Key: DOFAW = Division of Forestry and Wildlife

2.10.3 Avoidance, Minimization, and Mitigation Measures

The following wildfire prevention mitigation measures would be implemented when engaging in activities with a high risk of starting a wildfire:

- Wet down the area before starting a construction task.
- Continuously wet down the area as needed.
- Have a fire extinguisher on hand.
- If a worker’s vision is impaired (i.e., using welding goggles), a spotter should be present to watch for fire ignitions.

Additionally, vehicles would not be parked in or near tall grass to prevent heat from the engine/exhaust from igniting dry vegetation.

Because the Proposed Action would not adversely affect the project area’s vulnerability to natural hazards, such as earthquakes, flooding, tsunami, or SLR, no additional avoidance, minimization, and mitigation measures are proposed other than standard erosion control BMPs previously discussed. Standard erosion control BMPs and construction stormwater BMPs would be implemented, as described in Section 2.1.3 and Section 2.6.3, respectively.

2.11 Public Services, Utilities and Infrastructure

2.11.1 Existing Conditions

The vicinity of the project area is largely developed for tourism with infrastructure including hotels along the coastline, shopping centers like the Coconut Marketplace, and restaurants. Although the vicinity is mostly developed, the project area itself is bordered by mostly agricultural lands on the mauka side and more development and commercial buildings on the makai side. The types of utilities include sewer mains that run along Kūhiō Highway and other standard utilities services, such as water, electricity, and telecommunications. There are no existing shared use paths in the project area.

2.11.2 Potential Impacts

HDOT consulted with several state and county agencies as part of the HRS 343 review process. The County of Kaua‘i Department of Water (DOW) indicated no objections to the Proposed Action and informed HDOT that they are planning a waterline improvement project along Kūhiō Highway, from Papaloa Road to Kawaihau Road, which is located in Kapa‘a by the northern terminus of Kapa‘a Bypass Road. This DOW project would include portions of the project area. The Proposed Action is not expected to adversely affect existing underground utilities or other ground disturbance activities in the corridor.

Early consultation comments indicated that there are no concerns regarding potential impacts to essential emergency services, such as police and fire response from County of Kaua’i emergency response agencies (see Chapter 4 and Appendix A). The construction of a two-lane roundabout would improve traffic flow and reduce congestion through the Kūhiō Highway corridor, which would facilitate safe, efficient movement of emergency vehicles and evacuees.

2.11.3 Avoidance, Minimization, and Mitigation Measures

Because public facilities, services, utilities, and other infrastructure are not anticipated to be significantly and adversely impacted by the Proposed Action, no additional avoidance, minimization, and mitigation measures are necessary. Construction logistics would be coordinated with public utility providers, such as the County of Kaua‘i DOW and Wastewater Branch, to avoid or minimize any potential service disruptions and adverse impacts to utility services. Similarly, HDOT would coordinate with essential emergency service providers prior to and during construction.

2.12 Noise

2.12.1 Existing Conditions

Noise is defined as any sound that is undesirable or interferes with normal human activities. Energy level equivalent (Leq) is the constant noise level over a specified period of time that is equivalent in energy to a fluctuating (or brief) noise “averaged” over that period of time. Leq is also a function of time and is expressed as Leq (time period). A noise impact occurs from roadway projects when the predicted traffic noise levels approach or exceed the Noise Abatement Criteria, or when the predicted traffic noise levels substantially exceed the existing noise levels.

Current noise levels in the vicinity of the project site are predominantly attributable to vehicular traffic traveling along Kūhiō Highway. The posted speed limit along Kūhiō Highway within the project area is currently 25 mph. The existing noise level is generally low as a result of the posted speed limit and the rural character of the area.

All residences along the project area are R-10 units and qualify as noise-sensitive properties under the HDOT Highway Noise Policy and Abatement Guidelines. No other noise-sensitive land uses are known within or adjacent to the project area. These HDOT guidelines call for noise abatement measures to be considered if noise levels reach 66 a-weighted decibels (dBA) or higher at noise-sensitive properties or if predicted traffic noise exceeds existing noise levels by 15 dBA or more.

2.12.2 Potential Impacts

No adverse impacts to noise levels are anticipated to result from this project. The Proposed Action would result in no significant increase in traffic volumes compared to the 2043 No Action condition. Kūhiō Highway would maintain its current 25 mph posted speed limit, and no speed limit changes are proposed on intersecting streets. The Proposed Action would result in slower traffic along the through movement of Kūhiō Highway, which would produce southbound queuing and delays along Kūhiō Highway, especially during PM peak hour traffic. These slower speeds along Kūhiō Highway would produce lower noise levels than what is currently produced by fast-moving traffic. Therefore, no long-term noise abatement would be necessary.

During construction, contractors may use heavy machinery and vehicles that at times exceed the maximum levels allowed by community noise control regulations. The types of construction equipment expected for this project typically generate noise levels of 70–90 dBA at 50 feet while operating (see Table 2-5). Construction equipment operations can vary from intermittent to fairly continuous, with multiple pieces of equipment operating concurrently. Episodes of high noise

levels would not be continuous throughout the day and would be generally restricted to daytime hours, if possible. Contractors would be required to follow HDOH regulations regarding loud noises, as discussed in the next section. If construction activities adhere to HDOH Community Noise Permit and Community Noise Variance requirements, no significant noise impacts to the community are anticipated.

Table 2-5: Noise Levels of Common Construction Equipment

Equipment Type	Noise Level in dBA at 50 Feet
Air compressor	74–87
Backhoe	72–93
Bulldozer	80
Concrete pump	81–83
Dump trucks	83–90
Electrical generator	71–82
Front loader	72–84
Jack hammer or rock drill	81–93
Pneumatic tools	81–98
Roller (compactor)	73–75
Saws	73–82
Scraper and grader	83–90

Source: U.S. EPA 1971
Key: dBA = a-weighted decibels

2.12.3 Avoidance, Minimization, and Mitigation Measures

Unavoidable construction noise impact would be mitigated by the contractor’s compliance with provisions of HAR Chapter 11-46, Community Noise Control. The contractor would be required to obtain a Community Noise Permit from HDOH for anticipated exceedances of permissible noise levels before 7 a.m. or after 6 p.m. on weekdays, or before 9 a.m. and after 6 p.m. on Saturday, or any time on Sundays and holidays. Since some work would occur at nighttime, the contractor would obtain and comply with the requirements of a Community Noise Variance from HDOH, which would place additional restrictions on noisy activity. Permit and variance requirements may include measures such as ensuring that all construction equipment and on-site vehicles are equipped with muffling devices to mitigate noise impacts and restricting noisier construction activities to between 7 a.m. and 6 p.m. on weekdays, and between 9 a.m. and 6 p.m. on Saturdays, Sundays, and holidays.

2.13 Air Quality

2.13.1 Existing Conditions

As required by the 1977 Clean Air Act, National Ambient Air Quality Standards (AAQS) were established by the U.S. Environmental Protection Agency (EPA) for seven major air pollutants: carbon monoxide, nitrogen oxides, ozone, particulate matter smaller than 10 microns, particulate matter smaller than 2.5 microns, sulfur oxides, and lead. The State of Hawai‘i has also established

its own standards for these pollutants as well as hydrogen sulfide. The national and state AAQS are periodically reviewed and revised (see Table 2-6).

Table 2-6: National and State Ambient Air Quality Standards

Pollutant	Standards		
	Hawai‘i State	Federal Primary (Health)	Federal Secondary (Welfare)
Carbon Monoxide			
1 Hour[a]	9 ppm	35 ppm	—
8 Hour[a]	4.4 ppm	9 ppm	—
Nitrogen Dioxide			
1 Hour	—	0.1 ppm	—
Annual Mean	0.04 ppm	0.053 ppm	0.053 ppm
PM10			
24 Hour[c]	150 µg/m^3	150 µg/m3	—
Annual (Arithmetic)[b]	50 µg/m^3	—	—
PM2.5			
24 Hour[e]	—	35 µg/m^3	35 µg/m^3
Annual (Arithmetic)[d]	—	12 µg/m^3	15 µg/m^3
Ozone			
8 Hour Rolling Average	157 µg/m^3 (0.08 ppm)	0.07 ppm	0.07 ppm
Sulfur Dioxide			
1 Hour	—	0.075 ppm	—
3 Hour[a]	0.5 ppm	—	1,300 µg/m^3 (0.5 ppm)
24 Hour Block Average	0.14 ppm	—	—
Annual Average	80 µg/m^3 (0.03 ppm)	—	—
Lead			
3 Months (Arithmetic)	1.5 µg/m^3	0.15 µg/m^3	0.15 µg/m^3
Hydrogen Sulfide			
1 Hour	25 ppb	—	—

Notes:
[a] Not to be exceeded more than once per year.
[b] Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the agency revoked the annual PM_{10} standard in 2006 (effective December 17, 2006).
[c] Not to be exceeded more than once per year on average over three years.
[d] To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m^3.
[e] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3 (effective December 17, 2006).
Key:
µg/m^3 = micrograms per cubic meter
ppm = parts per million
ppb = parts per billion
$PM_{2.5}$ = particulate matter smaller than 2.5 microns
PM_{10} = particulate matter smaller than 10 microns
Source: HDOH CAB 2025
U.S. EPA 1990

The air in Hawai‘i is relatively clean and low in pollutants. Based on the latest year of available ambient air monitoring data (2023), the state is in attainment of all national and state AAQS. The

HDOH Clean Air Branch has one air monitoring station on the Island of Kaua‘i, located in Niumalu, approximately 8 miles from the project area. However, this station only monitors sulfur oxides.

The lack of sizable heavy industry and the nearly constant winds and breezes contribute to the clean air quality of rural communities. Occasionally, natural pollution from volcanic activity on the island of Hawai‘i reaches Kaua‘i. This natural pollution is known as “vog” and consists primarily of sulfur dioxide.

This sparsity of development and exposure to the prevailing trade-winds promote good air quality in the project area. Vehicular traffic on Kūhiō Highway, Kapa‘a Bypass, and adjoining roads represent the primary source of emissions in the project area.

2.13.2 Potential Impacts

No adverse air quality impacts are anticipated to result from this project. The Proposed Action would result in no significant increase in traffic flow compared to the 2043 No Action condition. Kūhiō Highway would maintain its current 25 mph posted speed limit. As also stated in Section 2.9, the Proposed Action would significantly reduce queuing and delays for left-turn movements, with the LOS for turning from Kapa‘a Bypass onto Kūhiō Highway improving from a LOS of F to LOS B. Although the Proposed Action would result in slower traffic along the through movement of Kūhiō Highway, which would produce longer, slow-moving queues during PM peak hours, these queues are expected to move more steadily in comparison to the existing stop-controlled intersection. With the improved traffic flow and no proposed speed limit changes on Kūhiō Highway or intersecting streets, carbon monoxide concentrations are anticipated to remain well below both national and state AAQS. Other air quality indicators are expected to decrease as well.

Construction-related air emissions could include fugitive dust and emissions from diesel-powered equipment and vehicles. These air quality impacts would be temporary and last only for the duration of construction. Mitigation efforts to reduce construction-related emissions would be implemented.

2.13.3 Avoidance, Minimization, and Mitigation Measures

No avoidance, minimization, and mitigation measures are proposed, because no violation of the national or state AAQS is anticipated.

The project must comply with HDOH requirements for dust control during construction (HAR 11-60.1). These requirements include implementing temporary measures to stabilize soil from wind erosion and reduce airborne, fugitive dust. Such measures include installing temporary dust screens downwind along property lines, using water trucks to sprinkle water onto areas of exposed dirt and soil stockpiles, and thorough watering of disturbed areas after construction activity ceases. Additionally, the contractor would limit the areas of disturbance at any given time to minimize soil exposure, and soil stabilization (paving or landscaping) would be reestablished as early as possible to limit fugitive dust. Stabilized entrances would help prevent haul trucks from tracking

dirt onto paved streets. State regulations further stipulate that open-bodied trucks must be covered at all times when in motion and transporting wind-erodible materials.

2.14 Social and Economic Conditions

2.14.1 Existing Conditions

General Socioeconomic Conditions

HDOT's Title VI Plan (HDOT 2025) is designed to fulfill its responsibilities under Title VI of the Civil Rights Act of 1964, as amended. If minority or low-income populations are found in the project vicinity, good faith effort must be made to ensure that disproportionate and adverse impacts on low-income and minority populations are prevented, minimized, or mitigated. An example of good faith effort is additional public notification or outreach to these groups. The federal definition of "minority" includes the following groups:

- Black or African American: a person having origins in any of the black racial groups of Africa. Terms such as "Haitian" or "Negro" can be used in addition to "Black or African American."
- Hispanic or Latino: a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race. The term "Spanish origin" can be used in addition to "Hispanic or Latino."
- Asian: a person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.
- American Indian or Alaska Native: a person having origins in any of the original peoples of North and South America (including Central America), and who maintains tribal affiliation or community attachment.
- Native Hawaiian or Other Pacific Islander: a person having origins in any of the original peoples of Hawaiʻi, Guam, Samoa, or other Pacific Islands.

Pursuant to HDOT's Title VI Plan (HDOT 2025), "low-income" is defined as a person whose median household income is at or below the U.S. Department of Health and Human Services (DHHS) poverty guidelines. The 2023 poverty guidelines for the State of Hawaiʻi are at or below $34,500 for a family unit size of four.

The following discussion is based on selected census data from the American Community Survey 5-Year Estimates Data Profiles for the year of 2023, summarized in Table 2-7 and Table 2-8. The selected census data covers Hawaiʻi State and Kauaʻi County, and the Census Designated Places (CDPs) for Kapaʻa, Wailua, and Wailua Homesteads. The Kapaʻa, Wailua, and Wailua Homesteads CDPs are the three CDPs that surround the project area and would be most affected by the Proposed Action.

Population and Ethnicity

The State of Hawaiʻi is an unusual, though increasingly common case, where traditionally defined racial "minority" populations make up the majority of a population.

The Kapaʻa CDP has approximately 5 percent points more people who are White than the state as a whole, while the Wailua CDP has approximately 26 percent points more and Wailua Homesteads CDP has approximately 34 percent points more than the state. Wailua, Wailua Homesteads, and Kapaʻa CDPs have lower percentages of the population that are Native Hawaiian/Pacific Islander than the rest of the state.

Table 2-7: Demographic Conditions

	Hawaiʻi State	Kauaʻi County	Wailua Homesteads CDP, Hawaiʻi	Wailua CDP, Hawaiʻi	Kapaʻa CDP, Hawaiʻi
Population	1,445,635	73,610	7,136	2,544	10,886
Ethnicity (alone or in combination with one or more races)					
White	614,813 (42.5%)	38,265 (52.0%)	5,466 (76.6%)	1,752 (68.9%)	5,182 (47.6%)
Black or African American	53,354 (3.7%)	1,087 (1.5%)	6 (0.1%)	69 (2.7%)	57 (0.5%)
American Indian/Alaska Native	37,753 (2.6%)	2,286 (3.1%)	96 (1.3%)	312 (12.3%)	221 (2.0%)
Asian	822,945 (56.9%)	37,836 (51.4%)	2,847 (39.9%)	1,011 (39.7%)	5,650 (51.9%)
Hispanic or Latino	142,225 (9.8%)	7,720 (10.5%)	737 (10.3%)	584 (23.0%)	911 (8.4%)
Native Hawaiian/Other Pacific Islander	386,149 (26.7%)	20,992 (28.5%)	1,740 (24.4%)	449 (17.6%)	2,781 (25.5%)
Other	68,517 (4.7%)	3,065 (4.2%)	694 (9.7%)	283 (11.1%)	367 (3.4%)

Source: U.S. Census Bureau 2023a
Key: CDP = Census Designated Place

Income and Employment

Wailua Homesteads and Kapaʻa CDPs have slightly lower percentages of "low-income" households than the percentages found throughout the state or Kauaʻi County. However, the Wailua CDP has a slightly higher percentage than that of the state or county.

Table 2-8: Income in the Past 12-Months (In 2023 Inflation-Adjusted Dollars)

	Hawai‘i State	Kaua‘i County	Wailua Homesteads CDP, Hawai‘i	Wailua CDP, Hawai‘i	Kapa‘a CDP, Hawai‘i
Number of households	488,991	23,465	2,240	954	3,598
Less than $10,000	4.4%	4.3%	5.2%	2.7%	5.6%
$10,000 to $14,999	2.6%	1.9%	0.4%	9.4%	1.2%
$15,000 to $24,999	4.7%	4.5%	0.0%	5.8%	5.7%
$25,000 to $34,999	4.8%	5.1%	3.3%	10.3%	2.3%
$35,000 to $49,999	7.9%	6.7%	4.4%	7.2%	5.8%
$50,000 to $74,999	13.7%	17.7%	24.6%	17.4%	19.7%
$75,000 to $99,999	12.8%	12.7%	12.7%	10.1%	14.1%
$100,000 to $149,999	19.9%	20.1%	12.8%	15.3%	24.6%
$150,000 to $199,999	11.8%	11.7%	13.5%	9.9%	8.9%
$200,000 or more	17.5%	15.3%	22.9%	11.9%	12.2%
Median income (dollars)	98,317	93,612	94,900	68,548	89,440
Mean income (dollars)	128,123	124,027	153,329	96,742	112,863

Source: U.S. Census Bureau 2023b
Key: CDP = Census Designated Place

2.14.2 Potential Impacts

As presented earlier, “minorities,” including those of Asian and Native Hawaiian/Pacific Island ancestry, are present in Kapa‘a, Wailua, and Wailua Homesteads. Additionally, socioeconomic data for the project area indicates that some households in the area have incomes lower than the DHHS poverty guidelines for Hawai‘i. However, the Proposed Action would not disproportionately and adversely affect these minority or low-income populations. The Proposed Action is an infrastructure improvement project that is anticipated to benefit the surrounding community by improving intersection operations and addressing roadway safety concerns in the area. The Proposed Action would not result in permanent and adverse environmental impacts, such as those related to water, noise, and air quality; such impacts would be temporary in relation to construction activities. Populations of a racial “minority” and “low-income” households would not be unequally affected by any benefits or impacts.

The project area is near the Coconut Marketplace, but no adverse impacts are anticipated at Coconut Marketplace. The project would improve traffic operations along Kūhiō Highway and potentially add bi-directional bus stops, which would create a more accessible environment for residents and tourists to interact with the many businesses and community events at Coconut Marketplace.

Also in the vicinity of the project area is the leased property, Healing Horses Kaua‘i, a locally operated nonprofit organization that provides Equine Assisted Activities and Therapies. Since the Proposed Action requires the use and acquisition of some of the land that Healing Horses Kaua‘i leases from a private landowner, the Proposed Action would negatively impact their operations.

However, similar to Coconut Marketplace, the intersection improvements from the Proposed Action could also improve long-term public accessibility to Healing Horses Kaua‘i’s facilities. See Section 2.2 for more information on impacts to Healing Horses Kaua‘i and Coconut Marketplace.

2.14.3 Avoidance, Minimization, and Mitigation Measures

Because the proposed project would not disproportionately and adversely affect a minority community and would provide an improved intersection that would be beneficial and accessible to motorized and non-motorized users alike, HDOT does not propose any avoidance, minimization, or mitigation measures for the Proposed Action.

Since the Proposed Action would not negatively impact Coconut Marketplace, no avoidance, minimization, or mitigation measures are proposed. See Section 2.2.3 for proposed mitigation for the impacts of the Proposed Action on Healing Horses Kaua‘i.

2.15 Hazardous Materials and Solid Waste Management

2.15.1 Existing Conditions

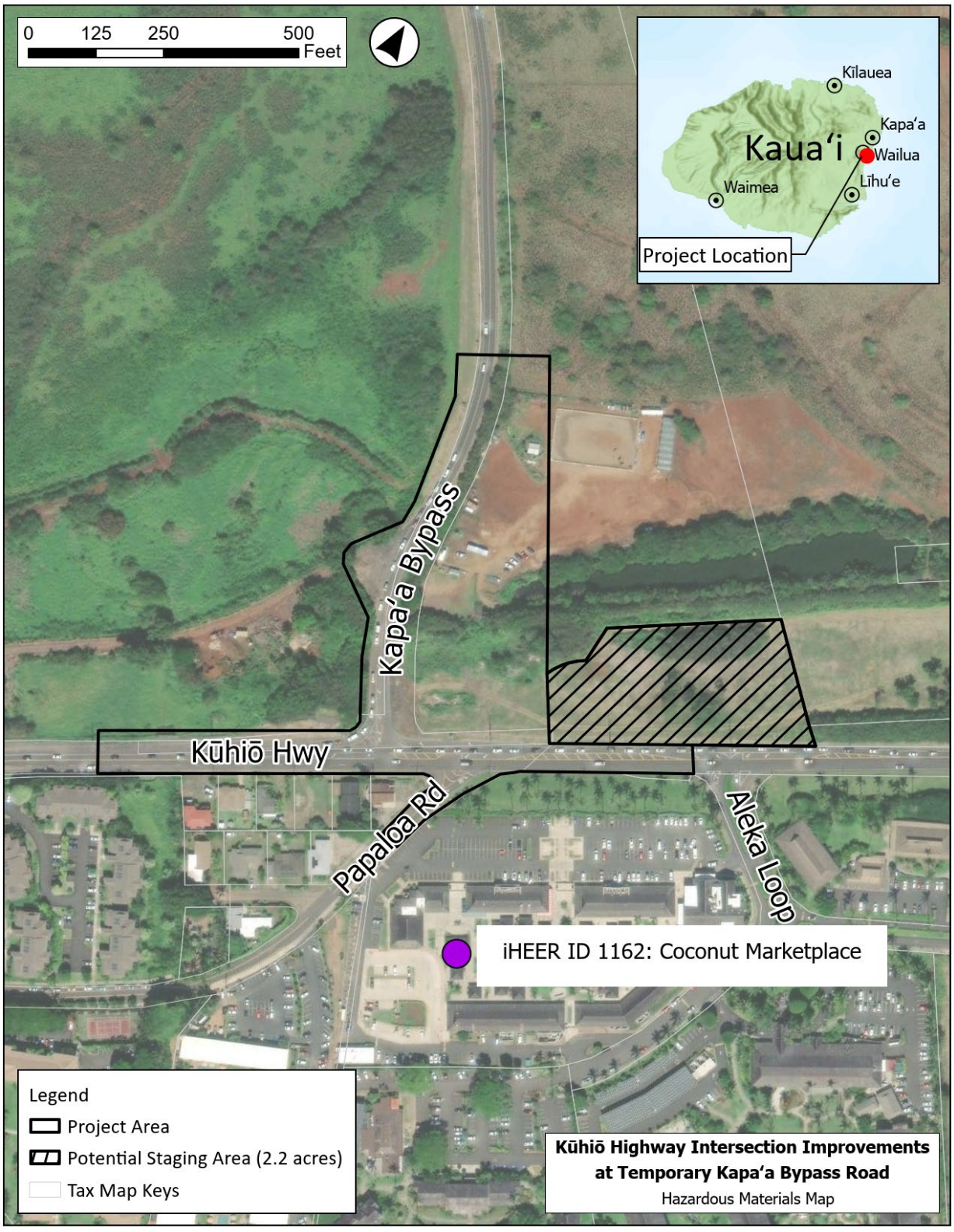
A hazardous material is any substance that poses a health risk to humans, animals, or plants. Examples include pesticides, herbicides, toxic metals and chemicals, volatile chemicals, explosives, and nuclear fuels or low-level radioactive wastes. This section discusses the potential for the presence of hazardous materials resulting from previous and existing uses in areas where new project construction may disturb such materials. This section also summarizes the measures that would be implemented to avoid adverse impacts from exposure of such materials to the workers and the surrounding community.

In July 2025, WSP USA Inc. reviewed the Hawai‘i Hazard Evaluation and Emergency Response (HEER) office's online database of historical hazardous material release sites (iHEER). The review identified one site in the vicinity of the project area: Coconut Marketplace (iHEER ID 1162). See Figure 2-19 for sites identified by the HEER office. According to documents available on the iHEER website, pesticide-contaminated soil is located within the courtyard area of Coconut Marketplace, which is 0.32 miles makai of the project area. Given the discrete and isolated nature of the known contaminated site at Coconut Marketplace, it is unlikely that the project area contains contaminated soil related to the release associated with iHEER ID 1162.

2.15.2 Potential Impacts

Because no hazardous materials are anticipated to be found in the project area, HDOT does not anticipate the Proposed Action to result in significant adverse impacts. However, the following avoidance, minimization, and mitigation measures are proposed if hazardous materials are inadvertently encountered during construction.

Figure 2-19: Hazardous Materials Map



Source: HDOH 2025; ESRI, World Imagery 2026; ESRI, World Hillshade and World Terrain Base 2026.

2.15.3 Avoidance, Minimization, and Mitigation Measures

Any unanticipated hazardous materials discovered during construction would be reported to HDOH and handled and disposed of in accordance with all federal and state regulations. BMPs to minimize water quality impacts caused by construction equipment and materials would be implemented as discussed in Section 2.6.3. Furthermore, during construction, vehicles and construction equipment would be examined for leaks and spills to prevent contamination of the construction site and potential staging area, and drip protection would be used when equipment is not in use. If spills do occur, they would be cleaned up immediately and appropriately. A plan for managing equipment, materials, and job site conditions in the event of approaching storm events would be developed to prevent stormwater from carrying contaminants into water.

2.16 Environmental Justice

2.16.1 Existing Conditions

The HDOT Title VI Program, which works to develop and implement environmental justice strategies, defines environmental justice as “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies” (HDOT 2025). Part of this fair treatment and meaningful involvement includes the support of the needs of people with Limited English Proficiency (LEP). The following discussion is based on selected census data, summarized in Table 2-7, Table 2-8, and Table 2-9 (see Section 2.14).

Population and Ethnicity

As mentioned in Section 2.14.1, the State of Hawai‘i is an unusual, but increasingly common case, where traditionally defined “minority” populations make up majority of the population.

Kapa‘a, Wailua, and Wailua Homesteads CDPs have higher percentages of the population who are White than the state as a whole. Aside from American Indian/Alaska Native and Hispanic or Latino populations, Wailua, Wailua Homesteads, and Kapa‘a CDPs all have lower percentages of a “minority” population than the rest of the state (see Table 2-7).

Income and Employment

Wailua Homesteads and Kapa‘a CDPs have a higher percentage of households with general average incomes or greater than the percentage found throughout the state or Kaua‘i County. This difference ranges from approximately 1 to 8 percent points. The Wailua CDP has approximately 12 percent points less households with general average incomes or greater than the state or county (see Table 2-8).

Limited English Proficiency

LEP refers to a population of people who have difficulty reading, writing, speaking, or understanding English. This term applies to individuals whose primary language is not English and who may need language assistance to communicate effectively. LEP addresses the accessibility of a language, not the intelligence or ability of a person. According to the U.S. Census

Bureau, LEP households are identified when no one age 14 or older speaks English “very well” (U.S. Census Bureau 2023c).

As shown in Table 2-9, roughly 5.4 percent of the households in the State of Hawai‘i are classified as LEP households. In comparison, Kaua‘i County has approximately 2 percentage points less LEP households than the state. No LEP data was available for the Kapa‘a CDP, Wailua CDP, and Wailua Homesteads CDP.

Table 2-9: Language English Proficiency Conditions

	Hawai‘i State	Kaua‘i County
Total Households	488,991	23,465
Limited English-Speaking Households	26,186 (5.4%)	736 (3.1%)

Source: U.S. Census Bureau 2023c

2.16.2 Potential Impacts

As presented earlier, U.S. Census data indicates a large minority population present in Kapa‘a, Wailua, and Wailua Homesteads. Socioeconomic data shows households near the project area having incomes lower than the DHHS poverty guidelines for Hawai‘i, and additional data indicates that some households in the county are LEP households.

The Proposed Action would not disproportionately and adversely affect these minority, low-income, or LEP populations. HDOT anticipates that the Proposed Action would benefit the surrounding community by improving intersection operations and roadway safety. The Proposed Action anticipates no permanent or adverse environmental impacts, such as those related to water, noise, and air quality. Any anticipated impacts would be temporary in relation to construction activities. Populations of a racial “minority,” “low-income” households, and LEP households would not be unequally affected by any benefits or impacts.

2.16.3 Avoidance, Minimization, and Mitigation Measures

Because the proposed project would not disproportionately and adversely affect any minority community and would provide an improved intersection that would be beneficial and accessible to motorized and non-motorized users alike, HDOT does not propose any avoidance, minimization, or mitigation measures for the Proposed Action.

2.17 Secondary and Cumulative Impacts

2.17.1 Secondary Impacts

Secondary impacts, or indirect effects, are effects that are caused by an action that is later in time or farther removed in distance but are still reasonably foreseeable. Such effects may include growth-inducing impacts, including changes in land use patterns, population density, or growth rate, and related effects on air, water, and other natural systems.

The Proposed Action does not add any infrastructure that may spur secondary impacts on the residential population, land use patterns, public facilities or infrastructure, or the natural environment. The work being done is mostly within the HDOT ROW, with some portions in

privately owned parcels. The Proposed Action may result in minor traffic impacts in the surrounding area due to changes in traffic patterns, reductions in car speeds, and riding behavior. However, this would result in an overall improvement in intersection operation and safety without causing any significant adverse traffic impacts, compared to the No Action Alternative. In addition, project construction is expected to generate short-term construction employment for a limited number of workers. It is anticipated that local contractors on Kaua‘i or within the state would be used for construction of the project. These construction workers would have minimal, if any, impact on the island’s residential population or housing demand. Overall, the project is not anticipated to result in any significant secondary impacts.

2.17.2 Cumulative Impacts

Cumulative impacts are effects on the environment that result from the incremental impact of an action when added to past, present, and reasonably near future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The Proposed Action is a complete, independent project that would not result in commitment to any other projects, such as the Kūhiō Highway Short-Term Improvements Project, which widened Kapa‘a Bypass Road and was completed in August 2023. The Proposed Action is intended to address localized safety and operational issues at the existing intersections and would therefore cumulatively improve traffic operations on the Kūhiō Highway corridor and contribute to the development of a more urbanized roadway system.

Because the project area is also located in a highly developed area with commercial, resort, or residential uses, no adverse cumulative impacts on land use, historic resources, cultural resources, parks, and recreational resources are anticipated beyond those discussed in Section 2.2, Section 2.3, Section 2.4, and Section 2.7.

While the project would result in changes to existing landforms (i.e., agricultural lands to be acquired for the new roadway), the surrounding area is largely developed and heavily trafficked by tourism (see Section 2). Similarly, with the increased impervious pavement and anticipated increase in stormwater runoff, a new drainage system is proposed to manage these impacts (see Section 2.6).

The project is not anticipated to result in other cumulative impacts, such as demand for public utilities and emergency services. The Proposed Action is not dependent on the use of public utilities and is anticipated to facilitate safe traffic movement for emergency vehicles. With the implementation of mitigation measures, cumulative adverse effects on other resources discussed in Chapter 2 are not anticipated, other than the localized and temporary impacts identified in Chapter 2.

The Proposed Action would result in no significant increase in traffic volumes compared to the 2043 No Action Condition, the existing highway would maintain its current speed limit, and no other speed limit changes are proposed on the intersecting roads. In addition, with the anticipated slower queues in the p.m. hours as well as the through movement along Kūhiō Highway, as

described in Section 2.12.2, this would result in lower noise levels. Similarly, due to no changes in the speed limit and overall improved traffic flows, carbon monoxide concentrations are anticipated to decrease as well.

Overall, the project is not anticipated to result in any significant cumulative impacts.

Chapter 3 Consistency with Government Plans and Policies

3.1 State of Hawai‘i Plans and Controls

3.1.1 Hawai‘i State Plan

The Hawai‘i State Plan is a long-range comprehensive plan that includes an overall theme, goals, objectives, policies, priority guidelines, and implementation mechanisms. The Hawai‘i State Plan acts as a roadmap for long-term state development, setting goals, policies, and priorities. The plan also aids in resource allocation; enhances coordination among federal, state, and county plans and programs; and establishes a systematic approach to integrate major state and county activities.

By creating an environment that allows for a continuous flow of vehicles along Kūhiō Highway, Kapa‘a Bypass, and Papaloa Road, the Proposed Action supports the overarching goals and follows the given policies of the Hawai‘i State Plan. Relevant Hawai‘i State Plan goals, objectives, and policies are listed and discussed in Appendix H.

3.1.2 Hawai‘i Coastal Zone Management Program

Consistent with the federal Coastal Zone Management Act of 1972, the Hawai‘i CZM law (HRS Chapter 205A) manages and protects coastal zone resources. Hawai‘i’s coastal zone includes all lands within the state. As a result, the proposed project is within the CZM area and is subject to consistency review. The Proposed Action was found to not adversely impact coastal recreational resources, historic resources, scenic and open space resources, coastal ecosystems, protection from coastal hazards, beaches and coastal dunes, or marine and coastal resources. The Proposed Action would promote public participation through a collaborative and diligent development review process and provide intersection improvements important to Hawai‘i’s economy. The 10 objectives and policies of the Hawai‘i CZM Program, as well as a further discussion of project lighting, are discussed in Appendix I, Hawai‘i Coastal Zone Management Program, Chapter 205(A), HRS.

3.1.3 Federal-Aid Highways 2035 Transportation Plan for the District of Kaua‘i.

The Statewide Federal-Aid Highways 2035 Transportation Plan (July 2014) provides a basis for transportation decision-making through the year 2035. The plan embraces the values held by the people of Hawai‘i and identifies needs for the movement of people and goods for all modes of land-based transportation. The project is consistent with the following selected goals from the District of Kaua‘i plan:

- *Goal 1.4—Promote the use of sustainable practices in designing, constructing, operating, and maintaining transportation facilities and programs.*
- *Goal 1.5—Promote long-term resiliency relative to all hazards mitigation, namely global climate change, with considerations to reducing contributions to climate change from transportation facilities and reducing the future impacts of climate change on the transportation system.*
- *Goal 3.2—Maintain a safe, efficient, complete transportation system for the long term.*

- *Goal 4.1—Plan, maintain, and operate a transportation system that supports evacuation response, and recovery for incidents.*
- *Goal 6.1—Improve capacity and efficiency and reduce congestion within the existing transportation system for long-term benefit.*
- *Goal 8.1—Maintain a safe transportation system for all land transportation modes.*
- *Goal 8.2—Improve safety of the community through connectivity of the transportation infrastructure.*

The Proposed Action would redesign a highly congested intersection along Kūhiō Highway, alleviating traffic pressure and ensuring a safer, more reliable, and more carbon-efficient transportation system that supports climate resilience. The two-lane roundabout would improve movement and access to Kapa‘a Bypass from Kūhiō Highway, which would be helpful for evacuation and emergency response purposes.

3.1.4 Hawai‘i 2050 Sustainability Plan

The Hawai‘i 2050 Sustainability Plan, revised June 2021, serves as a guide for the future long-range development of the state. The Hawai‘i 2050 Sustainability Plan promotes the growth and diversification of the state’s economy, the protection of the physical environment, the provision of public facilities, and the promotion of and assistance to socio-cultural advancement. The project is consistent with Sustainable Development Goal 9 to “build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.”

The Proposed Action would realign and innovate the intersection of Kapa‘a Bypass and Kūhiō Highway, introducing a new two-lane roundabout and climate-resilient infrastructure improvements, such as improved drainage and potential bi-directional bus stops.

3.1.5 Bike Plan Hawai‘i

HDOT’s Bike Plan Hawai‘i (updated 2022) intends to establish a long-term strategy for bicycle facility improvements by creating an inventory of existing bicycle facilities and outlining future facilities. The plan evaluates potential routes based on their mobility, connectivity, safety, implementation costs, and aesthetics. Based on these factors, certain bike routes are designated as a higher priority.

Within the project area, Bike Plan Hawai‘i recommends that Kūhiō Highway be a signed, shared roadway connecting Wailua and Keālia. Under this plan, signage would indicate that bikes can share the road with other vehicles. Consistent with this plan, HDOT does not intend to provide a separate bike lane or painted shoulder for bikes at the proposed two-lane roundabout. Currently, there are no bike lanes along Kūhiō Highway in the vicinity of the project area. Creating bike facilities along this approximately 1,100 feet long stretch of Kūhiō Highway would not provide any additional connectivity with existing infrastructure. If bikers seek a more sheltered biking facility than the signed, shared roadway, a separate shared use path along the coast between Lydgate Park and Kapa‘a is currently under construction and in the vicinity of the project area.

This shared use path would be part of a larger Kaua‘i East Side coastal path plan connecting Nāwiliwili and Līhu‘e to Anahola.

3.2 County of Kaua‘i Plans

3.2.1 Kaua‘i County General Plan

The 2018 Kaua‘i County General Plan (General Plan) acts as a framework for Kaua‘i County policy. Areas of concern include land use, development, and growth. In providing core actions and objectives, the plan presents a countywide vision to improve quality of life and environment within Kaua‘i County.

The Proposed Action supports the framework set by the General Plan by improving traffic operations in a key area without adversely impacting the environment or conflicting with any other objectives of the General Plan. The goals of the General Plan relevant to the Kūhiō Highway Intersection Improvements project are summarized in Appendix G, Kaua‘i County General Plan, Kaua‘i County Planning Department.

3.2.2 East Kaua‘i Community and Circulation Plan

Kaua‘i County is currently updating the East Kaua‘i Community and Circulation Plan (EKCCP). The plan generally aims to advance the goals of the Kaua‘i County General Plan (2018), as discussed in Appendix G, with specific guidance for implementing policies and land use changes. HDOT acknowledges the purpose of the EKCCP and aligns the Proposed Action with this prospective long-term plan by supporting the community goals expressed in the 2018 Kaua‘i County General Plan. The Proposed Action further supports the EKCCP by creating a safer intersection whose traffic improvements would enhance connection between different nodes of activity.

3.2.3 Comprehensive Zoning Ordinance

The purpose of the Comprehensive Zoning Ordinance (CZO) (County of Kaua‘i Ordinances Title IV Chapter 8) is “to provide regulations and standards for land development and the construction of buildings and other structures in the County of Kaua‘i.” The CZO aims to promote development compatible with the Island’s scenic beauty and environment while avoiding “inadequate, harmful or disruptive conditions that may prove detrimental to the social and economic well-being of the residents of Kaua‘i.” While the Proposed Action would alter some agricultural property adjacent to an existing highway, the roundabout HDOT proposes to build is anticipated to improve the quality of travel on Kūhiō Highway in a way that would support the social and economic well-being of Kaua‘i residents and visitors.

Chapter 4 Comments and Coordination

This chapter summarizes public and agency consultation and coordination activities associated with the proposed project that has been conducted to date. Project pre-assessment consultation and coordination activities included meetings and correspondence with government agencies and the affected communities.

4.1 Pre-Assessment and Early Consultation

At the initiation of the Draft EA process in June 2025, pre-consultation letters were sent to community stakeholders to request input on environmental concerns, designs, and alternatives; engage in community outreach; and identify studies or issues for further study. A list of letter recipients is provided below, and an asterisk appears next to those entities and individuals that responded to the letter. HDOT received seven sets of comments in response to the request for pre-assessment consultation. See Table 4-1 for a summary of the comments and HDOT's responses. A copy of the Comments is provided in Appendix A.1.

- State and Local Elected Officials:
  - County of Kaua‘i, Mayor Derek Kawakami
  - Kaua‘i County Council, Council Chair Mel Rapozo
  - State Representative (District 15) Nadine Nakamura
  - State Senator (District 8) Ronald Kouchi
- Federal Agencies:
  - Department of the Interior, U.S. Geological Survey, Pacific Island Ecosystems Research Center
  - U. S. Army Corps of Engineers
  - U.S. Coast Guard
- State of Hawai‘i Agencies:
  - Department of Agriculture
  - Department of Business, Economic Development, & Tourism
  - Department of Hawaiian Home Lands
  - Department of Health (HDOH)
  - HDOH, Clean Air Branch*
  - HDOH, Clean Water Branch
  - HDOH, Environmental Health Services Division
  - HDOH, Hazard Evaluation and Emergency Response Office
  - HDOH, Solid and Hazardous Waste Branch
  - Department of Land and Natural Resources (DLNR)
  - DLNR, Aha Moku Advisory Committee
  - DLNR, Commission on Water Resource Management
  - DLNR, Division of Aquatic Resources
  - DLNR, Division of Forestry and Wildlife
  - DLNR, Engineering Division
  - DLNR, Historic Preservation Division and State Historic Preservation Officer
  - Department of Land and Natural Resources, Kaua‘i Island Burial Council
  - Department of Land and Natural Resources, Land Division
  - Office of Hawaiian Affairs

  - Office of Planning and Sustainable Development
- County of Kaua‘i Agencies:
  - Department of Parks and Recreation
  - Department of Water
  - Emergency Management Agency
  - Fire Department
  - Kaua‘i Historic Preservation Review Commission
  - Office of Economic Development*
  - Planning Department
  - Police Department
  - Public Works Department
  - Transportation Agency
- Other Parties:
  - Līhu‘e Public Library
- Utilities and Businesses:
  - Kaua‘i Island Utility Cooperative
  - Hawaiian Telcom*
  - Spectrum
- Private Landowners:
  - Fee Owner of TMK 4-3-001:009
  - Fee Owner of TMK 4-3-002:008
  - Fee Owner of TMK 4-3-002:018
  - Fee Owners of TMK 4-3-010:001
  - Fee Owners of TMK 4-3-010:005
  - Fee Owners of TMK 4-3-010:006

Table 4-1: Summarized Comments and HDOT Responses to Pre-Assessment Consultation Letters

Commentor	Comment	HDOT Response
HDOH, Clean Air Branch	Provided standard comments for land use reviews.	See Section 2.13, Air Quality.
Hawaiian Telcom	No Hawaiian Telcom projects are planned for the project area at the moment. The only consideration for Hawaiian Telcom would be a Permit to Work Along State Highway. They requested more detailed project plans to be shared to refine their comments.	HDOT will share project plans with Hawaiian Telcom and coordinate further, prior to finalizing design and starting construction.
County of Kaua‘i, Transportation Agency	Requested bi-directional bus stop shelters along the mauka and makai sides of Kūhiō Highway fronting Coconut Marketplace.	See Section 2.9, Transportation Infrastructure and Traffic.
County of Kaua‘i, Office of Economic Development	Supports the installation of a roundabout. The office is working on a plan to build a mobility hub and airport shuttle at Coconut Marketplace and believes that a roundabout will complement their plans.	Thank you for your support. Based on community comments and project goals, a roundabout is proposed.
DLNR, Engineering Division	Provided information and references regarding flood zones and standards for construction in those zones.	See Section 2.10, Natural Hazards and Sea-Level Rise.

Commentor	Comment	HDOT Response
DLNR, DOFAW	Provided a list of species that could be impacted by the project and mitigation measures to avoid impacts on those species. Additional non-species-specific BMPs were provided.	See Section 2.5, Biological Resources.
County of Kaua‘i, Engineering Division, DOW	They stated that they have no objections to the project but stated that the DOW is planning a waterline improvement project along Kūhiō Highway in the project area.	Thank you for providing this information. HDOT will coordinate with DOW. This waterline improvement project is acknowledged in Section 2.11, Public Services, Utilities, and Infrastructure.
Member of the Public	Supports installing a traffic light in the intersection. He stated that the roundabout will result in slower traffic and bottlenecks, that roundabouts are intended for rural or suburban locations where traffic intensity is low, and that roundabouts are not safe for pedestrian traffic. Further, he stated that the only alternative safe alternative for busy intersections on Kaua‘i are up-to-date technology traffic signal systems.	The Signalized Intersection Alternative was not chosen. While traffic for the Kūhiō Highway through lane may experience minor delays, the intersection Proposed Action is expected to operate adequately by Year 2043. See Section 2.9. As discussed in Section 1.2.5, roundabouts are safer for pedestrians than signalized intersections due to slower approach speeds for vehicles.

Key: BMP = Best Management Practice; DLNR = Department of Land and Natural Resources; DOFAW = Division of Fish and Wildlife; DOW = Department of Water; HDOH = Hawai‘i Department of Health; HDOT = Hawai‘i Department of Transportation

4.2 Public Meeting

HDOT held a public meeting in Kaua‘i to solicit comments on September 17, 2025 (see Appendix A.2). The intention of this meeting was to introduce project alternatives and determine if community members preferred a specific alternative.

During the public meeting, community members shared questions, recommendations, and opinions about the project. Community members generally supported the roundabout options over the signalized intersection. See Table 4-2 for a summarized list of relevant comments at the public meeting that were considered in the project design and EA drafting, with HDOT’s responses. See Appendix A.2 for a full list of community comments during the meeting.

Table 4-2: Summary of Public Meeting Comments and HDOT Responses

Comment	HDOT Response
Keep in the dedicated right-turn lane from Kapaʻa Bypass onto Kūhiō Highway.	The preferred alternative maintains this right-turn lane.
Provide a cost-benefit analysis.	See Section 1.7 for the cost estimate of each of the alternatives.
The left turn from Lanikai Street (near Kintaro Restaurant) is dangerous and needs to be improved.	This project would provide another left turn from the Papaloa Area, allowing HDOT to restrict left turns from Lanikai Street. See Section 1.5.2.
The project should make a bike lane parallel to the lane or within the shoulder.	The Proposed Action does not include bike lanes, consistent with the State of Hawaiʻi Bike Plan, which recommends that Kūhiō Highway should be a signed, shared roadway. See Section 3.1.4.
Provide accident data in the EA.	See Section 2.9.1.3 for crash data.
Provide an entrance and exit to the ranch and base yard on project plans.	HDOT will continue to coordinate with affected landowners and tenants as plans are drafted. Access would be maintained.
Will emergency vehicles be able to safely negotiate a roundabout if the intersection is in gridlock?	Roundabouts typically provide free-flowing, slower traffic movement compared to a full stop at a stoplight. This would allow cars to pull over for emergency vehicles. See Section 2.11 for more details.
Avoid affecting landscaping plants and trees mauka of the Healing Horses Kauaʻi driveway.	During final design, the project would be designed to minimize potential impacts to these landscaping trees and plants as much as possible, in coordination with the landowner and tenant, Healing Horses Kauaʻi.
Provided HDOT with a list of plants and animals present on Healing Horses Ranch that may be impacted by the project. Supports the project but requests that the cost of plant relocation be paid by the state.	HDOT will work with the lessee of TMK parcel 4-3-010:005 to pot and relocate the plants identified by the Healing Horses volunteer.

Key: EA = Environmental Assessment; HDOT = Hawaiʻi Department of Transportation

4.3 Regulatory Coordination

Because the proposed project would involve the use of federal funds, it must comply with certain federal, state, and local environmental laws and regulations. The following information provides supporting documentation for coordination and consultation activities being conducted to comply with required regulatory reviews. See Appendix A.3 for copies of written correspondence referenced in the discussions below.

4.3.1 Federal Coordination

National Environmental Policy Act Categorical Exclusion

The NEPA process is required when a federal agency proposes to take major federal action. These federal actions, which are defined at 40 CFR 1508.1, may be "categorically excluded" (CatEx) from a detailed environmental analysis when the federal action normally does not have a significant effect on the human environment. FHWA has determined that a NEPA CatEx is appropriate for this Proposed Action under 23 CFR 771.117. The CatEx documentation for this project will be completed separately from this HRS Chapter 343 EA and will address the federal permits and approvals for this Proposed Action.

Section 106 of the National Historic Preservation Act

As described in Section 2.3, the NHPA requires that actions that are federally funded, authorized, or implemented consider the effect of such actions on any district, site, building, structure, or object that is included in or eligible for inclusion in the NRHP. Such resources are called historic properties. The Section 106 process involves coordination and consultation with the SHPO and other agencies and organizations that have an interest in or is mandated to protect historic properties. In addition, the ACHP is afforded the opportunity to comment on actions that may adversely affect historic properties.

Consultation with the SHPO and other potential Section 106 consulting parties is ongoing. Therefore, the significance evaluations, potential impacts, and treatment recommendations presented in this EA should be considered as preliminary findings only. Given the presence of a human burial, density of possible archaeological features found in the vicinity of the project area, and the potential for subsurface features, HDOT and the FHWA anticipates that the project would have an "Adverse Effect" on historic properties.

In a letter dated December 30, 2025, HDOT initiated the Section 106 process and requested the SHPO's concurrence with the APE. Additionally, HDOT requested information on the proposed area and if SHPD has any individuals or organization who may have cultural or historical knowledge of the area.

In a letter dated January 20, 2026, SHPD responded concurring with the APE. They also informed HDOT of three archaeological historic properties that were previously identified in the vicinity of the APE (SIHP 50-30-08-00886, 50-30-08-00890, and 50-30-08-02420). Finally, SHPD recommended that HDOT refer to the Native Hawaiian Organization Notification List as provided by the U.S. Department of the Interior.

A Section 106 notice/advertisement of consultation was published in the *Garden Island News* on March 27, 2026. Native Hawaiian Organizations (NHOs) and Native Hawaiian descendants with ancestral lineal or cultural ties to, cultural or historic properties knowledge of and concerns for, and cultural or religious attachment to the proposed APE as well as other individuals and organizations with a demonstrated legal, economic or historic property concern were asked to provide information of known historic properties in the APE.

Section 106 consultation letters dated March 20, 2026, were sent to descendants with ancestral lineal or cultural ties to, cultural or historic properties knowledge of and concerns for, and cultural or religious attachment to the proposed APE as well as other individuals and organizations with a demonstrated legal, economic or historic property concern. The mailing list was developed in part by referring to the NHO Notification List provided by the U.S. Department of the Interior and maintained by the Office of Native Hawaiian Relations.

See the discussion in Section 2.3 and in Appendix A.

Section 7 of the Endangered Species Act

As described in Section 2.5, Section 7 of the ESA requires that federally funded actions do not jeopardize any species listed as threatened or endangered or adversely modify designated critical habitat. Section 7 requires federal agencies to consult with federal wildlife management agencies, the USFWS, and the NMFS, on actions that may affect federally listed species or designated critical habitats.

On November 3, 2025, FHWA determined that the project meets all requirements for the Standard Local Operating Procedures for Endangered Species in Hawai‘i (HI-waySLOPES) and that the project is not likely to adversely affect species listed under the ESA or their designated critical habitat administered by the NMFS. On November 3, 2025, NMFS concurred with the FHWA determination that the proposed project is not likely to adversely affect the threatened green sea turtle, the endangered hawksbill turtle, the endangered Hawaiian monk seal, or Hawaiian monk seal critical habitat.

On March 24, 2026, HDOT sent an informal consultation letter to USFWS requesting concurrence that the project *may affect, but is not likely to adversely affect* the Hawaiian hoary bat, Hawaiian seabirds, Hawaiian waterbirds, and the Hawaiian goose. Consultation with USFWS is ongoing. Formal consultation is anticipated to be required for Hawaiian seabirds due to the installation of permanent highway lighting in the project area. With the implementation of standard guidance and BMPs, it is anticipated that the project would have minimal effects to all other threatened and endangered species. The significance evaluations, potential impacts, and treatment recommendations presented in this EA should be considered as preliminary findings only. See Section 2.5.4 and Appendix A.3 for more information about avoidance and minimization measures.

Magnuson-Stevens Act

As described in Section 2.5, the Magnuson-Stevens Act, as amended (16 U.S.C. 1801-1891(d)), requires agencies which fund, permit, or undertake activities that may adversely affect EFH to consult with NOAA/PIRO regarding the potential effects of their actions on EFH and respond to NMFS recommendations. EFH are defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, and/or growth to maturity,” including open water, wetlands, coral reefs, and submerged structures, associated with federally managed fish species. Actions outside of EFH, such as upstream/upslope activities, must also be reviewed.

EFH consultation for the project is complete. In a letter dated June 17, 2025, FHWA requested NMFS concurrence that the proposed project would have no more than minimal adverse effect on EFH and managed species. On June 24, 2025, NMFS agreed with FHWA's determination and provided an additional conservation recommendation. On June 25, 2025, FHWA agreed with the conservation recommendation completing the EFH Consultation. See Section 2.5.4 and Appendix A.3 for more information about avoidance and minimization measures.

Migratory Bird Treaty Act

The MBTA (16 U.S.C. § 703 et seq.) establishes protections for migratory birds and prohibitions for activities involving migratory birds that "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase, deliver for shipment, ship, export, import, cause to be shipped, exported, or imported, deliver for transportation, transport or cause to be transported, carry or cause to be carried, or receive for shipment, transportation, carriage, or export" unless permitted by regulations."

As discussed in Section 2.5, migratory birds of conservation concern, include the cattle egret, which was identified during the biological survey, could potentially occur in the project area. However, the cattle egret is common on Kaua‘i, and project actions would not impact cattle egret populations. BMPs that apply to endangered species would also minimize the impacts of the proposed project on migratory birds, no significant impacts to MBTA species are anticipated.

Farmland Protection Policy Act

The FPPA is intended to minimize the impact of federal programs on the unnecessary and irreversible conversion of farmland to nonagricultural uses. Activities receiving assistance, like funding, from federal agencies are also subject to this law. The FPPA also requires federal programs to be administered in a way that is compatible with state and local units of government and private programs and policies to protect farmland.

The proposed project would convert Prime Agricultural Lands into roadway ROW. FHWA would coordinate with NRCS and prepare a Farmland Conversion Impact Rating form for the project. This form assigns points to the federal action based on criteria including, but not limited to, rural character of the area, existing use of the land, and local or state farmland protections. Lower point scores indicate less of an impact on farmland. This project is anticipated to score low on the impact form.

4.3.2 State and Local Coordination

HRS Chapter 6E-8

Similar to Section 106, HRS Chapter 6E-8 places responsibilities on state agencies to evaluate their projects.

The HRS Chapter 6E-8 review by SHPD is pending. Therefore, the significance evaluations, potential impacts, and treatment recommendations presented in this EA should be considered as preliminary findings only. Given the presence of a human burial, density of possible archaeological features found in the vicinity of the project area, and the potential for subsurface features, HDOT anticipates a determination of "Effect, with Proposed Mitigation Measures" under the

HRS Chapter 6E-8 review. SHPD is expected to conduct its HRS Chapter 6E-8 review responsibilities in conjunction with their Section 106 responsibilities, separate from the requirements of HRS Chapter 343.

HRS Chapter 195D

HRS Chapter 195D, the state counterpart law to the ESA, provides for the protection of aquatic life, wildlife, or land plant species that are indigenous to Hawai‘i. Under Chapter 195D, state agencies are required to consult with the DLNR-DOFAW and DLNR-DAR.

HDOT sent letters to DLNR-DOFAW and DLNR-DAR on September 9, 2025, to request comments on endangered species and critical habitat or other input or concerns. No responses were received to this letter. However, in a letter dated August 7, 2025, DLNR-DOFAW responded to HDOT's Draft EA pre-consultation letter sent out in June 2025. In this letter DOFAW requested that the project implement mitigation measures to reduce its impacts on the Hawaiian hoary bat, Hawai‘i seabirds, Hawaiian waterbirds, and the pueo. Additionally, standard mitigation measures to reduce the attraction of nonnative predators, the spread of invasive species, and wildfire risks were provided. HDOT would implement these measures during construction. To see the full list of mitigation measures, see Appendix A.3.

Coastal Zone Management Act

As described in Section 3.1.2 and Appendix F, the project is subject to the Hawai‘i Coastal Zone Management Federal Consistency Review.

In an email dated December 3, 2025, WSP USA, on behalf of HDOT, consulted with OPSD to determine whether a CZM federal consistency review is required for the proposed project. On December 4, 2025, OPSD responded, stating that Federal Consistency Review is required because HDOT would receive federal funds for the increase in ROW, and HDOT activity may require a federal permit, which would trigger a blanket federal consistency review. A draft CZM consistency review document is attached to this EA as Appendix F, Hawai‘i Coastal Zone Management Program, Chapter 205(A), HRS.

Special Management Area and Shoreline Setback

HRS Chapter 205A, Coastal Zone Management Law, established SMAs along the coast to regulate land uses and development close to the shore. HDOT has consulted with the County of Kaua‘i Planning Department, which has determined that an SMA Use Permit is not required because the proposed project would not be considered "development" as defined in HRS Chapter 205A-22(Q). See Appendix A.2 for the County Planning Department's SMA determination.

National Pollution Discharge Elimination System Permit

Section 402 of the Clean Water Act requires an NPDES permit for point source discharges, including storm water discharges associated with construction activities. The permit is mandatory for construction activities that disturb 1 or more acres and discharge stormwater from the project site to waters of the United States. Although this is a federal requirement, it is administered by HDOH. HDOT would obtain an NPDES permit from HDOH for the proposed project.

Chapter 5 Anticipated Finding of No Significant Impact

In accordance with HRS Chapter 343 and HAR Chapter 11-200.1-19, HDOT anticipates issuing a FONSI for the proposed project. This assessment is based on an evaluation of project impacts in relation to the "Significance Criteria" specified in HAR Chapter 11-200.1-13.

The discussion below is the preliminary significance evaluation, subject to changes that may be made upon receipt of public and agency review comments that may be filed during the public comment period of this Draft EA. The Significance Criteria appear below in italics, followed by a discussion of the proposed project in relation to the specific criterion. Potential impacts and committed mitigation measures are discussed in detail in Chapter 2.

1. *Irrevocably commit a natural, cultural, or historic resource.* While the Proposed Action has the potential to affect natural, cultural, and historic resources, FHWA and HDOT are consulting with a variety of state and federal natural resource and historic agencies to develop mitigation measures to ensure that natural, cultural, and historic resources are minimally impacted (see Chapter 2).

   The Proposed Action proposes installing permanent highway lighting. This could result in the "take" of endangered and threatened Hawaiian seabirds. FHWA and HDOT is coordinating with USFWS to determine appropriate measures to mitigate the impacts of this project on Hawaiian seabirds. With the implementation of species-specific and non-species-specific mitigation measures, no other impacts are anticipated to special status flora and fauna species. The Proposed Action would increase the amount of impervious surfaces in the project area, which could increase stormwater runoff. With the implementation of permanent BMPs to mitigate the increased runoff, the project is not anticipated to result in significant impacts on adjacent streams or coastal waters. The project would not result in permanent impacts to park lands or recreational resources. However, the acquisition of approximately 1 acre of land and temporary use of 2 acres of land on parcel 4-3-010:005 could impact the lessee's horsemanship and equine therapy business. HDOT is working with the affected property owner to discover ways to mitigate the impacts of the land acquisition on the lessee (see Section 2.5, Section 2.6, and Section 2.7).

   The Proposed Action would affect historic features identified by the LRFI; however, final design is pending and therefore, impacts to these features are still not known. While the project is still pending SHPD responses, HDOT anticipates the following effect determinations: "effect, with proposed mitigation commitments" under the Chapter 6E-8 review and an "adverse effect" under the NHPA Section 106 review. Accordingly, an AMP would be implemented as a mitigation measure to address the potential impacts to the historic features identified within the project area (see Section 2.3).

2. *Curtails the range of beneficial uses of the environment.* The Proposed Action would not significantly curtail beneficial uses of the environment. The Proposed Action would involve permanent use of approximately 1 acre of partially undeveloped private properties on the mauka side for the new roundabout. This unavoidable use of partially undeveloped private

lands includes permanent vegetation removal, new pavement, additional lighting, and new drainage features. The old Kapa‘a Bypass would be removed, hydromulched, and allowed to revegetate naturally. Additionally, 2 acres of partially undeveloped land would be temporarily used for construction staging, which could require vegetation clearing. Following construction, the staging area would be returned to its preconstruction conditions, as much as practicable. The project area also contains some freshwater wetlands. However, construction would avoid these wetlands and no impacts are anticipated (see Section 2.2 and Section 2.6).

3. *Conflicts with the State's environmental policies or long-term environmental goals established by law.* The Proposed Action is consistent with the environmental goals and objectives of the state, as demonstrated in this chapter and in Chapter 3.
4. *Have a substantial adverse effect on the economic welfare, social welfare, and cultural practices of the community or State.* The Proposed Action would not have an adverse effect on the economic, social welfare, or the cultural practices of the community or state. Rather, the Proposed Action would support the social welfare of the community by providing a safer roundabout compared to the two existing intersections. The proposed roundabout would better serve the needs of current and future drivers and pedestrians (see Section 2.4 and Section 2.14).
5. *Have a substantial adverse effect on public health.* The Proposed Action would not adversely affect public health. The roundabout would provide a safer intersection, reducing the risk of fatal and injury crashes in the area.
6. *Involve adverse secondary impacts, such as population changes or effects on public facilities.* The Proposed Action is not expected to cause secondary impacts, as it does not increase roadway capacity. The proposed project is not anticipated to induce development of the area or lead to population growth as a result of its construction (see Section 2.17).
7. *Involve a substantial degradation of environmental quality.* The Proposed Action would not result in a substantial degradation of environmental quality, as demonstrated in Chapter 2, Affected Environment, Potential Impacts, and Proposed Mitigation.
8. *Be individually limited but cumulatively have substantial adverse effect upon the environment or involves a commitment for larger actions*. The Proposed Action is a complete, independent project that would not result in commitments to other projects, nor would it result in substantial, adverse cumulative impacts on the environment (see Section 2.17).
9. *Have a substantial adverse effect on a rare, threatened, or endangered species or its habitat.* Resource agency consultation is still ongoing; however, it is anticipated that the installation of permanent highway lighting in the area may result in an adverse effect to protected Hawaiian seabirds. FHWA will coordinate with USFWS to develop mitigation measures to minimize impacts to Hawaiian seabirds. Therefore, there should not be a substantial adverse effect on protected species. The Proposed Action would not adversely affect any other species of concern. Although potential habitat for species of concern was identified within the project area, FHWA and HDOT are working with USFWS and DLNR-DOFAW to develop mitigation measures that would be implemented during construction to minimize the effects of the project on these species (see Section 2.5).

10. *Have a substantial adverse effect on air or water quality or ambient noise levels.* The project would not have a substantial adverse effect on air or water quality or ambient noise levels because the Proposed Action would result in no significant increase in traffic flow compared to the 2043 No Action condition. The project would comply with state environmental regulations and standards to protect air and water quality and ambient noise levels. The Proposed Action would not result in violations of national and state AAQS. During construction, the contractor would implement standard BMPs to minimize the potential for impacts to stormwater quality and to control fugitive dust and construction noise. While there would be unavoidable short-term construction impacts, no long-term adverse air, noise, or water quality impacts are anticipated (see Section 2.13, Section 2.12, and Section 2.6).
11. *Have a substantial adverse effect on or be likely to suffer damage by being located in an environmentally sensitive area such as a floodplain, tsunami zone, sea level rise exposure area, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters*. The Proposed Action is located in a tsunami zone and is partially within the 3.2-foot SLR-XA. While the project is located in FEMA Flood Zone X, community comments indicate that the area floods during heavy rains. The Proposed Action would be designed with appropriate drainage features to prevent flooding under normal conditions and would not exacerbate existing risk to flooding. The project area also contains some freshwater wetlands; however, construction would avoid these wetlands and no impacts are anticipated. Although intersection improvements are proposed within these environmentally sensitive areas, the Proposed Action would not increase the susceptibility of the highway system or surrounding properties to these hazards. The intersection improvement would also improve intersection operations and safety, which would facilitate safer and more efficient evacuation in the event of an emergency (see Section 2.11).
12. *Have a substantial adverse effect on scenic vistas and view planes, during day or night, identified in county or state plans or studies*. The project is not in an area of the island with scenic vistas or view planes (see Section 2.8).
13. *Require substantial energy consumption or emit substantial greenhouse gases.* The proposed project would not result in substantial energy consumption. There may be a short-term increase in energy consumption and greenhouse gas emissions during the project’s construction. However, when completed, the project’s long-term benefits would offset these temporary impacts, as the realigned roadways with increased line of sight are anticipated to help traffic flow more efficiently at the new intersection. Therefore, no adverse impacts to traffic-related energy consumption or greenhouse gas emissions are anticipated.

Chapter 6 References

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Appendix A Pre-Draft Environmental Assessment Coordination and Consultation and Regulatory Correspondence

Appendix A-1
Pre-Draft Environmental Assessment Coordination and Consultation

A-1a: Example 343 Scoping Letter
A-1b: 343 Scoping Letter Responses

Appendix A-1
Pre-Draft Environmental Assessment Coordination and Consultation

A-1a: Example 343 Scoping Letter

JOSH GREEN, M.D.
GOVERNOR
KE KIAʻĀINA

EDWIN H. SNIFFEN
DIRECTOR
KA LUNA HOʻOKELE

Deputy Directors
Nā Hope Luna Hoʻokele
DREANALEE K. KALILI
TAMMY L. LEE
CURT T. OTAGURO
ROBIN K. SHISHIDO

STATE OF HAWAIʻI | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF TRANSPORTATION | KA ʻOIHANA ALAKAU
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

HWY-K 4.250135

June 12, 2025

First Name Last Name, Title
Agency / Office / Group
Address Line 1
Address Line 2
City, State ZIP

Dear Title Last Name:

Subject: Pre-consultation for Draft Environmental Assessment (EA)
Kuhio Highway Intersection Improvements at Temporary Kapaʻa Bypass Road Southern Terminus
Olohena Ahupuaʻa, Puna Moku, Island of Kauaʻi
Federal Aid Project No. NH-056-1(066)
Tax Map Key Nos. Kuhio Highway Roadway Right-of-Way (ROW) and (4)4-3-001:999, (4)-3-002:999, (4)4-3-010:001, (4)4-3-010:005

The State of Hawaiʻi Department of Transportation (HDOT) is conducting an environmental review to examine the impacts of a project to renovate the intersection between Kuhio Highway (State Route 56), Temporary Kapaʻa Bypass Road, and Papaloa Road in Kapaʻa, Kauaʻi.

HDOT is preparing an Environmental Assessment (EA) in compliance with the Hawaiʻi Revised Statutes Chapter 343, Hawaiʻi's environmental impact statement law, to evaluate and disclose the project's potential environmental impacts and identify any potential permitting requirements. At this time, HDOT is seeking input on the project information provided below, as well as information related to any environmental, social, or economic concerns related to the project or project area.

The Federal Highway Administration intends to fund the intersection improvements and therefore, this project is also considered a federal action, triggering federal requirements

including the National Environmental Policy Act (NEPA), and 42 United States Code 4332(2)(c). To comply with NEPA, preparation for environmental documentation to be consistent with the findings of this EA is being done.

Existing Condition Information

Kuhio Highway is a major thoroughfare that connects Līhuʻe to northern parts of Kauaʻi. The Project Area is located in Wailua and contains two unsignalized, T intersections. One intersection connects Kuhio Highway to Papaloa Road, a small road servicing residents, the Coconut Marketplace, and various resorts and hotels. The other intersection connects Kuhio Highway to Temporary Kapaʻa Bypass Road, which provides an alternative route to Kuhio Highway for those who want to avoid slowdowns in Kapaʻa town.

The project area is approximately 8.96 acres and includes Kuhio Highway ROW and private-owned land. Construction staging will occur in the northeast portion of the project area, mauka of Kuhio Highway.

Overview

HDOT is currently evaluating realigning the southern terminus of Temporary Kapaʻa Bypass Road at Kuhio Highway to intersect with the existing intersection of Kuhio Highway with Papaloa Road (North) near the Coconut Marketplace. The realignment will consolidate the two (2) existing T intersections into a single full access intersection. In addition to consolidating the intersections, the realignment will provide the opportunity to allow left turns from Papaloa Road (North) onto Kuhio Highway. These intersection improvements will improve safety and connectivity of the road and ease traffic in the area. Safety standard compliant highway lights will also be installed in the project area.

Some vegetation clearing will occur in areas mauka of Kuhio Highway and along Temporary Kapaʻa Bypass Road to allow construction and staging to occur. Best Management practices will be implemented in accordance with An Integrated Storm Water Management Approach and a Summary of Clear Water Diversion and Isolation Best Management Practices for use in the State of Hawaiʻi, by the Federal Highway Administration and Hawaiʻi Department of Transportation Practitioners Guide (2016) or the Construction Best Management Practices Field Manual by the State of Hawaiʻi Department of Transportation (2008). Night work will need to be completed to allow the construction to be finished in a reasonable time and reduce major traffic impacts.

Night work will not be conducted during Shearwater fledging season (mid-September through December).

Request for Input
HDOT is reaching out to you as well as other County, State, Federal agencies, and the surrounding community to gather project input. We request comments and input regarding environmental concerns in all resources areas as well as design concerns that might help us to evaluate the project. Also, if relevant, we would like to know if you have any recent or upcoming projects planned in the area, or if there are any specific permitting issues or considerations that you would like to bring to our attention.

If you have any questions or concerns, or want to provide our contact information to additional parties that may be interested in participating in the environmental review for this project, please contact Mr. Eric Fujikawa, Project Manager, Highways Kauaʻi District Engineer at:

State of Hawaiʻi, Department of Transportation
1720 Haleukana Street
Līhuʻe, HI 96766
(808) 241-3015
eric.i.fujikawa@hawaii.gov

Please send your written comments to Mr. Fujikawa within 30 days of receipt of this letter to the email or mailing address listed above.

Sincerely,

Randall Haraguchi

FOR ERIC FUJIKAWA
District Engineer

Attachments: Attachment 1: Project Area Map

Appendix A-1
Pre-Draft Environmental Assessment Coordination and Consultation

A-1b: 343 Scoping Letter Responses

From:	Fujikawa, Eric I <eric.i.fujikawa@hawaii.gov>
Sent:	Friday, June 27, 2025 10:03 AM
To:	Urasaki, Randall; Silva Jr, Dennis
Cc:	McClellan, Malie; Aguinaldo, Jeff J
Subject:	FW: Kuhio Highway, Temporary Kapa'a Bypass Road, and Papaloa Road in Kapa'a Kaua'i

Good morning Randy and Dennis,

Please see submitted comments from DOH-Clean Air Branch.

Thank you,
Eric

From: DOH.CABPASS <DOH.CABPASS@doh.hawaii.gov>
Sent: Friday, June 27, 2025 9:35 AM
To: Fujikawa, Eric I <eric.i.fujikawa@hawaii.gov>
Subject: Kuhio Highway, Temporary Kapa'a Bypass Road, and Papaloa Road in Kapa'a Kaua'i

Hello Eric Fujikawa,
State of Hawaii, Dept. of Transportation,

We have received your mailed letter for Subject: Environmental Assessment (EA) Pre-Consultation for Draft Environmental Assessment for Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road Southern Terminus Olohena Ahupuaa, Puna Moku, Island of Kauai Federal Aid Project No. NH-056-1(066), TMK: Kuhio Highway Roadway Right-Of-Way and (4)4-3-001:999, (4)-3-002:999, (4)4-3-010:001, (4)4-3-010:005. Please go to the Clean Air Branch (CAB) website to download and utilize our Standard Comments for Land Use Reviews. The link is included below.

https://health.hawaii.gov/cab/clean-air-branch/standard-comments-for-land-use-reviews/

Lisa Kitahara
Planning & Administrative Support Staff Supervisor | Clean Air Branch
Hawai'i State Department of Health | Ka 'Oihana Olakino
2827 Waimano Home Road #130 | Pearl City, Hawaii 96782
Office: (808) 586-4200

CONFIDENTIALITY NOTICE: This mail message (and attachments) is for the sole use of the intended recipient(s). It may contain confidential and/or privileged information. It might also be protected from disclosure under the Hawaii Uniform Information Practice Act (UIPA) or other laws and regulations. Review, use, disclosure, or distribution by unintended recipients is prohibited. If you are not the intended recipient, please contact the sender immediately in a separate e-mail and destroy the original message and any copies.

Standard Comments for Land Use Reviews
Clean Air Branch
Hawaii State Department of Health
July 3, 2024

All project activities shall comply with Hawaii Administrative Rules (HAR), Chapter 11-59 and 11-60.1.

If your proposed project:

Requires an Air Pollution Control Permit

- You must obtain an air pollution control permit from the Clean Air Branch and comply with all applicable conditions and requirements. If you do not know if you need an air pollution control permit, please contact the Permitting Section of the Clean Air Branch.
- Permit application forms can be found here: https://health.hawaii.gov/cab/permit-application- forms/

Has the potential to generate fugitive dust

- You must reasonably control the generation of all airborne, visible fugitive dust. Note that construction activities that occur near existing residences, businesses, public areas and major thoroughfares exacerbate potential dust concerns. It is recommended that a dust control management plan be developed which identifies and mitigates all activities that may generate airborne, visible fugitive dust. The plan, which does *not* require Department of Health approval, should help you recognize and minimize potential airborne, visible fugitive dust problems.
- Construction activities must comply with the provisions of Hawaii Administrative Rules, §11- 60.1-33 on Fugitive Dust. In addition, for cases involving mixed land use, it is strongly recommended that buffer zones be established, wherever possible, in order to alleviate potential dust concerns.
- You must provide reasonable measures to control airborne, visible fugitive dust from the road areas and during the various phases of construction. These measures include, but are not limited to, the following:
    - Planning the different phases of construction, focusing on minimizing the amount of airborne, visible fugitive dust-generating materials and activities, centralizing on-site vehicular traffic routes, and locating potential dust-generating equipment in areas of the least impact;
    - Providing an adequate water source at the site prior to start-up of construction activities;
    - Landscaping and providing rapid covering of bare areas, including slopes, starting from the initial grading phase;
    - Minimizing airborne, visible fugitive dust from shoulders and access roads;
    - Providing reasonable dust control measures during weekends, after hours, and prior to daily start-up of construction activities; and
    - Controlling airborne, visible fugitive dust from debris being hauled away from the project site.
- If you have questions about fugitive dust, please contact the Enforcement Section of the Clean Air Branch. Please also see fugitive dust fact sheet at: https://health.hawaii.gov/cab/files/2024/02/Hawaii-Fugitive-Dust-Fact-Sheet-February-2024.pdf.

Includes construction, demolition, or renovation activities that involve potential asbestos and lead containing materials

- Please contact the Indoor and Radiological Health Branch at (808) 586-4700 or visit: https://health.hawaii.gov/irhb/

Increases the population and potential number of vehicles in an area

- The creation of apartment buildings, complexes, and residential communities may increase the overall population in an area. Increasing the population in an area may inadvertently lead to more air pollution via vehicle exhaust. Vehicle exhaust releases pollutants in the air that can negatively impact human health and air quality, including lung irritants, carcinogens, and greenhouse gases.
- Ensure that drivers keep vehicle idling times to three (3) minutes or less.
- Consider and incorporate support for alternative transportation options such as bike racks and/or electric vehicle charging stations where possible.

If you have any questions, please contact the Clean Air Branch at (808) 586-4200 or at cab@doh.hawaii.gov.

From: Fujikawa, Eric I <eric.i.fujikawa@hawaii.gov>
Sent: Tuesday, July 1, 2025 7:39 AM
To: Urasaki, Randall; Silva Jr, Dennis
Cc: Aguinaldo, Jeff J; McClellan, Malie
Subject: FW: DOT EA Kuhio Highway_HT-PR-25062401MA

Good morning Randy and Dennis,

Please see below comment from Hawaiian Tel. I'm sure we'll be communicating with all utilities through project design.

Thank you,
Eric

From: Rammell Transfiguracion <Rammell.Transfiguracion@hawaiiantel.com>
Sent: Monday, June 30, 2025 9:52 PM
To: Fujikawa, Eric I <eric.i.fujikawa@hawaii.gov>
Cc: Jon Lui-Kwan <Jon.Lui-Kwan@hawaiiantel.com>; HT-Plan Reviews <HT-PlanReviews@hawaiiantel.com>; Stephen Tercino <Stephen.Tercino@hawaiiantel.com>
Subject: [EXTERNAL] DOT EA Kuhio Highway_HT-PR-25062401MA

Aloha Eric,

HTI does not have any planned/upcoming projects in the area at the moment. The only pertinent consideration would be a Permit To Perform Work Along State Highways.
Otherwise, more detailed plans regarding the new approaches to the intersection would be useful in determining both our UG facilities and pole leads relative to new traffic and their new environmental setting.
Please note, Manholes Labeled "SIC" along Kuhio Hwy are Hawaiian Tel owned.
We appreciate the involvement to comment on the environmental assessment however, construction plans would greatly narrow our focus on our environmental concerns and design for relocation.
In any case please do keep us informed on any upcoming details and timelines about this intersection.

Mahalo,
Rammell Transfiguracion
Hawaiian Telcom Inc.
OSP Engineer I – Hawai`i Island
Office: 808-329-7525 Work: 808-494-8323 Personal: 808-825-7245
fioptics
powered by Hawaiian Telcom

From: Fujikawa, Eric I <eric.i.fujikawa@hawaii.gov>
Sent: Monday, June 30, 2025 10:32 AM
To: Urasaki, Randall; Silva Jr, Dennis
Cc: Aguinaldo, Jeff J; McClellan, Malie
Subject: FW: Project No. NH-056-1(066) / HWY-K 4.250135
Attachments: Screenshot-Preconstruction for Draft EA.png

Good morning Randy and Dennis,

Please see attached and below comments from the Kauai Bus. Please look to incorporate bus stops at the proposed intersection improvements.

Thank you,
Eric

From: Leonard Peters <lpeters@kauai.gov>
Sent: Monday, June 30, 2025 9:37 AM
To: Fujikawa, Eric I <eric.i.fujikawa@hawaii.gov>
Cc: Celia Mahikoa <cmahikoa@kauai.gov>
Subject: [EXTERNAL] Project No. NH-056-1(066) / HWY-K 4.250135

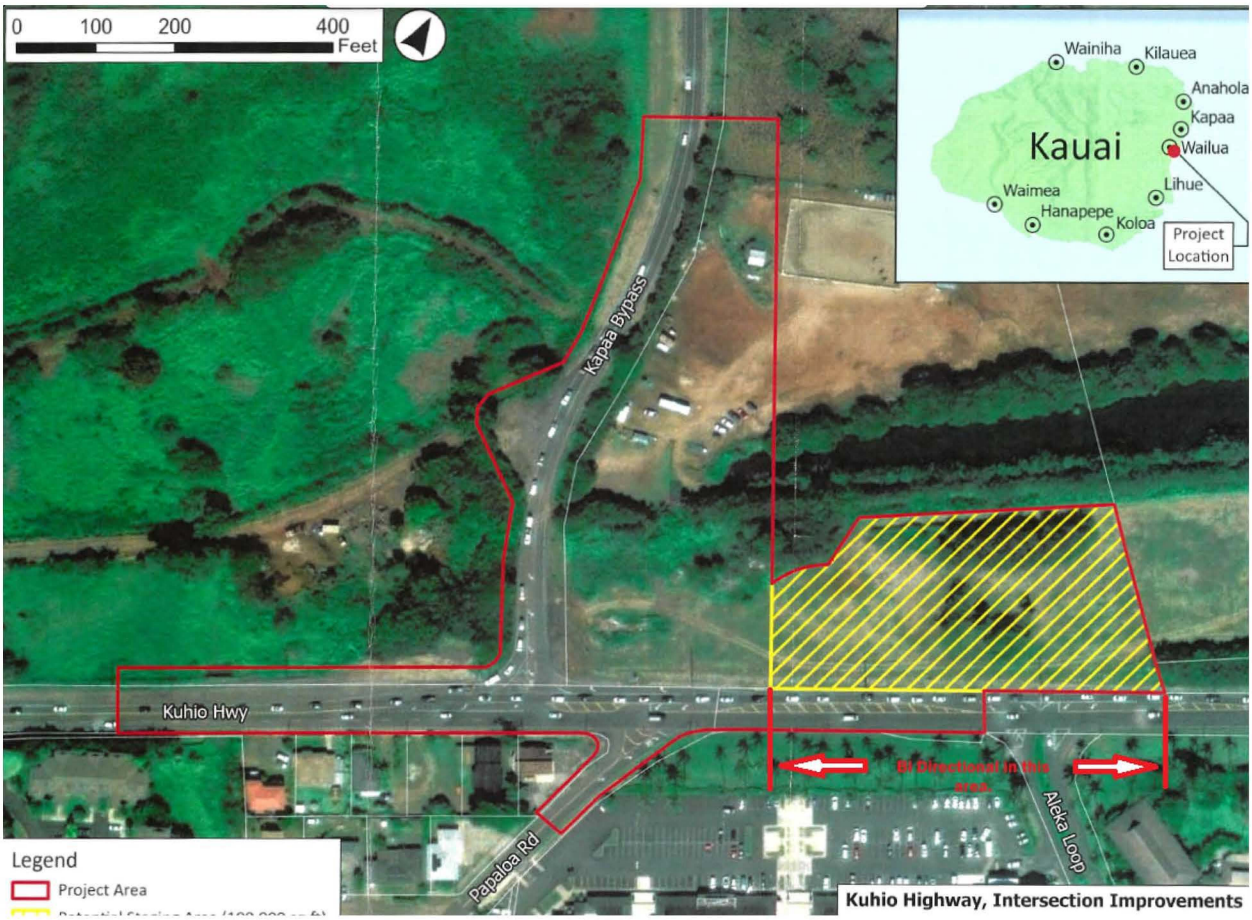
Aloha Eric-
In response to a letter recently received, regarding the planned project to renovate the intersection between Kuhio Highway (State Route 56), Temporary Kapaa Bypass Road, and Papaloa Road in Kapaa, Kauai. The County of Kauai Transportation Agency respectfully requests bi-directional bus stop shelters be added to the project in the area noted in the attached. Please let us know if you have questions or need anything further. We appreciate your consideration in this matter.

Mahalo,

THE KAUA`I BUS

Leonard T Peters
Assistant Executive on Transportation
County of Kaua`i

Direct Line : 808-246-8112
Main Line : 808-246-8110
Email : lpeters@kauai.gov
www.Kauai.gov/Transportation
www.theKauaiBus.com


0 100 200 400
Feet
Wainiha
Kilauea
Anahola
Kapaa
Kauai
Wailua
Waimea
Lihue
Hanapepe
Koloa
Project Location
Kapaa Bypass
Kuhio Hwy
Bi Directional in this area
Aleka Loop
Papaloa Rd
Legend
Project Area
Kuhio Highway, Intersection Improvements

OFFICE OF ECONOMIC DEVELOPMENT
NALANI BRUN, DIRECTOR

DEREK S.K. KAWAKAMI, MAYOR
REIKO MATSUYAMA, MANAGING DIRECTOR

July 7, 2025

Eric Fujikawa
District Engineer
State of Hawaii Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813-5097

Dear Mr. Fujikawa,

Thank you for providing notice of the Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road Southern Terminus Project and requesting consultation.

We are excited to hear that this project is moving forward and look forward to all the value it will bring to the transportation network in Kapaa, as well as our future projects.

We strongly urge you to consider constructing a roundabout as the intersection improvement, considering first and foremost the community's positive experiences with them, in addition to their ability to allow drivers to save gas, reduce emissions, and keep traffic flowing.

This work also directly relates to and enhances our department's projects. The County of Kauai Office of Economic Development completed the Coconut Marketplace Mobility Hub Plan in March 2025. We are now working on the next phase of the project, which is being passed off to a community-based organization that will coordinate efforts to build out the mobility hub and launch an airport shuttle. A major part of the mobility hub's success will depend on infrastructure improvements to the highway system, including constructing pedestrian paths and bike lanes, providing space for bus stops and safe cross walks, and having the ability for drivers to turn left off Papaloa Rd and onto Kuhio Highway. A shuttle network that goes between the Lihue Airport and Coconut Marketplace could operate much more seamlessly entering the highway via roundabout from Papaloa Rd and heading sound as opposed to the current exit point which is a stop sign from Aleka Loop.

We greatly appreciate your consideration of our feedback and will remain engaged in these efforts. Please don't hesitate to reach out with any questions.

Mahalo Nui Loa,

Nalani K. Brun
Director

4444 Rice Street, Suite 200 • Līhu'e, Hawai'i 96766 • (808) 241-4946 (b) • (808) 241-6399 (f)
An Equal Opportunity Employer

From:	Fujikawa, Eric I <eric.i.fujikawa@hawaii.gov>
Sent:	Friday, July 18, 2025 3:06 PM
To:	Urasaki, Randall; Silva Jr, Dennis
Cc:	McClellan, Malie
Subject:	FW: Request for Comments: Pre-Consultation for Draft EA for Kuhio Highway Intersection Improvements - Temporary Kapaa Bypass Road and Papaloa Road
Attachments:	PC DEA Kuhio Hwy Intersection Improvements-signed.pdf; PC DEA Kuhio Hwy Intersection Improvements-eng.pdf

Hi Randy and Dennis,

Forwarding comments from DLNR.

Thank you,
Eric

From: Vierra, Dayna K <Dayna.K.Vierra@hawaii.gov>
Sent: Thursday, July 17, 2025 3:19 PM
To: Fujikawa, Eric I <eric.i.fujikawa@hawaii.gov>
Subject: Request for Comments: Pre-Consultation for Draft EA for Kuhio Highway Intersection Improvements - Temporary Kapaa Bypass Road and Papaloa Road

Aloha,

Thank you for the opportunity to review and provide comments on the subject project.

Attached are comments from the Hawai'i Department of Land and Natural Resources (DLNR) for the above entitled subject project.

Please note that future requests for the DLNR's review and comments may be emailed to either of the following email addresses:

- dlnr@hawaii.gov
- dlnr.land@hawaii.gov

Mahalo,

Dayna Vierra, Planner

Department of Land and Natural Resources, Land Division

1151 Punchbowl Street, Room 220

Honolulu, HI 96813

Tel: (808) 587-0423

Fax: (808) 312-6357

JOSH GREEN, M.D.
GOVERNOR | KE KIAʻĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIAʻĀINA

DAWN N. S. CHANG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAIʻI | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA ʻOIHANA KUMUWAIWAI ʻĀINA
LAND DIVISION

P.O. BOX 621
HONOLULU, HAWAII 96809

July 16, 2025

State of Hawaiʻi
Department of Transportation
Highways Division
ATTN: Eric Fujikawa, District Engineer *via email:* eric.i.fujikawa@hawaii.gov
1720 Haleukana Street
Līhuʻe, Hawaiʻi 96766

SUBJECT: Pre-Consultation Draft EA - Kūhio Highway Intersection Improvements at Temporary Kapaʻa Bypass Road Southern Terminus, Island of Kauaʻi; TMKs: Kuhio Highway Roadway Right-of-Way and (4)4-3-001:999, (4)4-3-002:999, (4)4-3-010:001, (4)4-3-010:005

Dear Mr. Fujikawa:

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

Please find enclosed, comments from the Engineering Division, on the subject matter. Should you have any questions, please feel free to contact Dayna Vierra at (808) 587-0423 or email: dayna.k.vierra@hawaii.gov.

Sincerely,

Ian Hirokawa
Acting Land Administrator

Enclosure(s)

JOSH GREEN, M.D.
GOVERNOR | KE KIA'ĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIA'ĀINA

DAWN N. S. CHANG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAI'I | KA MOKU'ĀINA 'O HAWAI'I
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA 'OIHANA KUMUWAIWAI 'ĀINA
LAND DIVISION

P.O. BOX 621
HONOLULU, HAWAII 96809

June 20, 2025

MEMORANDUM

FROM: TO:

DLNR Agencies:
_X_ Div. of Aquatic Resources (kendall.l.tucker@hawaii.gov)
__ Div. of Boating & Ocean Recreation
_X_ Engineering Division (DLNR.ENGR@hawaii.gov)
_X_ Div. of Forestry & Wildlife (rubyrosa.t.terrago@hawaii.gov)
__ Div. of State Parks
_X_ Commission on Water Resource Management (DLNR.CWRM@hawaii.gov)
__ Office of Conservation & Coastal Lands
_X_ Land Division – Kaua'i District (reynold.km.lee@hawaii.gov)
_X_ Aha Moku Advisory Committee (leimana.k.damate@hawaii.gov)

TO: FROM: Ian C. Hirokawa, Acting Land Administrator

SUBJECT: Pre-Consultation for Draft Environmental Assessment for Kūhiō Highway Intersection Improvements at Temporary Kapa'a Bypass Road, and Papaloa Road

LOCATION: Kapa'a, Island of Kaua'i; TMKs: (4) 4-3-001:999, 4-3-002:999, 4-3-010:001, 4-3-010:005

APPLICANT: State of Hawai'i Department of Transportation (HDOT)

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit comments by **July 15, 2025.**

If no response is received by the above date, we will assume your agency has no comments. Should you have any questions about this request, please contact Dayna Vierra at dayna.k.vierra@hawaii.gov. Thank you.

BRIEF COMMENTS:

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

Signed:
Print Name: Dina U. Lau, Acting Chief Engineer
Division: Engineering Division
Date: Jul 14, 2025

Attachment(s)

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/Ian C. Hirokawa

Ref: Pre-Consultation for Draft Environmental Assessment for Kūhiō Highway Intersection Improvements at Temporary Kapa'a Bypass Road, and Papaloa Road
Location: Kapa'a, Island of Kaua'i
TMK(s): (4) 4-3-001:999, 4-3-002:999, 4-3-010:001, 4-3-010:005
Applicant: State of Hawai'i Department of Transportation (HDOT)

COMMENTS

The rules and regulations of the National Flood Insurance Program (NFIP), Title 44 of the Code of Federal Regulations (44CFR), are in effect when development falls within a Special Flood Hazard Area (high-risk areas). State projects are required to comply with 44CFR regulations as stipulated in Section 60.12. Be advised that 44CFR, Chapter 1, Subchapter B, part 60 reflects the minimum standards as set forth by the NFIP. Local community flood ordinances may stipulate higher standards that can be more restrictive and would take precedence over the minimum NFIP standards.

The owner of the project property and/or their representative is responsible to research the Flood Hazard Zone designation for the project. Flood Hazard Zones are designated on FEMA's Flood Insurance Rate Maps (FIRM). The official FIRMs can be accessed through FEMA's Map Service Center (msc.fema.gov). Our Flood Hazard Assessment Tool (FHAT) (fhat.hawaii.gov) could also be used to research flood hazard information.

If there are questions regarding the local flood ordinances, please contact the applicable County NFIP coordinating agency below:

- Oahu: City and County of Honolulu, Department of Planning and Permitting (808) 768-8098.
- Hawaii Island: County of Hawaii, Department of Public Works (808) 961-8327.
- Maui/Molokai/Lanai County of Maui, Department of Planning (808) 270-7139.
- Kauai: County of Kauai, Department of Public Works (808) 241-4896.

Signed: _____
DINA U. LAU, ACTING CHIEF ENGINEER

Date: Jul 14, 2025

JOSH GREEN, M.D.
GOVERNOR | KE KIAʻĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIAʻĀINA

STATE OF HAWAIʻI | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA ʻOIHANA KUMUWAIWAI ʻĀINA

DIVISION OF FORESTRY AND WILDLIFE
1151 PUNCHBOWL STREET, ROOM 325
HONOLULU, HAWAII 96813

DAWN N.S. CHANG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RYAN K.P. KANAKAʻOLE
FIRST DEPUTY

CIARA W.K. KAHAHANE
DEPUTY DIRECTOR - WATER

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

MEMORANDUM

TO: IAN C. HIROKAWA, Acting Land Administrator
Land Division

FROM: JASON D. OMICK, Wildlife Program Manager
Division of Forestry and Wildlife

SUBJECT: Pre-Consultation for Draft Environmental Assessment (EA) for Kūhiō Highway Intersection Improvements at Temporary Kapaʻa Bypass Road and Papaloa Road, Olohena Ahapuaʻa, Puna Moku, Island of Kauaʻi; TMKs: Kūhiō Highway Roadway Right-of-Way and (4) 4-3-001:999, 4-3-002:999, 4-3-010:001, 4-3-010:005.

The Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) has received your pre-consultation request regarding the Draft Environmental Assessment (EA) for the proposed Kūhiō Highway Intersection Improvements at Temporary Kapaʻa Bypass Road and Papaloa Road, in Olohena Ahapuaʻa, Puna Moku, Kauaʻi within TMKs (4) 4-3-001:999, 4-3-002:999, 4-3-010:001, 4-3-010:005. Kūhiō Highway is a major thoroughfare which connects Līhuʻe to northern parts of Kaua'i. The proposed project is located in Wailua and contains two unsignalized, T intersections. One intersection connects Kūhiō Highway to Papaloa Road, a small road servicing residents, the Coconut Marketplace, and various resorts and hotels. The other intersection connects Kūhiō Highway to Temporary Kapa'a Bypass Road, which provides an alternative route to Kūhiō Highway for those who want to avoid slowdowns in Kapa'a town. HDOT is currently evaluating realigning the southern terminus of Temporary Kapa'a Bypass Road at Kuhio Highway to intersect with the existing intersection of Kuhio Highway with Papaloa Road (North) near the Coconut Marketplace. Safety standard compliant highway lights will also be installed in the project area. The proposed project area is approximately 8.96 acres and includes Kūhiō Highway ROW and privately owned land. Construction staging will occur in the northeast portion of the project area, mauka of Kūhiō Highway. Some vegetation clearing will occur in areas mauka of Kuhio Highway and along Temporary Kapa'a Bypass Road to allow construction and staging to occur. Night work will need to be completed to allow the construction to be finished in a reasonable time and reduce

major traffic impacts but will not be done during shearwater fledging season (mid-September through December). Best Management practices will be implemented.

DOFAW provides the following comments regarding the potential for the proposed work to affect listed species in the vicinity of the project area.

The State listed ʻōpeʻapeʻa or Hawaiian hoary bat (*Lasiurus semotus*) could potentially occur at or in the vicinity of the project and may roost in nearby trees. Any required site clearing should be timed to avoid disturbance to bats during their birthing and pup rearing season (June 1 through September 15). During this period, woody plants greater than 15 feet (4.6 meters) tall should not be disturbed, removed, or trimmed. Barbed wire should also be avoided in any construction as bats can become ensnared and killed by such fencing material during flight.

Artificial lighting can adversely impact seabirds that may pass through the area at night by causing them to become disoriented. This disorientation can result in their collision with manmade structures or the grounding of birds. It is DOFAW's stance that permanent lighting would pose a high risk of seabird attraction on the proposed stretch of road. New highway lights, therefore, should not be installed in this area to protect seabird flyways and preserve the night sky. For illustrations and guidance related to seabird-friendly light styles that also protect seabirds and the dark starry skies of Hawaiʻi please visit https://dlnr.hawaii.gov/wildlife/files/2016/03/DOC439.pdf.

If nighttime construction is required during the seabird fledgling season (September 15 to December 15), DOFAW recommends all lights used be fully shielded to minimize the attraction of seabirds. We also recommend a qualified biologist be present at the project site to monitor and assess the risk of seabirds being attracted or grounded due to the lighting. If seabirds are seen circling around the area, lights should be turned off. If a downed seabird is detected, please follow DOFAW's recommended response protocol by visiting https://dlnr.hawaii.gov/wildlife/seabird-fallout-season/.

State-listed waterbirds such as aeʻo or Hawaiian stilt (Himantopus mexicanus knudseni), ʻalae keʻokeʻo or Hawaiian coot (Fulica alai), ʻalae ʻula or Hawaiian gallinule (Gallinula chloropus sandvicensis), koloa maoli or Hawaiian duck (Anas wyvilliana), and nēnē or Hawaiian goose (*Branta sandvicensis)* could potentially occur at or in the vicinity of the proposed project site. It is against State law to harm or harass these species. If any of these species are present during construction, all activities within 100 feet (30 meters) should cease and the bird or birds should not be approached. Work may continue after the bird or birds leave the area of their own accord. If a nest is discovered at any point, please contact the **Kauaʻi Branch DOFAW Office at (808) 274-3433** and establish a buffer zone around the nest.

The endemic pueo or Hawaiian short-eared owl (*Asio flammeus sandwichensis*) could potentially nest in the project area. Pueo nest on the ground and active nests have been found year-round. Before any potentially disturbing activity like clearing vegetation, especially ground-based disturbance, DOFAW recommends a qualified biologist conduct

surveys during crepuscular hours. Observation surveys should be done at those times from vantage points where they can see the whole project area for 2-3 nights before construction is to start. If any breeding displays are observed, it is likely there could be a nest. If pueo nests are detected in the area, a buffer zone should be established in which no activity occurs within a minimum buffer distance of 100 meters until the nesting cycle is complete and the chicks are capable of flight. Kauaʻi Branch DOFAW staff should be notified of any nests or adult displayed breeding behavior.

DOFAW is concerned about the impacts of nonnative predators such as cats, rodents, and mongoose, on native and endangered waterbirds, seabirds, and forest birds. DOFAW recommends no feeding of feral cats should occur on the premises, as predation is instinctive and even well-fed cats will hunt and kill wildlife. Take action to minimize predator presence; remove cats, place bait stations for rodents and mongoose, and provide covered trash receptacles.

DOFAW recommends using native plant species for landscaping that are appropriate for the area; i.e., plants for which climate conditions are suitable for them to thrive, plants that historically occurred there, etc. Please do not plant invasive species. DOFAW also recommends referring to www.plantpono.org for guidance on the selection and evaluation of landscaping plants and to determine the potential invasiveness of plants proposed for use in the project.

Avoid importing soil or other plant material from off-island. Soil and plant material may contain fungi (e.g., rapid ʻōhiʻa death) and other pathogens which could harm our native species and ecosystems. We recommend consulting the Hawaiʻi Interagency Biosecurity Plan at http://dlnr.hawaii.gov/hisc/plans/hibp/ in the planning, design, and construction of the project.

DOFAW recommends minimizing the movement of plant or soil material between worksites. Soil and plant material may contain detrimental fungal pathogens (e.g., Rapid ʻŌhiʻa Death, Coffee Leaf Rust), vertebrate and invertebrate pests (e.g., Coqui Frogs, Little Fire Ants, Coffee Berry Borer, etc.), or invasive plant parts (e.g., Barbados Gooseberry, False Kava, Giant Reed, etc.) that could harm our native species and ecosystems. We recommend consulting the Kauaʻi Invasive Species Committee (KISC) at (808) 821-1490 to help plan, design, and construct the project, learn of any high-risk invasive species in the area, and ways to mitigate their spread. All equipment, materials, and personnel should be cleaned of excess soil and debris to minimize the risk of spreading invasive species.

To prevent the spread of Rapid ʻŌhiʻa Death (ROD), DOFAW requests that removal, pruning/trimming, and potentially injury to ʻōhiʻa trees be avoided as much as possible. Wounds serve as entry points for ROD fungus and increase the odds that the tree will be infected and die. Also, clean gear/tools, clothes, footwear, and vehicles before and after use. Make sure to removal all loose soil from the aforementioned items, spray gear/tools with 70% rubbing alcohol, and wash clothes with hot water and soap. Wash tires and undercarriages of all vehicles/machinery with a high-pressure water source. If ʻōhiʻa trees must be removed or pruned/trimmed, please conduct these activities on a still day to

minimize blown sawdust and use a sharp saw to create chips rather than dust. Seal all wounds to these trees with a stump seal product (e.g. Spectricide, etc.). For more information, please consult https://cms.ctahr.hawaii.edu/rod.

The invasive coconut rhinoceros beetle (*Oryctes rhinoceros*) or CRB is widespread on the island of Oʻahu. CRB have been detected on other islands with moderate infestation on Kauaʻi, one incipient site on Hawaiʻi Island, and only one positive site on Maui in 2023. Hawaiʻi Department of Agriculture interim rule 24-1 restricts the movement of CRB-host material from the island of Oʻahu, which is defined as the Quarantine Area. Regulated material (host material or host plants) is considered a risk for potential CRB infestation. Host material for the beetle specifically includes 1) entire dead trees; 2) mulch, compost, trimmings, fruit and vegetative scraps, and 3) decaying stumps. CRB host plants include the live palm plants in the following genera: *Washingtonia*, *Livistona*, and *Pritchardia* (all commonly known as fan palms), *Cocos* (coconut palms), *Phoenix* (date palms), and *Roystonea* (royal palms). When such material or these specific plants are moved there is a risk of spreading CRB because they may contain CRB in any life stage. Inspection and/or treatment approved by HDOA is mandatory before inter-island transport. For more information regarding CRB, please visit https://dlnr.hawaii.gov/hisc/info/invasive-species-profiles/coconut-rhinoceros-beetle/.

Due to the arid climate, high fine fuel load (grasses) surrounding the worksite, and risks of wildfire to listed species and native habitats, we recommend coordinating with the Hawaiʻi Wildfire Management Organization at (808)-850-0900 or admin@hawaiiwildfire.org, on how wildfire prevention can be addressed in the project area. When engaging in activities that have a high risk of starting a wildfire—like wielding in/near tall grass, it is recommended that you: 1) wet down the area before starting your task, 2) continuously wet down the area as needed, 3) have a fire extinguisher on hand, and 4) in the event that your vision is impaired, (i.e. welding goggles) have a spotter to watch for fire ignitions. Additionally, do not park any vehicles in or near tall grass as heat from the engine/exhaust may ignite dry vegetation.

We appreciate your efforts to work with our office for the conservation of our native species. These comments are general guidelines and should not be considered comprehensive for this site or project. It is the responsibility of the applicant to do their own due diligence to avoid any negative environmental impacts. Should the scope of the project change significantly, or should it become apparent that threatened or endangered species may be impacted, please contact our staff as soon as possible. If you have any questions, please contact Kelli Yamaguchi, Protected Species Habitat Conservation Planning Associate via email at kelli.yamaguchi.researcher@hawaii.gov.

Sincerely,



JASON D. OMICK
Wildlife Program Manager

Water has no substitute……. Conserve it

ENGINEERING DIVISION
DEPARTMENT OF WATER, COUNTY OF KAUA'I
JASON F. KAGIMOTO, P.E.

JOSEPH E. TAIT
MANAGER AND CHIEF ENGINEER

MICHAEL K. HINAZUMI, P.E.
DEPUTY MANAGER-ENGINEER

August 5, 2025

Eric Fujikawa
State of Hawai'i, Department of Transportation
1720 Haleukana Street
Līhu'e, HI 96766

Dear Eric Fujikawa:

Subject: Pre-Consultation for Draft Environmental Assessment (EA)
Kūhiō Highway Intersection Improvements at Temporary Kapa'a Bypass Road
Tax Map Key Nos. Kūhiō Highway Roadway Right-of-Way (ROW) and (4) 4-3-001:999, (4) 4-3-002:999, (4) 4-3-010:001, (4) 4-3-010:005, Kapa'a, Kaua'i

This is in regard to your letter dated June 12, 2025. We have no objections to the proposed Draft EA to renovate the intersection between Kūhiō Highway, Temporary Kapa'a Bypass Road, and Papaloa Road in Kapa'a, Kaua'i.

The applicant is hereby informed that the Department of Water (DOW) is planning a waterline improvement project along Kuhio Highway, from Papaloa Road to Kawaihau Road. The DOW's project will include replacing the waterlines within your project area.

If you have any questions, please contact Ms. Jessica-Renee Polk at (808) 245-5459 or wrp@kauaiwater.org.

Sincerely,

Regina Reyes-Flores
Regina Reyes-Flores (Aug 5, 2025 08:01:39 HST)

Regina Reyes-Flores, P.E.
Water Resources and Planning Section
Engineering Division

Draft EA, Kapaa Bypass-Papaloa Road, 20250805, Fujikawa/RF:jrp

McClellan, Malie

From: Larry Arruda <>
Sent: Tuesday, November 25, 2025 7:15 PM
To: KuhioKapaaIntersection
Subject: Fwd: Kuhio Hwy. @ Kapaa bypass.

Sent from my iPhone

Begin forwarded message:

> **From:** Larry Arruda <>
> **Date:** November 25, 2025 at 3:34:55 PM HST
> **To:** eric.i.fujikawa@hawaii.gov
> **Cc:** Mel Rapozo <>, Members Council <>, Luke Eveslyn <>, Luke evslin2 <>, Ron Kouchi <>, David Hazelbeck <>
> **Subject: Kuhio Hwy. @ Kapaa bypass.**

Kuhio & Kapaa bypass.

The only logical "alternative" for improving traffic circulation **and pedestrian safety** through this intersection, other than leaving it as is for now, is a full signalized intersection.

First of all , traffic circles (or round-abouts) are NOT conducive to standard traffic engineering objectives, especially on major highways with high ADT. (Average Daily Traffic). One of the main objectives in Traffic Engineering is maintaining a constant flow of traffic. Any disruption to that flow is called a "bottleneck". ALL bottlenecks result in a slow down of traffic flow, which results in a progressively worse slow down resulting in the complete stop of traffic flow.

Second, traffic circles were originally intended for rural or suburban locations where the intensity of traffic does not warrant a full traffic signal and pedestrian traffic is all but non existent.

Third.. ALL "roundabouts" should be void of all pedestrian traffic for at least 300 feet in all directions from that roundabout. To ignore this is positively grounds for tremendous liability on the agency's part.

A driver entering a roundabout is looking left to yield into the flow of traffic, and looking right so as not to run into another vehicle entering the roundabout He/she IS NOT paying attention, nor looking for pedestrians, nor bicycles.

Roundabouts with crosswalks are an invitation to tragedy.

Conclusion: the ONLY logical and SAFE alternative for SAFE pedestrian access, as well as vehicular access for this, and any busy intersection on Kauai is a full modern, **up-to-date technology** traffic signal system with induction loops, (not cameras), including

“advanced detection loops” to cue the controller computer to skip a cycle when no traffic is detected on any leg of the intersection.
THIS IS a technology that has existed for well over 30-40 years, yet is not yet used on Kauai.
THIS is why people on Kauai, who are not aware of this technology, prefer a roundabout over a traffic signal, because they believe that the existing antique signals presently being installed on Kauai is all that is available.
All of our traffic signals presently on Kauai should be upgraded with the most up-to-date technology.
Larry Arruda
Kapaa, Kauai
(808) 651-7549.

Appendix A-2
Pre-Draft Environmental Assessment Public Meeting Items

A-2a: Public Meeting Presentation
A-2b: Public Meeting Notes
A-2c: Post Meeting Comment Responses

Appendix A-2
Pre-Draft Environmental Assessment Public Meeting Items

A-2a: Public Meeting Presentation



KUHIO HIGHWAY KAPAA BYPASS INTERSECTION IMPROVEMENTS PROJECT

Kuhio Highway (State Route 56), Kapaa Bypass, and Papaloa Road Intersection

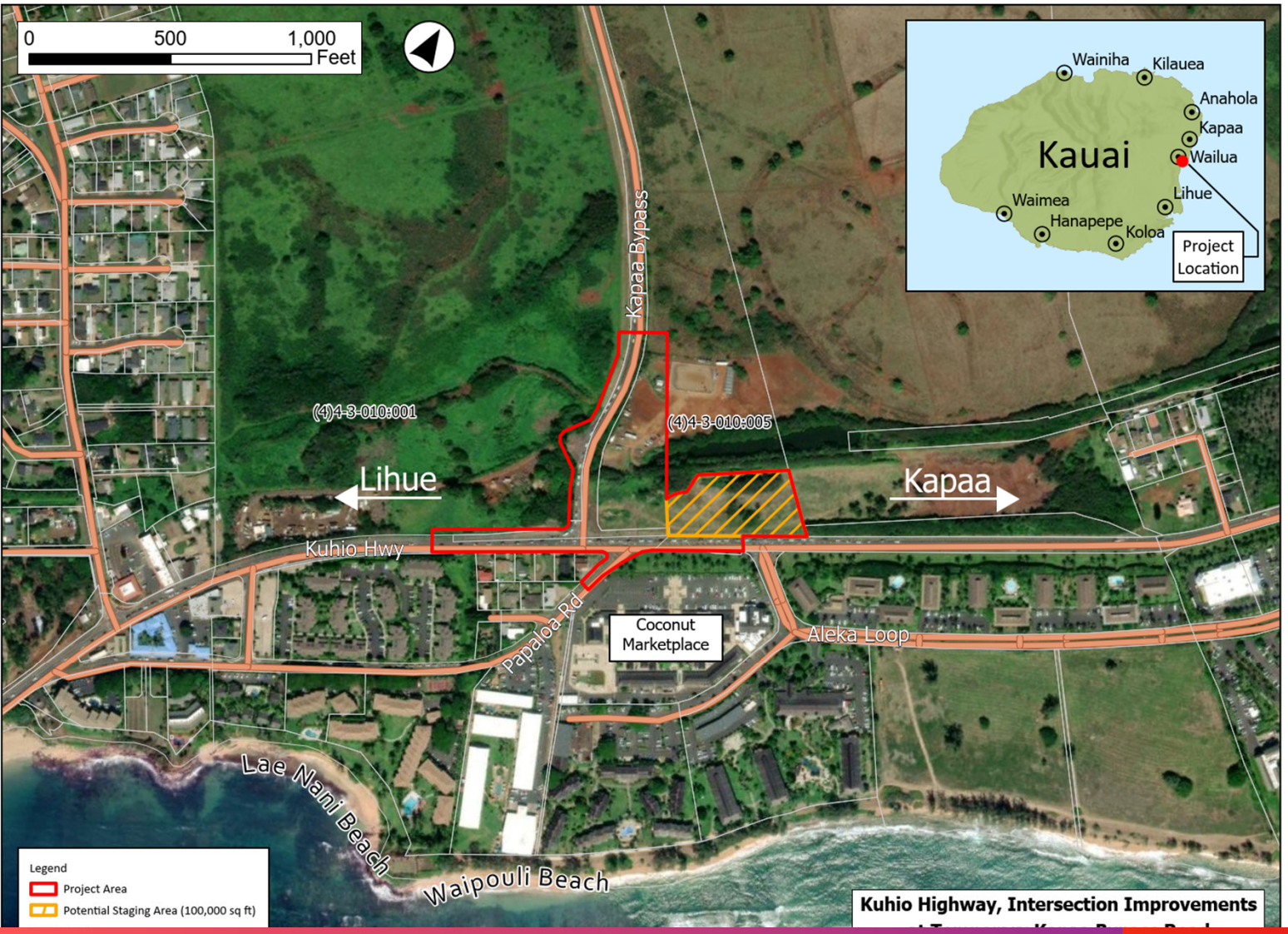
Public Scoping Meeting

September 17, 2025

Photo Source: Google Earth Pro

AGENDA

1. Project Location
2. Project Purpose and Need
3. Project Alternatives and Plans
4. Project Schedule
5. Public Input – Tonight's Meeting Purpose



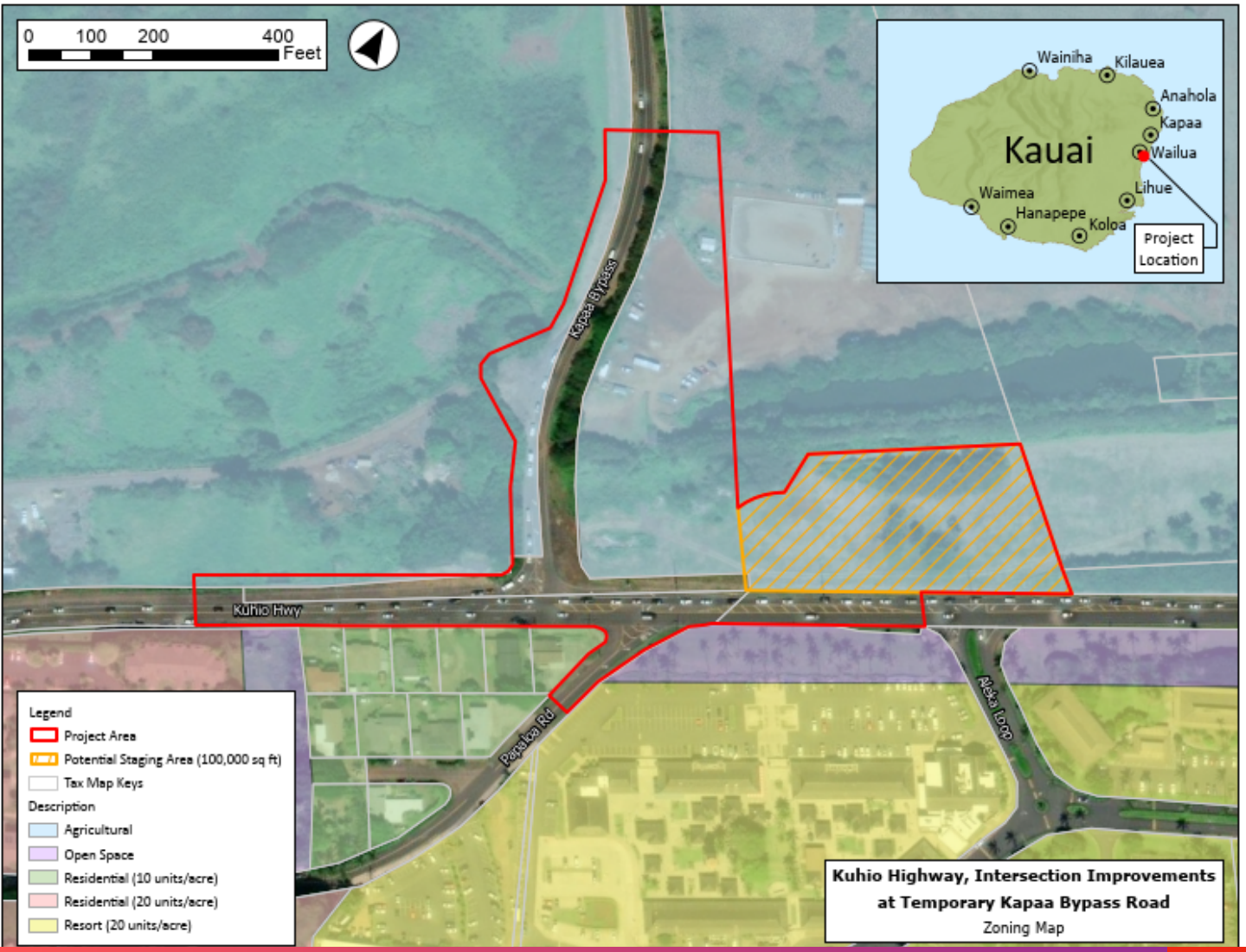
Project Location

Kuhio Highway (State Route 56), Kapaa Bypass, and Papaloa Road Intersection

TMK (4) 4-3-010:001, :005, and the rest of the Kuhio Highway Right-of-Way

Project Purpose and Need

- The project is intended to improve safety and connectivity of the intersection
- Project actions will include:
  - Realigning the southern terminus of Kapaa Bypass Road at Kuhio Highway to intersect with the existing Kuhio Highway and Papaloa Road
    - Consolidating the two intersections
    - Providing left turns from Papaloa Road onto Kuhio Highway



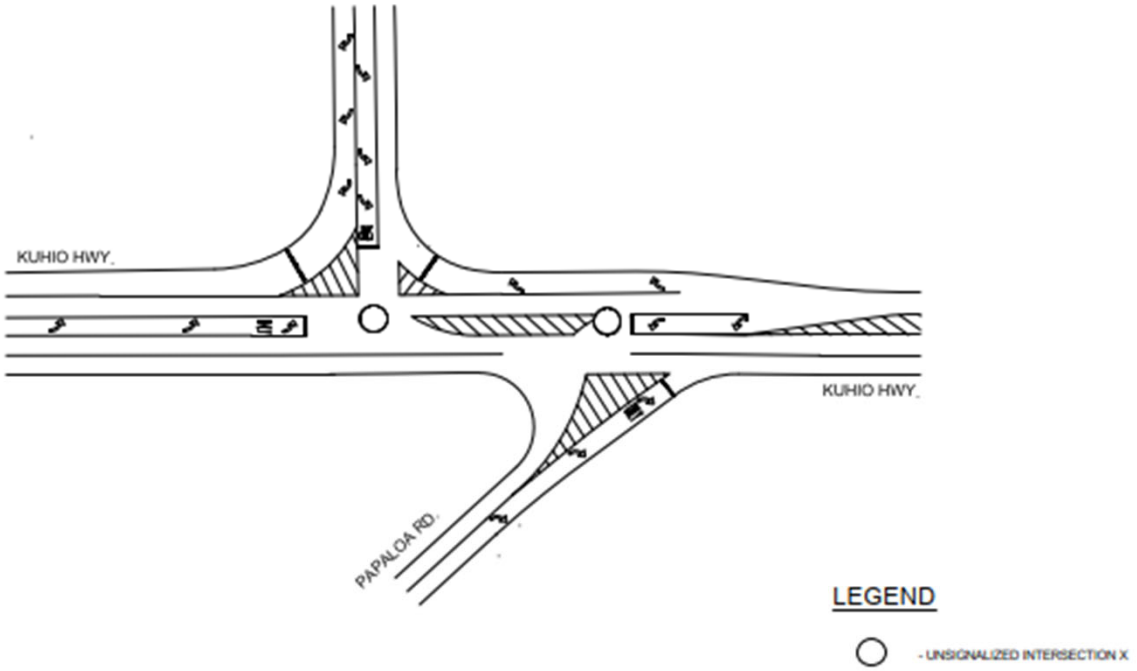
Project Location-Zoning

- The project is located in an Agricultural Zone
- No changes to zoning will occur as part of the intersection improvements

PROJECT ALTERNATIVES

1. No Build
2. Two Lane Roundabout
3. Turbo Roundabout
4. Signalized Intersection

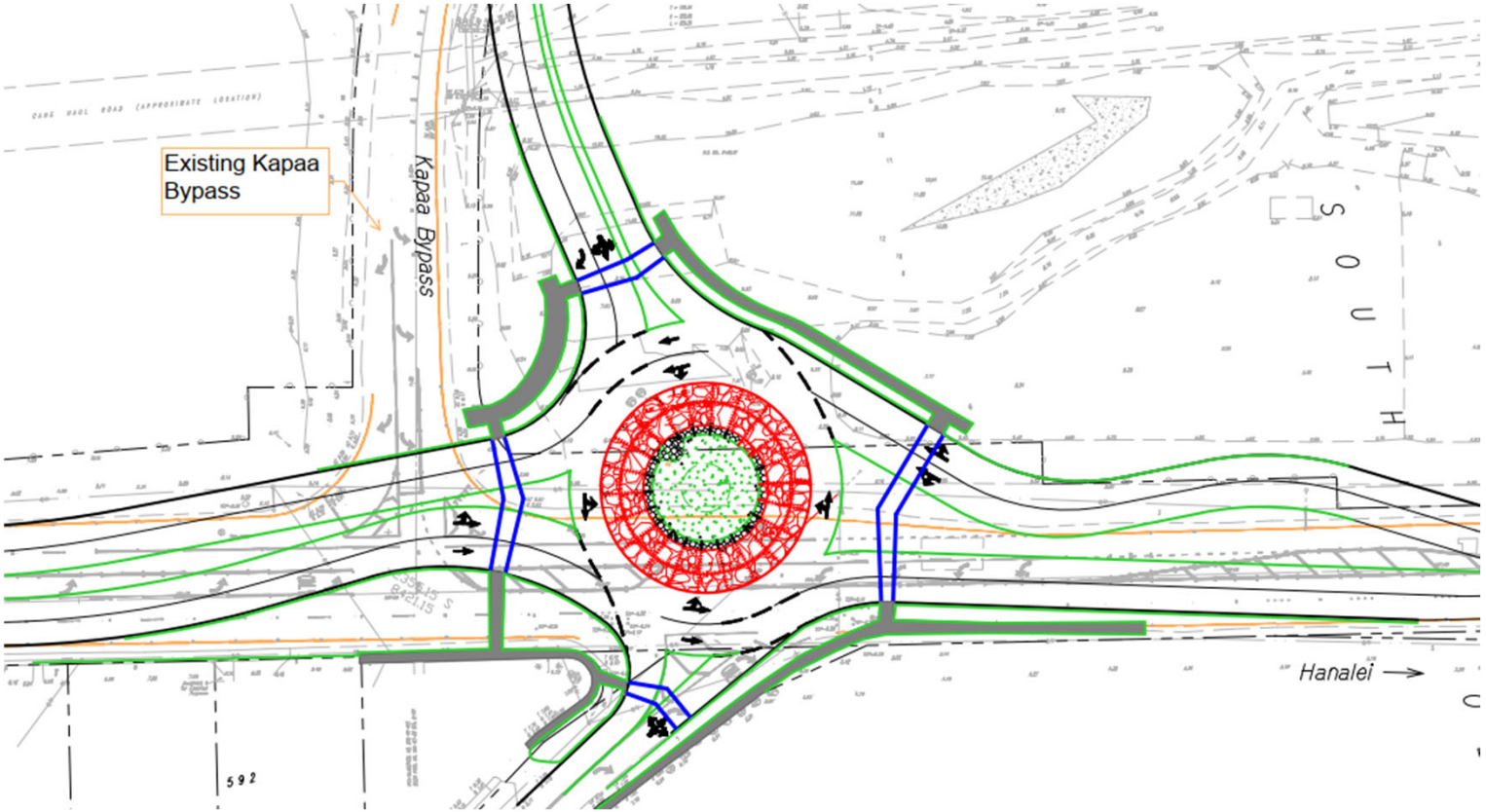
No Build



- The intersection will remain in its current state
- Benefits:
  - No upfront cost or construction
- Negatives:
  - Traffic is anticipated to increase in future year projections and this alternative will not reduce traffic

*Editors Note: This two-lane roundabout alternative is different that the one presented in the EA. Due to community comments, a free right hand turn from Kapaa Bypass onto Kuhio Highway was added and a Kuhio Highway southbound through lane was removed.

Project Alternative – Two-Lane Roundabout*



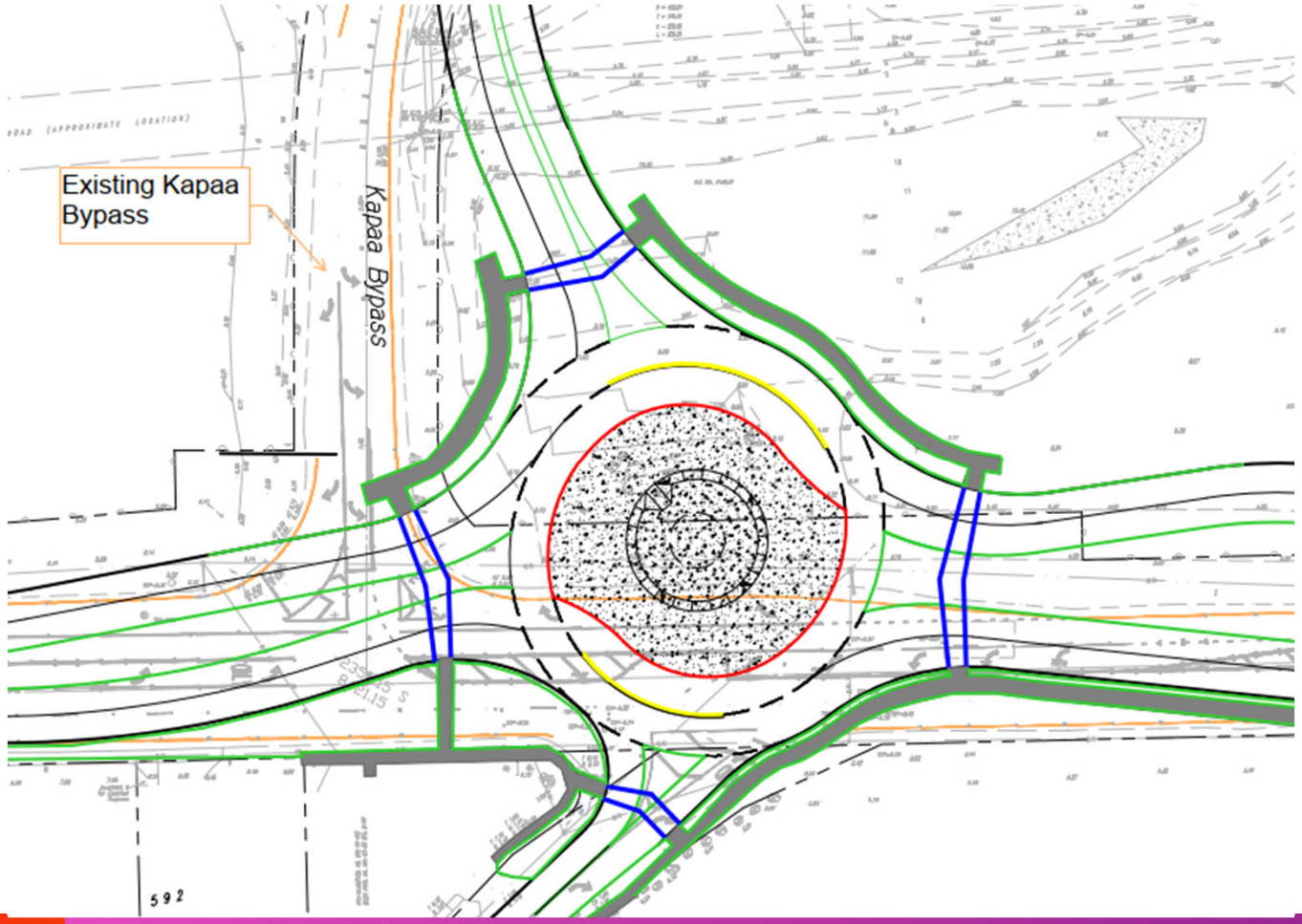
- Blue- Crosswalks
- Red- Truck Apron
- Green- Grass/Landscaping
- Orange- Existing Road Alignment
- Gray- Sidewalks

Project Alternative – Two-Lane Roundabout

- Benefits:
  - Kuhio Highway and adjacent roads operate at adequate capacity
  - Traffic calming
  - Less conflict points for vehicles, pedestrians, and bicyclists
  - Low maintenance cost and higher lifespan than signalized intersection
- Negatives:
  - Travel times expected to increase for travelers on Kuhio Highway during peak hours.
  - Higher installation cost than a signalized intersection

Project Alternative – Turbo Roundabout

- Blue- Crosswalks
- Red- Truck Apron
- Green- Grass/Landscaping
- Orange- Existing Road Alignment
- Gray- Sidewalks
- Yellow- Lane Dividers



Project Alternative – Turbo Roundabout

- The turbo roundabout requires drivers to choose which direction they are planning to go prior to entering the roundabout
- Benefits:
  - Kuhio Highway and adjacent roads operate at adequate capacity
  - Traffic calming
  - Less conflict for vehicles, pedestrians, and bicyclists
  - Low maintenance cost and higher lifespan than signalized intersection
  - Delineation between lanes will discourage lane changes, reducing conflicts within the roundabout
- Negatives:
  - Travel times expected to increase for travelers on Kuhio Highway during peak hours
  - Higher installation cost than a signalized intersection

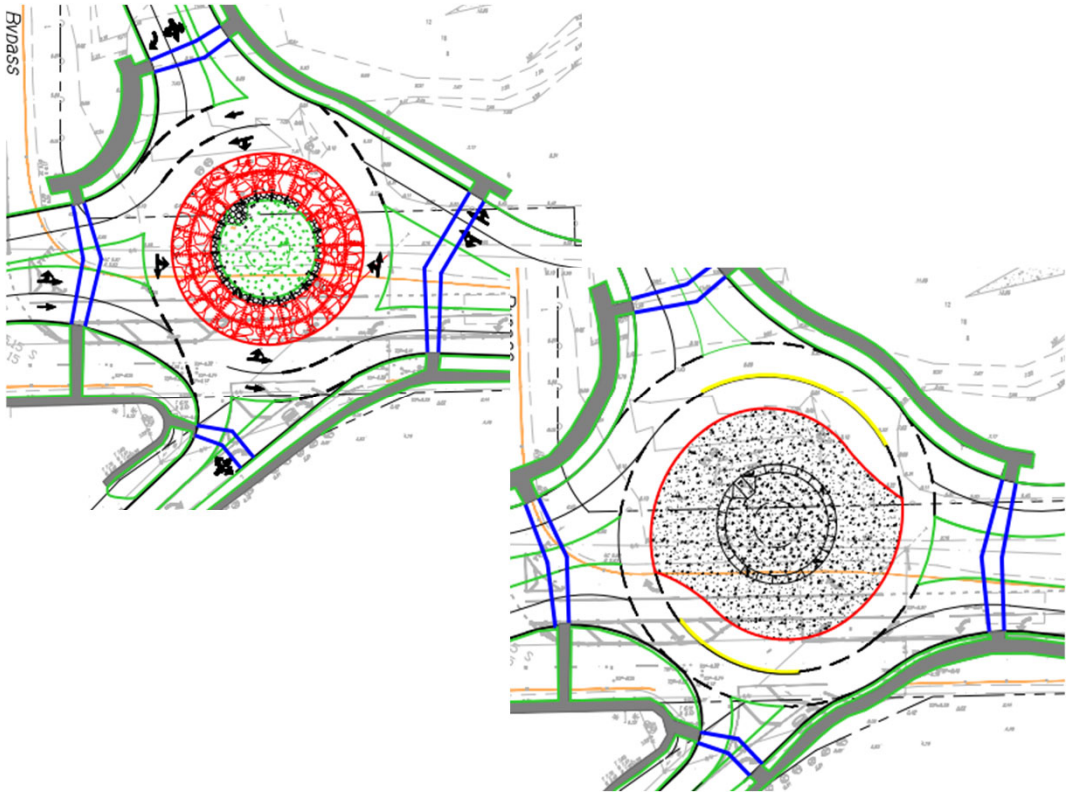
Two Lane Roundabout vs. Turbo Roundabout

TWO LANE

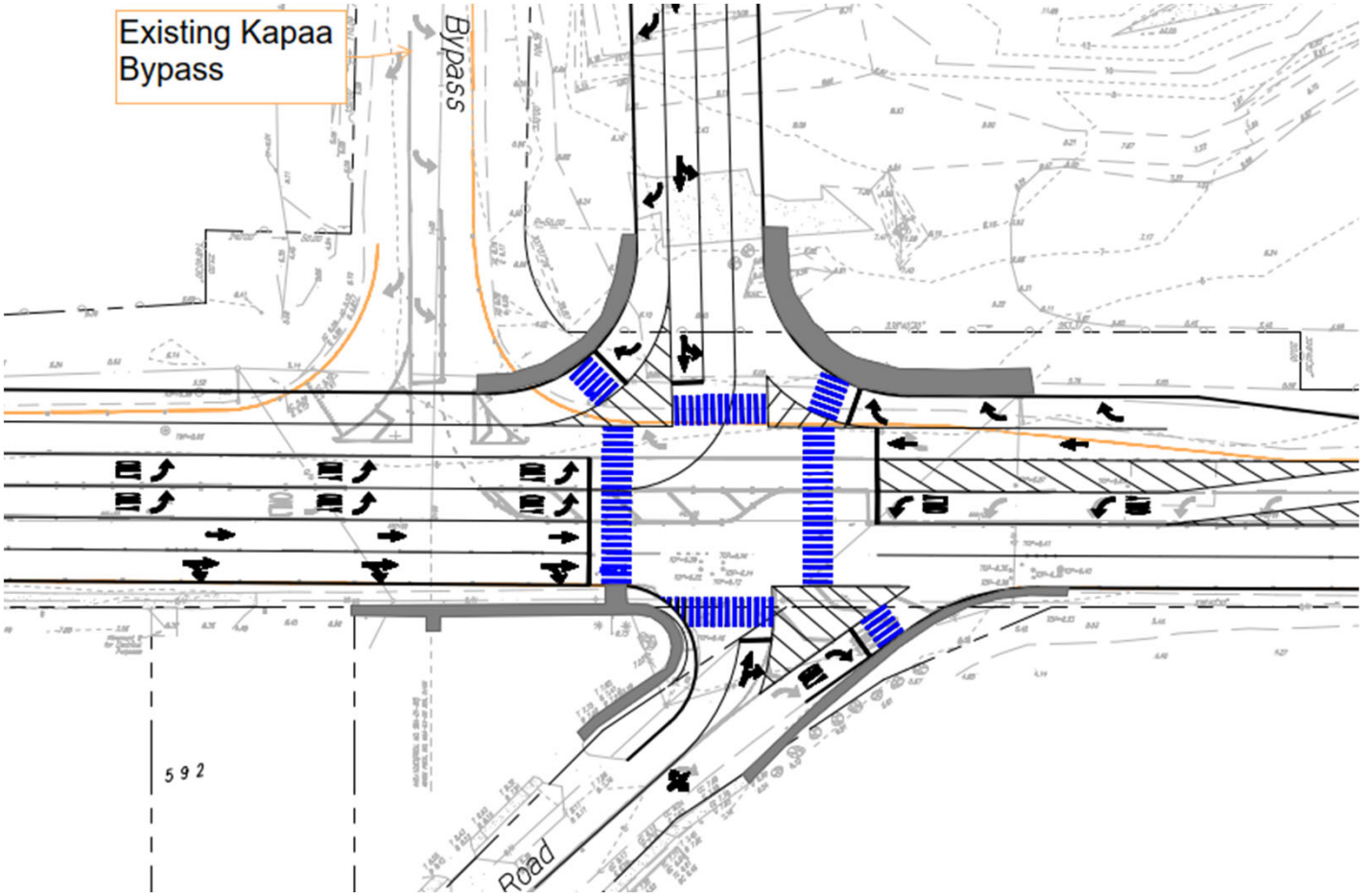
- Switching Lanes within the roundabout is permitted, increasing potential vehicle conflict within the intersection

TURBO

- Lane dividers discourage switching lanes within the roundabout reducing conflict points within the intersection
- Prior to entering the roundabout, drivers must choose final direction



Project Alternative – Signalized Intersection



- Blue- Crosswalks
- Orange- Existing Road Alignment
- Gray- Sidewalks

Project Alternative - Signalized Intersection

- A signalized intersection with two eastbound left turn lanes from Kuhio Highway to Kapaa Bypass will be constructed
- Benefits:
  - Kuhio Highway and adjacent roads operate at adequate capacity
  - Lower initial cost
- Negatives:
  - Higher maintenance cost and shorter lifespan
  - Higher operating cost
  - No speed mitigation

Alternatives Comparison

	No Build	Two-Lane Roundabout	Turbo Roundabout	Signalized Intersection
Cost	No immediate construction cost	Higher construction cost, lower maintenance cost	Higher construction cost, lower maintenance cost	Lower construction cost, higher maintenance cost
Benefits	N/A	Traffic calming, longer lifetime. Anticipated to result in fewer fatal and injury related crashes.	Traffic calming and no lane changing within roundabout, longer lifetime. Anticipated to result in fewer fatal and injury related crashes.	Roads operate at adequate capacity
Negatives	No reductions in congestion	Increase travel times during peak hours	Increase travel times during peak hours	Shorter lifespan, not traffic calming

Project Schedule

Public Meeting Comment Period	September 17, 2025 – October 17, 2025
Publication of Draft EA	November 23, 2025
Draft EA Comment Period	November 23, 2025 – December 23, 2025
Publication of Final EA	February or March 2026
Final Design	June 2026
Construction	January 2027 to December 2027

Public Input

- The project sent out HRS 343 scoping setters to agencies and the public on June 12, 2025
- Tonight's scoping meeting is intended to facilitate community discussion regarding the project. You can comment using the following means:
  - Comment Forms (mailed or submitted in person)
  - Project Email: KuhioKapaaIntersection@wsp.com
- You will also be able to comment on the project after Draft and Final EA publication



Photo Source: SWCA, 2025

Mahalo

Mr. Eric Fujikawa, HDOT
Project Manager

eric.i.fujikawa@hawaii.gov

1720 Haleukana Street

Lihue, HI 96766

Appendix A-2
Pre-Draft Environmental Assessment Public Meeting Items

A-2b: Public Meeting Notes

This is a matrix of notes taken during the public meeting. Included is a summary of the comments; the response to the comment during the meeting; and, if required, an additional response clarifying responses or directing to where the comment is answered in the EA.

Comment	During Meeting Response	Post Meeting Response
This project will make them, the lessee, lose 10 acres of their 15 acre property. We told that they would be able to use land up the road but just spent $94,000 on improvements by Kuhio Hwy. Would like to see it move down the road.	Thank you for your comment.	
There used to be a dedicated turn lane by Kintaro's to turn into, the current intersection has poor visibility and you cannot see when turning. I recommend no left-turn there and support the project.	Thank you for your comment.	This restriction of left turn here is discussed in the EA.
Kapaa has 21% of the population. New airport development **(Editors Note: Commenter mentioned another industrial development in Lihue, no notes caught name).** I think this project is important to improve intersection prior to development.	Thank you for your comment.	
I am concerned about increased travel times. There is already congestion in the area and the roundabout wouldn't ameliorate that. I think turbo would work better but tourists may go the wrong way and have to turn around later on the road and cause more traffic.	Some people likely will go the wrong direction but we will include a lot of signage to reduce confusion and allow drivers to prep ahead.	The Turbo roundabout alternative was removed from further consideration.
As a resident of Papaloa (~300 residents), people will have to merge through two lanes to reach the lane to travel to Lihue.	That is true but currently, unsignalized left requires two lanes of north bound traffic and one lane of southbound traffic. Drivers need to look both ways, in a roundabout only need to worry about one direction.	
Turbo will require lots of learning from residents and guests.	True, but signage will be on the road to designated lanes.	
This is a busy intersection, how will traffic be managed during construction?	Traffic Control Plan will be implemented, may include construction phasing and/or temporary bypass road	
Who decides which alternative is chosen?	HDOT will decide by taking into account comments on 343 process.	Based on community comments and project goals the two lane roundabout was chosen. See Chapter 1.
Is there a track record of roundabouts on Kauai to base schedule, what is approximate completion date?	Roundabout in Kilauea (Kuhio Hwy at Kalamania Rd and Kolo Road) is currently being constructed and is example. HDOT will stress to the contractor that a 1 year construction schedule is driven by federal funding deadlines.	
There are going to be curbs inside turbo roundabout?	Yes, extruded curbs (or plastic delineators) to keep traffic from easily changing lanes within intersection. They are more for disincentivize cars changing lanes but will not prevent lane changes completely.	
Is the project funded?	Yes, funded on 5 year STIP in place. Costs have been changing in past years but HDOT will establish appropriate funding.	
The turbo roundabout would be the first in Hawaii, have you considered boat trailers?	Yes, there are 4 operational in the US. The roundabout through motion (along Kuhio Highway) is designed for WD-67 (biggest trucks 67 feet from front axel to rear axel). Turning and/or from Papaloa and Kapaa Bypass is for WD-50 trucks.	
How will this improve traffic/what are the long range effects of this?	HDOT has completed a traffic impact analysis for the project, will be discussed in the EA.	See Section 2.9.

Comment	During Meeting Response	Post Meeting Response
This does not fit into the 1973 community plan, which includes transportation projects for the area. This project is a band aid. Provided the plan to HDOT. Sollution would be to make existing highway one way going north and the bypass going south.	Thank you for the plan, the project had a traffic impact analysis to determine impacts of project. HDOT will review the plan and discuss in the EA. HDOT has its own long range transportation plan written by HDOT Kauai planners that was drafted in 2014 and is being updated. This plan identifies this intersection and roadways south of Wailua River as high priorities.	A consistency review of the Kauai Community Plan is provided in the EA Appendices.
Are there any plans to move the coastal route inland to mitigate climate change, tsunami, hurricane risk?	Not currently aware of any plans to do so.	
Will emergency vehicles be able to go through the roundabout if in gridlock? Will trucks be able to?	Emergency vehicles will be able to move through.	Roundabouts generally are more free flowing and would allow cars to pull over if needed compared to complete stops at lights.
Ten years ago there was a project for roundabout intersection by Kintaro leading to Houselots **(Editors Note: Haleilio Road).** There is a light there and traffic backs up, are there any plans to work there?	No current plans but we have heard concerns about vehicles speeding through that light intersection. A roundabout will slow traffic prior to light and slow traffic a little way up from the Houselots light.	
Do the roundabout alternatives have adequate capacity?	They have increased travel times compared to signalized but would still operate at adequate level of service.	
Will larger vehicles be able to go over truck apron and turbo roundabout curves?	Yes, the final design is not complete but it will be designed with that in mind.	
Will bike lanes be considered for the intersection? You could make the bike lane parallel to the lane or painted shoulder.	Bikers would be within lanes and follow cars. Could also widen sidewalks to make a shared path.	No connecting sidewalks. If bike lanes were installed within the project area, there would be no connections to other bike infrastructure.
Do you have a contingency plan for funding?	STIP has a set amount, this project is a priority so by next August we can finalize federal requests for funds. If funds are higher than anticipated, this one would be prioritized and another could be delayed.	
What is the cost?	HDOT has $16 million is programmed for this intersection.	
Was a cultural survey done?	There has been a CIA (interviewed community) and an LRFI. Public was concerned about inducing development. Both reports will be included in the EA.	Cultural Impact Assessment is provided in the EA appendices.
What about vegetation?	Yes, a flora fauna survey report will be included in the EA and has been drafted.	Flora and Fauna Survey is provided in the EA appendices.
How far back will Kapaa Bypass realignment go before meeting existing road.	We don't have exact numbers now. Note that the roundabouts will connect earlier as they are curved. Signalized intersection is straight and would be further up.	
The Kapaa Bypass Road was never intended to connect to Kuhio. It was initially planned to cross Wailua River over a new bridge and connect to Houselots level. This would provide an answer for north shore traffic traveling to Lihue, are there any plans to do so?	HDOT has been made aware of this project but had to cease due to costs associated with building a new bridge. I have heard of discussions to have more entrance/exit from Houselots but not a bridge.	

Comment	During Meeting Response	Post Meeting Response
Will the Kapaa Bypass dedicated right turn lane onto Kuhio Hwy Remain?	HDOT recognizes the benefit of the dedicated lane to reduce traffic, all three alternatives will have the dedicated lane.	As discussed in Chapter 1, the turbo roundabout would not allow this dedicated right turn lane so it was removed from further consideration.
I would like to see a cost-benefit analysis for taxpayers .		Alternative Costs are provided in Section 1.8
We have other roads/intersections in Kapaa that are in bad condition i.e. Kintaro Restaurant (Lanikai St and Kuhio Hwy).	HDOT recognizes the area as a problem area.	This project would address Kintaro restaurant intersection by removing the poor sight distance left turn onto Kuhio and redirecting to better Papaloa Left turn.
The protected right turn onto Kuhio has been a godsend at reducing traffic. In these alternatives, is the right hand turn remaining? If not it should be added in.	Not in current alignments, can look into adding.	
I like the idea of moving improvements to Kintaro, Papaloa Road traffic is not too bad right now.		Kintaro Intersection left turns will be restricted due to allowing from Papaloa. This will reduce intersection issues at Kintaro.
I like the idea of moving intersection improvements to Kintaro's or Aleka Loop.	We have heard concerns about Kintaro intersection. Sight distance is bad making the turn challenging, Papaloa will allow a safer left turn. Considered realigning Kapaa with Aleka loop or Kintaro but cost implications were high.	
Can traffic lights be adjusted to time of day to synchronize?	Yes, just a note that capacity between signals and roundabout is similar.	
If you want to keep dedicated right turn from Kapaa, could look into making one through lane in roundabout and the other a dedicated right.	That is an option	
You mentioned that roundabouts have a reduction in fatal accidents, how many fatal accidents have occurred in this intersection since addition of second lane? How many before that?	We don't have police department numbers but the intention of this is to highlight that roundabouts reduce more serious four way intersection collisions that are sometimes increased due to lights (i.e. head on collisions, T-bone accidents). Lights can sometimes cause speeding as cars speed to pass through the light. Roundabouts also reduce speed and collisions are more likely to be side-by-side and less fatal.	Crash Data is included in section 2.9
There are two properties, the base yard and ranch, which don't have entrances/exits on the current plans	We will coordinate with landowners when an alternative is chosen and plans can be further worked on.	
No infrastructure for pedestrians/bikes in the area, would be nice to have an alternative to walking on the highway.	Adding pedestrian facilities is a longer term strategy.	
Olohena Road crosses over a river that crosses under the project area. This river connects the stream to Waiakea Canal and floods when we get heavy rains. Provided Stream Map.	We are open to any information you have regarding streams.	See Section 2.6 and 2.10. The stream map provided (included in Appendix A-2c) designates the stream outside of the project area.
The area floods during heavy rains. Holes were drilled and water table was ~5 feet below ground.	Thank you for sharing.	See Section 2.10.
If have to choose, would choose signalized intersection.		
I see benefits of various approaches, I like the roundabouts and turbo could be interesting.		

Comment	During Meeting Response	Post Meeting Response
I support this project and think Kapaa needs this. HDOT is trying to be efficient and spend money where it is needed, roundabouts work well. The Kilauea Roundabout has made a big difference to the community. What is the budget estimated now?	16 million.	
I lived in Europe with many roundabouts, double roundabout is easy to learn but Turbo roundabout seems like it would be more difficult for tourists.	Either Two-Lane roundabout or Turbo would be the first on Kauai. HDOT would provide education/outreach to drivers if either was chosen.	
Dedicated right turn from Kapaa onto Kuhio like people are recommending would remove a southbound lane. Has that been analyzed for traffic impacts?	Haven't looked at it specifically, current roundabout alignment has two through lanes.	At the time of the meeting, the two lane roundabout contained two through lanes and no protected right turn from Kapaa. This has since been revised based on community comment and traffic analysis. See Chapter 1 and Section 2.9.
In the turbo roundabout and two lane roundabout changing lanes could happen but isn't intended?	Yes, we are trying to discourage lane changes in both options.	

Appendix A-2
Pre-Draft Environmental Assessment Public Meeting Items

A-2c: Post Meeting Comment Responses

COMMENT FORM
Kuhio Highway Intersection Improvements
Kapa'a, Kaua'i [Federal-Aid Project No. NH-056-1(066)]

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To provide comments / input on the project, please email KuhioKapaaIntersection@wsp.com.

For more information on the project, please contact Mr. Eric Fujikawa, Project Manager, Highways Division, Kaua'i District via email at eric.i.fujikawa@hawaii.gov or by U.S. Postal Service at Department of Transportation, 1720 Haleukana Street, Līhu'e, Hawaii 96766.

Name: AVERY YOUNG **Address:**

Phone:

E-mail:

Comments:

Turbo Roundabout preferred due to expected major increase in traffic due to industrial subdiv. by airport, which will be an employment center, & because Hokua village may be approved (politically) over the public objections, which primarily focuses on the need for a 4th lane highway between Wailua & Lihue, this of which is still years in the future. That improvement should be done 1st before Hokua Village is developed or approved, however they are using the "affordable housing" card to get it through, so this Roundabout is needed in light of the foreseeable increase in traffic in the near future.

Also, I've been to many "Roundabout" countries (Iceland, New Zealand, Portugal, etc.) & their roundabouts do not have a wall or visual screen, or shaka sign in the middle to block views of oncoming traffic. Line of sight (to see oncoming traffic — FOR SAFETY PURPOSES) should be kept open. The curves you put at the approaches to the roundabout should address your concern of slowing down traffic. You did a great presentation. I think you'll take Larry's place one day!!

(use additional sheets if appropriate)

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Name: Cecelia Horkin **Address:**

Phone:

E-mail:

Comments:

I am concerned that there are so many rental condos on Papaloa road that there will always be many tourists mixed up at the round about. It is a great idea for locals, but I am concerned that too many newbies on a daily basis will clog it ~~down~~ up for the locals. Hopefully that will not be the case, but these people will not have had "learning curve". They will just be confused.

Please put "no left turn" when coming onto highway from Kintaro's.

(use additional sheets if appropriate)

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Name: Christina Kaser **Address:**

Phone:

E-mail:

- **Comments:** all the support for providing the opportunity for a left turn on the hwy off papaloa. ~~Helps~~
- project supports pedestrian movement & should
- work w/ Kauai Transit/Bus @ same time & build highway bus stops & walking lanes to roundabout during construction so access to coconut marketplace [Provide transit / pedestrian]
- Build in bike lanes to design, doesn't seem to be incorporated now, or paint bike so show it's shared w/ road

Thank you!

(use additional sheets if appropriate)

VOTE = TURBO

From: Felicia Cowden <fcowden@kauai.gov>
Sent: Wednesday, September 17, 2025 6:30 PM
To: KuhioKapaaIntersection
Subject: Intersection preference is double roundabout.

Aloha,
I use this intersection almost everyday. Both my preference as an individual and as an individual councilmember is the double roundabout.

I have never experienced a roundabout with internal curbs but am willing to learn.

Felicia Cowden
Councilmember, Kauaʻi County Council
Public Safety & Human Services Committee Chair
Public Works & Veterans Services Committee Vice Chair
4396 Rice Street, Suite 209
Līhuʻe, Hawaiʻi 96766
Cellular: (808) 652-4363
Telephone: (808) 241-4092
Facsimile: (808) 241-6349
E-mail: fcowden@kauai.gov

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Name: John Moore **Address:**

Phone:

E-mail:

Comments: After living in Holland for many years, I have lots of praise for 2 lane roundabouts!!!
And I have cursed the Turbo Roundabouts many times
Turbo are confusing & don't allow flexibility while driving.
Tourists will not adjust to the Turbo Roundabouts.
It takes repetitive use to understand how to navigate them.

I Agree that 2 Lane Roundabout will help this intersection
Everytime you need to make a Left Turn, we will be grateful for the 2 Lane Roundabouts!!!

Thank You
JM

(use additional sheets if appropriate)

From: Jose Villarin <>
Sent: Tuesday, September 23, 2025 8:46 AM
To: KuhioKapaaIntersection
Subject: Kuhio Hwy Intersection NH-056-1 (066)

Aloha,
I am a resident of Kapaa. I am in the service industry and drive all day long. My point of view is that the number of drivers on the road have outgrown infrastructure of the roadways. I keep hearing the word HIGHWAYS mentioned all of the time. We do not have highways on Kauai.
I think that the best option for the intersection improvement would be the Traffic Signal. This option keeps the right turn lanes in motion at all times. There are already three other Traffic Signal lights in the proximity of this intersection, and one more will not hinder or improve the traffic flow. During peak traffic hours, the traffic is already backed up from traffic light to traffic light.

In the meeting, it was said that the traffic circles would be the more expensive option to construct and less expensive to maintain. I believe that the cost of repaving the traffic circle every three years or so, would exceed the cost of the maintaining the traffic signal. Hawaii has the highest cost per mile for repaving in the entire country. The cost alone for administration was over $6000.00 dollars per mile the last time i checked. I can be reached at 808-631-1326, Jose Villarin.
Thank you.

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Name: MADELEINE BONTEA **Address:**

Phone:

E-mail:

Comments: thank you for inviting us here to participate in the project. We appreciate all your efforts improving the neighborhood in Kapaa. We wish you many success with your big projects improving our environment.

(use additional sheets if appropriate)

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Kapaa Business Association

Name: Neill Sams **Address:**

Phone:

E-mail:

Comments: I like the turbo

We still need a dedicated Right turn from Bi-Pass to Kuhio Hwy southbound

Would prefer a connection to Aleka Loop if not you will need another roundabout At Aleka Loop and at the Houselots intesection, + Kuamoo?

(use additional sheets if appropriate)

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Name: Stephenie Blakemore **Address:**

Phone:

E-mail:

Comments:

① Turbo seems best of 4 alternatives for issue with bike lanes included.
I have to ask - while we are always addressing increased use/drivers on Kuhio and Kamehameha Hghys why is the DOT state + county not looking at "distributing" the traffic across more roads - Cane haul roads - on East side esp. The ~~event~~ probability of a climate related event is very possible (coastal erosion, tsunami, hurricane) for what is currently the only road for traveling from the North Shore to Lihue - access to medical limited - before Wilcox - only Mahelona - We need alternative road ways on the island - not just traffic abatement on Kuhio and Kamehameha.

(use additional sheets if appropriate)

over →

also - showing videos of the turbo roundabouts as well as 2 lane roundabouts would be helpful. (work on presentations)

---------- Fold Here ----------

Return Address:

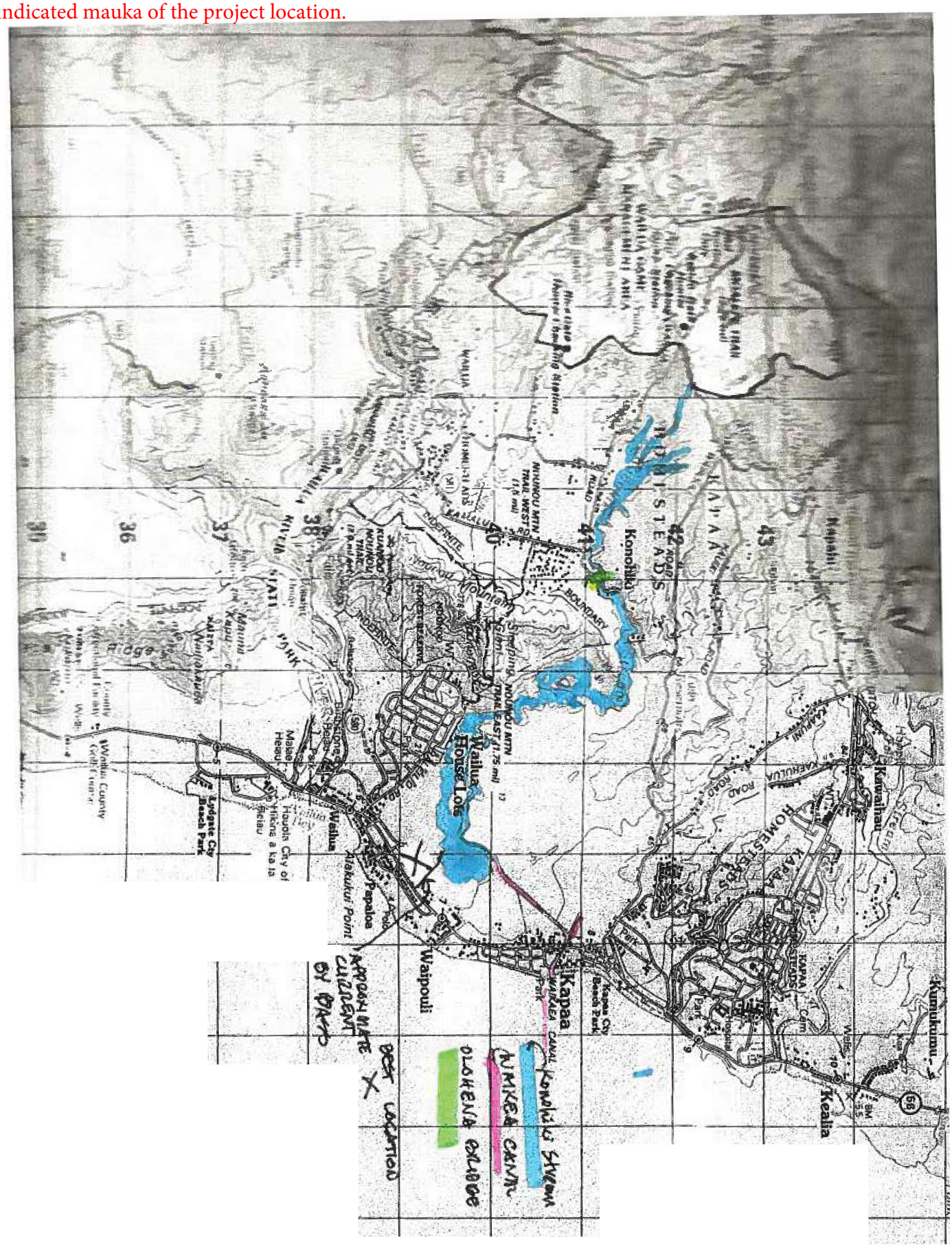
_____
_____
_____

First Class
Postage

Eric Fujikawa
State of Hawaii Department of Transportation
1720 Haleukana Street
Lihu'e, HI 96766

---------- Fold Here ----------

Map of streams provided to the project team at the public meeting. Note that Konohiki Stream is indicated mauka of the project location.


Konohiki
Waiulu
Waipouli
Kapaa
Kapaa Beach Park
Kapaa City Beach Park
Kawaihau
Kealia
Kumukumu
Papaloa
Alakukui Point
Wailua
Wailua Golf Course
Lydgate City Beach Park
Houois City of Hesiu
Hisiong a ka ia Petau
Mbbe Hesu
Ridge
Trail
Road
Boundary
Homesteads
Kapaa Homesteads
Kapaa Cem
Hospital
Park
Canal
Kapaa Canal
Konohiki Stream
Approximate Current Bridge Location
Proposed Bridge
Existing Bridge
Bridge
Stream
Ditch
Flume
Reservoir
Forest Reserve
Wailua River
Wailua Falls
Kuamoo Mountain Trail
Nonou Mtn Trail West Side
Nonou Mtn Trail East
Sleeping Giant
Nonou Mtn
Kaholalele
Kaholalele Road
Kuamoo Road
Kapaa Homesteads
Kapaa Homesteads Road
Kawaihau Road
Kuamoo Mountain
Kaholalele Mountain
Kaholalele Mountain Trail
Kaholalele Mountain Trail West Side
Kaholalele Mountain Trail East
Kaholalele Mountain Trail East Side
Kaholalele Mountain Trail West Side

RECEIVED
By Kauai District Office at 11:13 am, Oct 08, 2025

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Name: Karin Stoll, LCSW **Address:**

Phone:

E-mail:

Comments: As Board President of Healing Horses Kauai, this is a "re" document we need to have this round-a-bout placed somewhere else... Healing Horses Kauai provides an invaluable service for keiki through kupuna with a variety of emotional, physical & cognitive disabilities! Building a round-a-bout at the HHK site will clearly put us out of business... We cannot afford to lose the use of the front 10 acres for you to stage your equipment! We cannot afford to clear, fence & rebuild paddocks elsewhere on Ms. Ridley's property, regardless of her generosity of leasing extra acres... The inevitable traffic snarls for years during the construction phase will undoubtedly reduce our ridership... Lastly, our ranch is home to Hawaiian Mud Ducks, Black Crested Herons & indigenous palms that will be displaced by the noise & vibrations of heavy equipment... Please consider building farther South on the Hwy

(use additional sheets if appropriate)

RECEIVED
By Kauai District Office at 11:12 am, Oct 08, 2025

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Name: Patricia Hebson **Address:**

Phone:

E-mail:

Comments: Please do not disturb the lands Healing Horses Kauai uses for their much needed therapy/riding/treatment areas for all of Kauai and others, their work is important helping autistic to traumatized people and many more persons with spectrum problems. There is no where else that provides this therapy & People come from other countries to observe and take home their policy and ways of therapy to use at their country. Also groups of special needs + other children come from DOE and benefit from the Healing Horses Kauai. Kauai and the world need places like this more than they need traffic calming taking away the land that provides the therapy area. Adults use HHK too!

Patricia Hebson

(use additional sheets if appropriate)

Subject: FW: [EXTERNAL] Kuhio Highway Intersection Improvements Kapaa - Federal-Aid Project No. NH-056.01
Sent: 10/10/2025, 3:16:31 PM
From: Fujikawa, Eric I<eric.i.fujikawa@hawaii.gov>
To: Urasaki, Randall; Silva Jr, Dennis
Cc: McClellan, Malie
Attachments: RCCA Board of Directors '24-'25 updated 07.16.2025.pdf

---

Hi Randy and Dennis,

Forwarding you comments from Diane Pavao.

Thank you,
Eric

From: Diane Pavao <>
Sent: Friday, October 10, 2025 3:00 PM
To: Fujikawa, Eric I <eric.i.fujikawa@hawaii.gov>
Subject: [EXTERNAL] Kuhio Highway Intersection Improvements Kapaa - Federal-Aid Project No. NH-056.01

Aloha Eric,

I attended the public hearing on September 17th at the Sheraton Kauai Coconut Beach Resort and thought your presentation was very informative. I am the President of the Royal Coconut Coast Association and on behalf of the RCCA, we are in favor of the Turbo Roundabout for the intersection of Kuhio Highway and Papaloa Road by the Coconut Plantation Marketplace. Second choice would be the Two Lane Roundabout and lastly the 4-Way Signal Stoplights. I believe the Roundabout will keep the traffic flowing and hopefully will slow down traffic on Kuhio Highway from the intersection of Haleilio Road to the By Pass. It is very difficult at times to get out from the intersection at Lanikai Street. The 4-Way Signal Stoplights would cause a lot of congestion and back up of traffic on the highway.

We are also active with the Coconut Marketplace Mobility Hub and working with Joel Guy and the County to get it started.

Please let me know if we can be of further assistance. Attached is the list of the RCCA Board members for 2025.

Sorry for responding so late.

Mahalo and have a great weekend.
Diane Pavao

Kauai Landmark Realty
Real Estate Sales, Development and Property Management

Diane A. Pavao
Realtor Salesperson RS-58020
Cell: 808.651.3557
Office: 808.822.3100
4-356 Kuhio Hwy. Suite #109
Kapaa, HI 96746
Website: www.kauailandmark.com

Royal Coconut Coast Association
Board of Directors 2024-25

(alphabetical by membership)

Casie Riopta, General Manager, Aston Islander On The Beach

Braden Ah Mow, General Manager, Castle Kaha Lani Resort

Ala Perreira, General Manager, The ISO, The Bull Shed

Marc Bennor, General Manager, Hilton Garden Inn Kauaʻi at Wailua Bay

Alan Fern, General Manager, Kauaʻi Coast Resort at the Beachboy

Diane Pavao, Partner, Kauaʻi Landmark Realty, RCCA President

Sue Kanoho, Executive Director, Kauaʻi Visitors Bureau, RCCA Vice President

Jennie Waiwaiole-Vega, General Manager, Kauaʻi Shores Hotel. RCCA Secretary

Bronson Bautista, Owner KOI LLC, representing RCCA's General Members

Gana Maheshwarwan, General Manager, Outrigger's Waipouli Beach Resort

Phil Carvalho, General Manager, Plantation Hale Suites

Marilyn Solatre, General Manager Pono Kai Resort, RCCA Treasurer

Cindy Plemer, Owner, Premier Kauai Vacation Rentals

Julian Cable Treadwell, General Manager, Sheraton Kauaʻi Coconut Beach Resort

Kamika Smith, General Manager, Smith's Tropical Paradise

Ex-Officio: Michelle Rego, Kauai County OED, Tourism Specialist

Contracted Assistance:
Margy Parker, Margy Parker & Associates LLC – Marketing, Media, Communication, Organizational Issues, Community Affairs and Government
Judy Arrigo, JAA & Associates – Accounting and Taxes
Val and Robert Rekward, Delicious Design– Graphics, Website, Materials
Brianee Cabacungon, Administrative Support and Member Liaison

Subject: FW: [EXTERNAL] Wailua Roundabout
Sent: 2/2/2026, 9:26:00 AM
From: Silva Jr, Dennis<Dennis.SilvaJr@wsp.com>
To: Teodoro, Lean; McRae, Isabella

---

fyi

From: Fujikawa, Eric I <eric.i.fujikawa@hawaii.gov>
Sent: Monday, February 2, 2026 7:56 AM
To: Jim powell <>
Cc: Bautista, Joel O <joel.o.bautista@hawaii.gov>; Urasaki, Randall <Randall.Urasaki@wsp.com>; Silva Jr, Dennis <Dennis.SilvaJr@wsp.com>
Subject: RE: [EXTERNAL] Wailua Roundabout

Good morning Jim,

Thank you for reaching out to us and sharing your comments. I'm including our project design team to stay in touch with you as the project design progresses.

Thank you,

Eric Fujikawa, PE, PLS
District Engineer
Hawaii Department of Transportation
Highways, Kauai District
1720 Haleukana Street
Lihue, Hawaii 96766
Fax: (808) 241-3011
Mobile: (808) 278-8423
Email: eric.i.fujikawa@hawaii.gov

From: Jim powell <>
Sent: Saturday, January 31, 2026 6:45 PM
To: Fujikawa, Eric I <eric.i.fujikawa@hawaii.gov>
Subject: [EXTERNAL] Wailua Roundabout

Aloha Eric,
I'm writing as a volunteer at Healing Horses Kauai. I'd like to point out some plants and animals that may be impacted by the realignment of the by-pass road as it passes along the southern edge of the ranch.
Here are the rare or endangered plants and animals that I know of. Number indicates the number of individuals.
1 Loulu Palm Endangered 10+
2 Wili wiki under stress 2
3 Munroidendron extinct in the wild 2
4 Lono Mea 1
5 False sandalwood 1
6 Kou 1
Birds that use the pond on the property.
Night Heron
Ae'o
'Alae Ke 'Okeo
Nene
Koloa maoli

Using the existing driveway to come and go from the ranch I can attest to the danger I feel with the way drivers approach the intersection with Kuhio Highway. I support the roundabout solution and it's proposed location.

I would like the state to include the cost of transplanting of the above plants elsewhere on the property. HHK will be using them to round out the environmental lessons the ranch provides during camp days throughout the year.
Thanks for the opportunity to express my concerns.
If you need someone to point out the plants that we'll lose, just give me a call. I live and work in the Wailua House lots.

Jim Powell

Appendix A-3
Regulatory Coordination and Correspondence

A-3a: National Historic Preservation Act (NHPA) Section 106
A-3b: U.S. Fish and Wildlife Service (USFWS) Endangered Species Act Section 7
A-3c: National Marine Fisheries Service (NMFS) Endangered Species Act Section 7
A-3d: NMFS Essential Fish Habitat
A-3e: Hawaii Revised Statutes Chapter 195D
A-3f: Coastal Zone Management Coordination
A-3g: Special Management Area Determination
A-3h: Conservation District Use Application Coordination

Appendix A-3
Regulatory Coordination and Correspondence

National Historic Preservation Act (NHPA) Section 106

JOSH GREEN, M.D.
GOVERNOR
KE KIA'ĀINA

EDWIN H. SNIFFEN
DIRECTOR
KA LUNA HO'OKELE

Deputy Directors
Nā Hope Luna Ho'okele
DREANALEE K. KALILI
TAMMY L. LEE
CURT T. OTAGURO
ROBIN K. SHISHIDO

STATE OF HAWAI'I | KA MOKU'ĀINA 'O HAWAI'I
DEPARTMENT OF TRANSPORTATION | KA 'OIHANA ALAKAU
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

HWY-K 4.250403

December 30, 2025

TO: DAWN N.S. CHANG,
CHAIRPERSON AND STATE HISTORIC PRESERVATION OFFICER
DEPARTMENT OF LAND AND NATURAL RESOURCES

ATTN: JESSICA PUFF,
ADMINISTRATOR AND DEPUTY STATE HISTORIC PRESERVATION OFFICER
STATE HISTORIC PRESERVATION DIVISION

FROM: ERIC FUJIKAWA, P.E.
DISTRICT ENGINEER

SUBJECT: NATIONAL HISTORIC PRESERVATION ACT: INITIATION OF SECTION 106, REQUEST FOR CONTACT INFORMATION AND AREA OF POTENTIAL EFFECT CONCURRENCE
KUHIO HIGHWAY INTERSECTION IMPROVEMENTS AT TEMPORARY KAPAA BYPASS ROAD
SOUTH OLENA AHUPUAA, PUNA MOKU, ISLAND OF KAUAI
FEDERAL-AID PROJECT NO. NH-056-1(066)
TAX MAP KEYS: KUHIO HIGHWAY ROADWAY RIGHT-OF-WAY
(4) 4-3-001:999; (4) 4-3-002:999; (4) 4-3-010:999 AND (4) 4-3-010:001,
(4) 4-3-010:005.

On behalf of the Federal Highway Administration (FHWA), the State of Hawaii, Department of Transportation (HDOT) would like to initiate consultation with the Department of Land and Natural Resources, State Historic Preservation Officer (SHPO) under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended (2006), for the subject intersection improvements project. In addition, HDOT requests the State Historic Preservation Officer's concurrence on the proposed Area of Potential Effect (APE), pursuant to Section 106 of the NHPA and Title 36 of the *Code of Federal Regulations (CFR)*, Part §800.4(a)(1).

The proposed federally funded HDOT project is considered a federal action and undertaking as defined in 36 *CFR*, Part §800.16(y). Effective May 1, 2016, FHWA issued a Programmatic Delegation of Authority allowing the HDOT and local public agencies to conduct NHPA Section 106 consultations with the SHPO, Native Hawaiian organizations (NHO), and qualified consulting parties per 36 CFR, Part §800.2(c)(4). The FHWA will remain responsible for all findings and determinations charged to the agency during the Section 106 process.

Consultations
In addition to consulting with the SHPO, a Section 106 notice/advertisement will be published in the *Garden Island Newspaper*. NHO and Native Hawaiian descendants with ancestral, lineal or cultural ties to, cultural and historical property knowledge of and/or concerns for, and cultural or religious attachment to the proposed APE will be asked to provide a response within 30 days of notification. In addition, other individuals and organizations with demonstrated legal, economic or historic preservation interest will also be asked to respond to the Section 106 notice/advertisement.

A general project public information meeting was held on September 17, 2025. The public information meeting was attended by roughly 35 individuals and fifteen responses were received that provided comments and / or information regarding various aspects of the project.

Upon receipt of responses to the initial consultation, additional public involvement efforts such as site visits and conference calls may be conducted as necessary to address Section 106 requirements.

Request for Information
Pursuant to 36 *CFR* Part 800.3(f) in consultation with SHPO, we are interested if your agency is acquainted with any NHO or Hawaiian descendants with ancestral, lineal or cultural ties to or cultural and/or historic property knowledge of or concerns for, and cultural or religious attachment to the proposed project area, we would appreciate receiving their names and contact information within the 30 days of notification. Per 36 *CFR* Part 800.2(a)(4)(c)(5) we also request the names of individuals and organizations who has demonstrated their legal, economic, historic preservation interest to SHPD on the proposed undertaking.

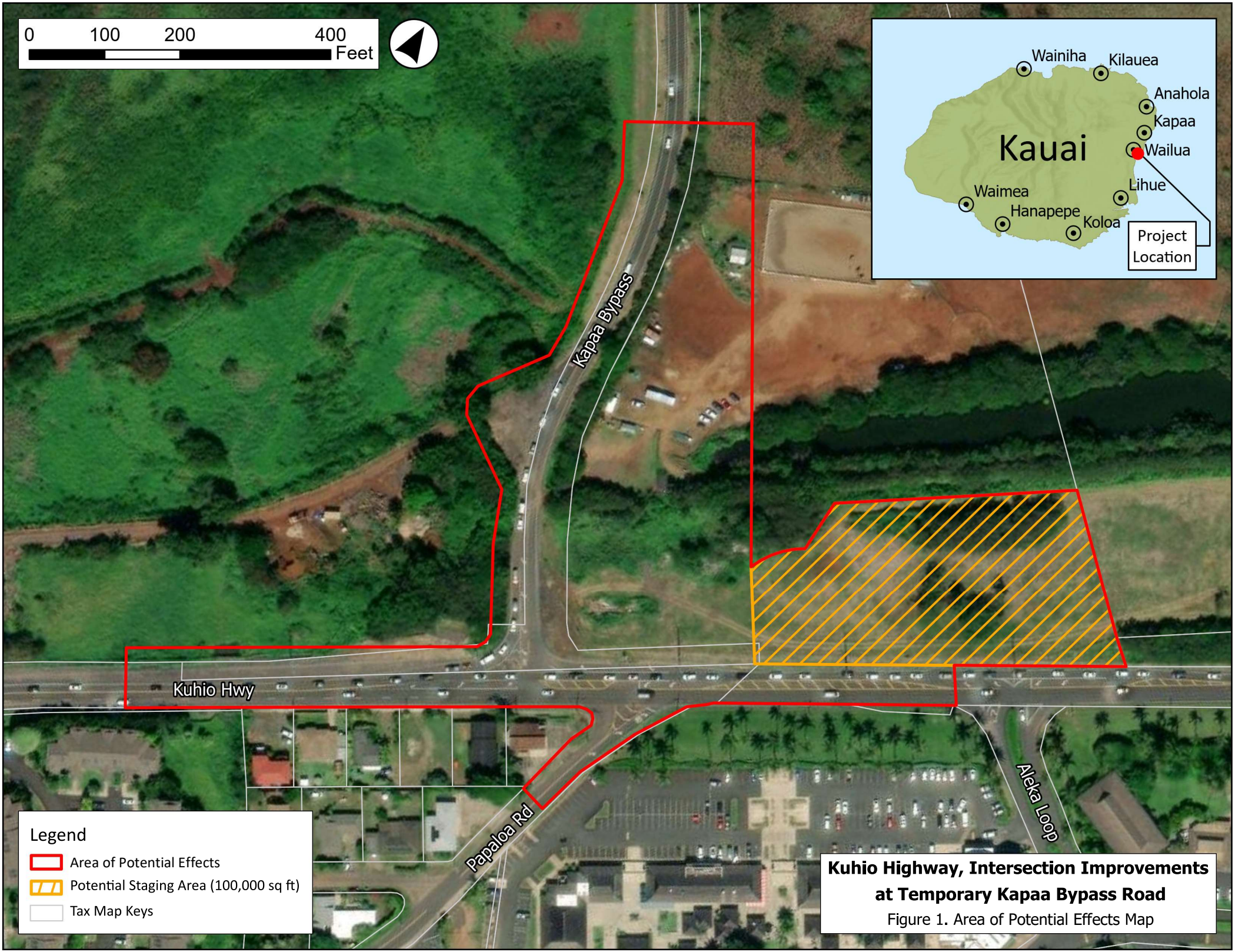
Area of Potential Effect
The proposed project is located in Kapaa, Kauai Island, Hawaii. The APE is located at the intersection of Kuhio Highway (State Route 56), Kapaa Bypass, and Papaloa Road. The APE includes the existing road right-of-way of Kuhio Highway, between mile posts 6 and 7. Please refer to the attached Figure 1. Area of Potential Effects Map. The area of the APE is approximately 8.96 acres. The APE extends approximately 0.25 miles (1330 feet) along Kuhio Highway. The APE area width varies but it extends around 640 feet along Kapaa Bypass Road and 180 feet along Papaloa Road. The APE will extend up to approximately 6 feet below the surface.

The staging area is located in the northeast portion of the APE, mauka of Kuhio Highway, on the private parcel 4-3-010:005.

In addition to providing us with information on NHO, and potential consulting parties, we ask for your concurrence to our determination on the APE for the proposed project within 30 days from notification.

We would appreciate a written response within 30 days from date of receipt, to Joel Bautista via email at joel.o.bautista@hawaii.gov, or by U.S. Postal Service to Department of Transportation, 1720 Haleukana Street, Lihue, Hawaii 96766.

Attachments



Kuhio Highway, Intersection Improvements at Temporary Kapaa Bypass Road

Figure 1. Area of Potential Effects Map

JOSH GREEN, M.D.
GOVERNOR | KE KIAʻĀINA

SYLVIA LUKE
LIEUTENANT GOVERNOR | KA HOPE KIAʻĀINA

STATE OF HAWAIʻI | KA MOKUʻĀINA ʻO HAWAIʻI
DEPARTMENT OF LAND AND NATURAL RESOURCES
KA ʻOIHANA KUMUWAIWAI ʻĀINA

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

DAWN N.S. CHANG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RYAN K.P. KANAKAʻOLE
FIRST DEPUTY

CIARA W.K. KAHAHANE
DEPUTY DIRECTOR - WATER

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

January 20, 2026

IN REPLY REFER TO:
Project No. 2025PR01417
Doc. No. 2601AM03
Archaeology

Eric Fujikawa
District Engineer
State of Hawaiʻi
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaiʻi 96813-5097
c/o Joel Bautista
Email: joel.o.bautista@hawaii.gov

Dear Eric Fujikawa:

SUBJECT: **National Historic Preservation Act (NHPA) Section 106 Review –**
State of Hawaiʻi, Department of Transportation
Kuhio Highway Intersection Improvements at Kapaa Bypass Road
HDOT Ref. No. HWY-K 4.250403, Federal-Aid Project No. NH-0056-1(66)
Request for Information and Concurrence with an APE
South Olohena Ahupuaʻa, Puna District, Island of Kauaʻi
TMK: (4) 4-3-001:999; (4) 4-3-002:999; (4) 4-3-010:001, 005, and 999 (Kuhio Highway and Kapaa Bypass Road Right-of-Ways [ROWs])

This letter provides the State Historic Preservation Division's (SHPD's) review of the State of Hawaiʻi, Department of Transportation's (HDOT's) request for information and the State Historic Preservation Officer's (SHPO's) concurrence with an area of potential effects (APE) for the Kuhio Highway Intersection Improvements at Kapaa Bypass Road project. SHPD received the submission on December 30, 2025, which included a map of the proposed APE and a letter from HDOT requesting information about potential consulting parties and concurrence with the APE (Submission No. 2025PR01417.001).

This HDOT project will receive funding from the Federal Highway Administration (FHWA) and is a federal undertaking as defined in 36 CFR § 800.16(y). Effective May 1, 2016, FHWA issued a Programmatic Delegation of Authority allowing the HDOT and local public agencies to conduct NHPA Section 106 consultations with the State Historic Preservation Officer (SHPO), Native Hawaiian Organizations (NHOs), and qualified consulting parties pursuant to 36 CFR § 800.2(c)(4). The FHWA will remain responsible for all findings and determinations charged to the agency during the NHPA Section 106 process. The project is also subject to the Hawaii Revised Statutes (HRS) Section 6E-8 historic preservation review process; however, HDOT has not initiated the process at this time.

HDOT proposes intersection improvements within an 8.96-acre APE located along the Kuhio Highway ROW where it intersects with the Kapaa Bypass Road ROW. The project scope of work includes the construction of a two-lane roundabout and the realignment of Kapaa Bypass Road to intersect where the Kuhio Highway and Papaloa Road (North) ROWs intersect. Additionally, lighting will be installed at the new intersection. The project will require ground disturbing work to a maximum depth of 6 feet below grade for the construction of the proposed improvements.

A search of SHPD records indicates several archaeological historic properties have been previously identified in the vicinity of the APE including SIHP #s 50-30-08-00886 (hearth, ‘auwai, and human skeletal remains), 50-80-08-02420 (human skeletal remains), and 50-30-08-00890 (grinding stones). Please note that this is not a complete list of historic properties that have previously been identified in the vicinity of the APE. Additional information can be researched at the SHPD library. Make an appointment to visit the Kapolei library by emailing DLNR.HP.Library@hawaii.gov.

At this time, the SHPO has **no objections** to the proposed APE. However, additional information, such as the locations of previously identified historic properties near the APE and the results of the public consultation process are needed and may result in the SHPO’s request for revisions to the APE.

In response to the request for consulting party contact information, the SHPD recommends HDOT refer to the Native Hawaiian Organization Notification List provided by the U.S. Department of the Interior and maintained by the Office of Native Hawaiian Relations which can be accessed at the following: https://www.doi.gov/hawaiian/nhol. Additionally, we recommend expanding consultation to interested parties such as civic clubs and historic preservation organizations such as the National Trust for Historic Preservation and the Historic Hawai‘i Foundation.

The SHPO looks forward to continuing participation in the Section 106 process and the initiation of the HRS Chapter 6E historic preservation process for the proposed undertaking.

Please submit all forthcoming information and correspondence related to the subject project by responding to our request under HICRIS Project No. 2025PR01417.

HDOT and FHWA are the offices of record for this undertaking. Please maintain a copy of this letter with your environmental review record for this undertaking.

Please contact Susan A. Lebo, Archaeology Branch Chief, at Susan.A.Lebo@hawaii.gov, for any matters regarding archaeological resources or this letter.

Aloha,



Jessica L. Puff, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: Jeff Aguinaldo, jeff.j.aguinaldo@hawaii.gov
Henry Kennedy, henry.kennedy@hawaii.gov
Holly Yuen, holly.yuen@hawaii.gov
Lawrence M. Laus, lawrence.m.laus@hawaii.gov
Gregory M. Ibara, gregory.m.ibara@hawaii.gov
Trisha K. Watson, watson@honuaconsulting.com

Sample NHO Consultation Letter

JOSH GREEN, M.D.
GOVERNOR
KE KIA'ĀINA

EDWIN H. SNIFFEN
DIRECTOR
KA LUNA HO'OKELE

Deputy Directors
Nā Hope Luna Ho'okele
DREANALEE K. KALILI
TAMMY L. LEE
CURT T. OTAGURO
ROBIN K. SHISHIDO

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
KAUAI DISTRICT
1720 HALUEUKANA STREET
LIHUE, HAWAII 96766

In reply REFER to:

HWY-K 4.260039

MARCH 16, 2026

TO: STACY K. FERREIRA, CHIEF EXECUTIVE OFFICER
OFFICE OF HAWAIIAN AFFAIRS

FROM: ERIC FUJIKAWA *Randall Haraguchi*
(for) DISTRICT ENGINEER

SUBJECT: NATIONAL HISTORIC PRESERVATION ACT, SECTION 106
CONSULTATION WITH NATIVE HAWAIIAN ORGANIZATIONS AND
POTENTIAL CONSULTING PARTIES
KUHIO HIGHWAY INTERSECTION IMPROVEMENTS
AT TEMPORARY KAPAA BYPASS ROAD
SOUTH OLOHENA AHUPUAA, PUNA MOKU, ISLAND OF KAUAI
FEDERAL-AID PROJECT NO. NH-056-1(066)
TAX MAP KEYS: (4) 4-3-001:999; (4) 4-3-002:999; (4) 4-3-010:999 AND (4) 4-3-010:001, (4) 4-3-010:005

On behalf of the Federal Highway Administration (FHWA), the State of Hawaii, Department of Transportation (HDOT) is hereby notifying you that on December 30, 2025, Section 106 of the National Historic Preservation Act (NHPA) of 1966 (amended, 2006), was initiated with the Department of Land and Natural Resources, State Historic Preservation Office (SHPO) for the subject highway intersection improvements project.

The proposed federally funded HDOT project is considered a federal action and undertaking as defined in 36 *Code of Federal Regulations (CFR)*, Part §800.16(y). Effective May 1, 2016, FHWA has issued a Programmatic Delegation of Authority allowing the HDOT and local public agencies to conduct NHPA Section 106 consultations with the SHPO, Native Hawaiian Organizations (NHO), and other consulting parties per 36 *CFR*, Part §800.2(c)(4). The FHWA will remain responsible for all findings and determinations charged to the agency during the Section 106 process.

Overview of the Undertaking
The Federal Highway Administration (FHWA), in cooperation with the Hawaii Department of Transportation (HDOT), is proposing improvements at the intersection between Kuhio Highway (State Route 56), Kapaa Bypass, and Papaloa Road in Kapaa, Kauai. HDOT is currently evaluating realigning the southern terminus of Kapaa Bypass Road at Kuhio Highway to intersect with the existing intersection of Kuhio Highway with Papaloa Road (North) near the Coconut Marketplace. The realignment will consolidate the two (2) existing T intersections into a single full access intersection in the form of a two-lane roundabout. In addition to consolidating the intersections,

the realignment will provide the opportunity to allow left turns from Papaloa Road (North) onto Kuhio Highway. The installation of approximately 30-foot tall, safety standard compliant highway lights is also proposed as a part of this project. These intersection improvements will improve safety and connectivity of the road and ease traffic in the area.

FHWA is providing funding for these improvements. Therefore, the FHWA requires compliance with the National Environmental Policy Act (NEPA) and other federal requirements including Section 106 of the National Historic Preservation Act (NHPA) of 1966.

Consultations
A Section 106 notice/advertisement will be included in the Garden Island Newspaper.

Entitled consulting parties during the Section 106 process includes the Advisory Council of Historic Preservation, SHPO, NHOs, and if applicable, local governments and applicants for federal assistance, permits, licenses and other approvals.

NHOs and/or Hawaiian Descendants
NHOs and Native Hawaiian descendants with ancestral, lineal or cultural ties to, cultural and historical property knowledge of and/or concerns for, and cultural or religious attachment to the proposed Area of Potential Effects (APE) are asked to provide a response to this letter within 30 days of notification.

Other Individuals and Organizations
Individuals and organizations with demonstrated legal, economic, or historic preservation interest are asked to respond within 30 days of notification, and provide intent to participate in the Section 106 process. Participation is subject to FHWA approval.

Area of Potential Effects (APE)
We would like to invite you to comment on the proposed APE.
The proposed project is located at the intersection between Kuhio Highway (State Route 56), Kapaa Bypass, and Papaloa Road in Kapaa, Kauai. The APE is approximately 8.96 acres. Construction staging and stock piling will occur in the northeast portion of the project area, mauka of Kuhio Highway. Please refer to the enclosed map of the APE.

Identification of Historic Properties within the APE
We welcome any information you may have on historical and cultural sites that have been recorded in or which you may have knowledge of within the proposed APE. In addition, if you are acquainted with any persons or organization that is knowledgeable about the proposed APE, or any descendants with ancestral, lineal or cultural ties to or cultural knowledge and/or historical properties information of or concerns for, and cultural or religious attachment to the proposed project area, we would appreciate receiving their names and contact information within 30 days of notice.

Conclusion
On behalf of FHWA, HDOT by way of this letter is notifying you of the proposed Kuhio Highway Intersection Improvements Project. Should you want to participate in the Section 106 process, we request your written intent. Please also provide your comments on the proposed APE, any information you may have on cultural and/or historical sites that have been recorded within the APE, as well as the names and contact information of people/organizations who may have cultural affiliations and historical properties information in the vicinity of the proposed APE.

We would appreciate a written response within 30 days from date of receipt to HDOT project manager, Mr. Joel Bautista via email at joel.o.bautista@hawaii.gov, or by U.S. Postal Service to Department of Transportation, 1720 Haleukana Street, Lihue, Hawaii 96766. Please feel free to contact Mr. Bautista by telephone at (808) 241-3015, if you have any questions and reference letter no. HWY-K 4.260039 as noted above.

Attachment

tgi Classifieds THE GARDEN ISLAND
hawaiiclassifieds
AS LITTLE AS
$9.99 A WEEK
ON ALL MERCHANDISE ADS
Business Hours Call Center
Monday-Friday: 7:30am - 5:30pm
WE GLADLY ACCEPT:
SAFE SECURE SCAM-FREE
What are you looking for?
Search
Place My Ad
Announcements | Business | Garage Sales | Legal Notices | Merchandise | Pets | Service Directory | Schools and Learning | State Legals

Notice #: 0001523833-01
Legal Notices

NOTICE OF CONSULTATION
SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT OF 1966
AS AMENDED (2006)
KUHIO HIGHWAY INTERSECTION IMPROVEMENTS
SOUTH OLOHENA AND NORTH OLOHENA AHUPUAA, PUNA MOKU, KAUAI ISLAND
FEDERAL-AID PROJECT NO. NH-056-1(066)
TAX MAP KEYS: (4) 4-3-001:999; (4) 4-3-002:999; (4) 4-3-010:999 AND (4) 4-3-010:001, (4) 4-3-010:005

Notice is hereby given that the Federal Highway Administration (FHWA), in cooperation with the State of Hawaii, Department of Transportation (HDOT), is proposing to renovate the intersection between Kuhio Highway (State Route 56), Kapaa Bypass, and Papaloa Road in Kapaa, Kauai.

This federally funded HDOT project is considered a federal action and undertaking, as defined by Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended (2006).

HDOT is currently evaluating realigning the southern terminus of Kapaa Bypass Road at Kuhio Highway (State Route 56) to intersect with the existing intersection of Kuhio Highway with Papaloa Road (North) near Coconut Marketplace. The realignment will consolidate the two existing T-intersections into a single two-lane roundabout. In addition to consolidating the intersections, the realignment will provide the opportunity to allow left turns from Papaloa Road (North) onto Kuhio Highway. The installation of approximately 30-foot tall, safety standard compliant highway lights is also proposed as a part of this project. These intersection improvements will improve safety and connectivity of the road and ease traffic in the area.

The proposed project area is approximately 8.96 acres and includes Kuhio Highway right-of-way and private-owned land. Construction staging will occur in the northeast portion of the project area, mauka of Kuhio Highway.

Pursuant to Section 106 of the NHPA, Native Hawaiian organizations and Native Hawaiian descendants with ancestral, lineal, or cultural ties to, cultural and historical property knowledge of, and/or concerns for, and cultural or religious attachment to the proposed project area are requested to contact HDOT. Other individuals and organizations with demonstrated legal, economic or historic preservation interest in the undertaking are asked to contact HDOT and share information you may have on historical and cultural sites that you may have knowledge of within the proposed APE. We welcome any information within 30 days of notice.

Interested participants are requested to contact Mr. Joel Bautista at joel.o.bautista@hawaii.gov or by U.S. Postal Service to State of Hawaii, Department of Transportation, 1720 Haleukana Street, Lihue, Hawaii 96766.

Please respond within thirty (30) days of publication of this notice.

Appendix A-3
Regulatory Coordination and Correspondence

U.S. Fish and Wildlife Service (USFWS) Endangered Species Act Section 7

JOSH GREEN, M.D.
GOVERNOR
KE KIA'ĀINA

EDWIN H. SNIFFEN
DIRECTOR
KA LUNA HO'OKELE

Deputy Directors
Nā Hope Luna Ho'okele
DREANALEE K. KALILI
TAMMY L. LEE
ROBIN K. SHISHIDO
CURTIS OTAGURO

STATE OF HAWAI'I | KA MOKU'ĀINA 'O HAWAI'I
DEPARTMENT OF TRANSPORTATION | KA 'OIHANA ALAKAU
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

HWY-4.260108

March 20, 2026

Via email: pifwo_admin@fws.gov

Dr. Earl Campbell, Field Supervisor
Pacific Islands Fish and Wildlife Office
U.S. Fish and Wildlife Service
300 Ala Moana Boulevard, Room 3-122
Honolulu, HI 96850

Dear Dr. Campbell:

Subject: Endangered Species Act Section 7 Informal Consultation
Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road Southern Terminus
Federal Aid Project No. NH-056-1(066)
Kuhio Highway Right-of-Way (4)4-3-001:999; (4)4-3-002:999; and (4)4-3-010:999 and Tax Map Key Parcels (4)4-3-010:001 and (4)4-3-010:005
Kapaa, Island of Kauai, State Of Hawaii

The Federal Highway Administration (FHWA), in cooperation with the Hawaii Department of Transportation (HDOT), is proposing the Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road Southern Terminus project in Kapaa, Kauai. See Attachment 1: Project Action Area Map. The Federal Highway Administration (FHWA) is providing funding for these improvements. Therefore, the project is considered a Federal action, which triggers Federal requirements including the National Environmental Policy Act (NEPA) and Section 7 of the Endangered Species Act (ESA) of 1973, as amended (Section 7).

Per 50 Code of Federal Regulations (CFR) 402.08, in a letter dated August 7, 1985, the FHWA has designated State highway or transportation agencies (in this case the HDOT) as non-Federal representatives to conduct informal consultations with U. S. Fish and Wildlife Service (USFWS). The FHWA remains responsible for all findings and determinations charged to the agency during the Section 7 process.

Pursuant to Section 7 of the ESA, HDOT requests concurrence from the USFWS that the proposed project *may affect, but is not likely to adversely affect* the following federally listed species: Hawaiian Hoary Bat (*Lasiurus cinereus semotus*), Band-rumped Storm-Petrel (*Oceanodroma castro*), Hawaiian Common Gallinule (*Gallinula galeata sandvicensis*), Hawaiian Coot (*Alae Keokeo*) (*Fulica alai*), Hawaiian Duck (*Anas wyvilliana*), Hawaiian Goose (*Branta (=Nesochen)*

sandvicensis), Hawaiian Petrel (*Pterodroma sandwichensis*), Hawaiian Stilt (*Himantopus mexicanus knudseni*), and Newell's Shearwater (*Puffinus newelli*) There is no critical habitat within the proposed project area.

FHWA has separately made a no effect determination for the remaining species.

Coordination with USFWS

The HDOT requested and received an Information for Planning and Consultation (IPaC) species list from the USFWS, downloaded on January 13, 2026 (Project Code: 2025-0147096) as generated by the USFWS https://ipac.ecosphere.fws.gov/ website. See Attachment 2: IPaC Endangered Species List. There is no designated final critical habitat within or adjacent to the project area.

- Mammals
  - Hawaiian Hoary Bat (*L. cinereus semotus*) (endangered)
- Birds
  - Hawaiian Seabirds
    - Band-rumped Storm-Petrel (H. *castro*) (endangered)
    - Hawaiian Petrel (*P. sandwichensis*) (endangered)
    - Newell's Shearwater (*P. newelli*) (threatened)
  - Hawaiian Waterbirds
    - Hawaiian Common Gallinule (*G. galatea sandvicensis*) (endangered)
    - Hawaiian Coot or Alae Keokeo (*F. alai*) (endangered)
    - Hawaiian Duck (*A. wyvilliana*) (endangered)
    - Hawaiian Stilt (*H. mexicanus knudseni*) (endangered)
  - Hawaiian Goose (*B. (=Nesochen) sandvicensis*) (threatened)
  - Short-tailed Albatross (*P. (=Diomedea) albatrus*) (endangered)
- Reptiles
  - Hawksbill Sea Turtle (*E. imbricata*) (endangered)
- Flowering Plants
  - Awikiwiki (*Canavalia napaliensis*) (endangered)
  - Awiwi (*Schenkia sebaeoides*) (endangered)
  - Carter's Panicgrass (*Panicum fauriei var. carteri*) (endangered)
  - *Cyperus pennatiformis* (endangered)
  - Ihi (*Portulaca villosa*) (endangered)
  - *Kadua st-johnii* (endangered)
  - Makou (*Peucedanum sandwicense*) (threatened)
  - Ohai (*Sesbania tomentosa*) (endangered)
  - Puukaa (*Cyperus trachysanthos*) (endangered)
- Ferns and Allies
  - (*Microlepia. strigosa var. mauiensis*) (endangered)

HDOT has determined that the Flowering Plants and Ferns and Allies listed above are unlikely to occur in the project action area. A flora and fauna survey was conducted for this project and none of the endangered plant species were identified within the project action area. HDOT has also determined that the hawksbill sea turtle is highly unlikely to occur in the project area due the project's distance to the shoreline and lack of sandy beaches. Finally, HDOT has determined that the short-tailed albatross is highly unlikely to occur in or transit the project area. FHWA has separately made a no effect determination on the flowering plants, ferns and allies, hawksbill sea turtle, and short-tailed albatross species. Therefore, these species are not discussed further in this letter.

Project Description

HDOT is currently evaluating realigning the southern terminus of Kapaa Bypass Road at Kuhio Highway to intersect with the existing intersection of Kuhio Highway with Papaloa Road (North) near the Coconut Marketplace. The realignment will consolidate the two (2) existing T intersections into a single full access intersection. In addition to consolidating the intersections, the realignment will provide the opportunity to allow left turns from Papaloa Road (North) onto Kuhio Highway.

Permanent highway lighting would be installed at intersections approaches. The lighting would be approximately 30 feet tall, safety standard compliant highway lighting. The exact location and quantity of lighting installations would be determined during final design per applicable standards and guidelines for motorists and pedestrians.

The project area is approximately 8.96 acres and includes Kuhio Highway ROW and private-owned land. Construction staging will occur in the northeast portion of the project area, mauka of Kuhio Highway. See Attachment 1: Project Action Area Map.

The Contractor will use the appropriate Best Management Practices (BMPs) (filter socks, drip pans, etc.) to prevent pollution from entering any receiving water body or drainage system. If in-water work occurs, the project will implement site-specific BMPs for work in aquatic environments.

To minimize the impact of project construction on traffic in the surrounding community, nightwork will occur; however, it will be avoided during the seabird fledging season (September 15 to December 15). At this time, the amount of construction lights is unknown and will depend on the selected Contractor's means and methods. To reduce the chance that lighting could disorient seabirds, construction lighting would be shielded down towards the ground and would use a narrow-spectrum bulbs. All lights will be turned off when human activity is not occurring in the lighted area, or automatic motion sensor switches and controls on all outdoor lights will be installed.

Biological Survey Report

SWCA Environmental Consultants (SWCA) prepared a Flora and Fauna Survey Report (September 2025). See Attachment 3: Flora and Fauna Report. The report presents the findings of a botanical and wildlife survey, conducted on May 11, 2025, to document species and biological issues of concern. The report includes discussion regarding the presence of any species that are State or Federally listed as threatened, endangered, or a candidate species for listing, as well as sensitive habitats. The report also identifies the potential impacts of implementing the proposed project and conservation measures that may be considered for inclusion into the planning and design phase.

Potential Impacts, Avoidance, Minimization, and Conservation Measures

Based on the recommendations in the IPaC project design guidelines and SWCA's Biological Survey Report, the following potential impacts may occur to ESA-listed species With the avoidance, minimization, and conservation measures discussed below, these impacts may be avoided and minimized.

Hawaiian Hoary Bat

Although no acoustic survey was completed to identify the presence of the Hawaiian hoary bat, records indicate that these bats can be found on Kauai in native, nonnative, agricultural, and developed landscapes. They forage over streams, reservoirs, wetlands, and within a wide variety of vegetation types. Hawaiian hoary bats typically roost in trees taller than 15 feet in dense canopy foliage or in the subcanopy. Areas of suitable foraging habitat and roosting habitat within the project action area were noted during the survey.

Project activities, including construction and staging, may require the removal of vegetation within the project action area. This could directly impact bats if a juvenile bat that is too small to fly but too large to be carried by a parent is present in a tree that is being cut down or trimmed. The HDOT commits to the following measures to avoid and minimize the potential impact of the project on the Hawaiian hoary bat:

- No vegetation, including any woody plants greater than 15 feet tall, will be trimmed, disturbed, or removed, during the bat-birthing and pup-rearing season (June 1 through September 15).
- Barbed wire, which could ensnare foraging bats, will not be used for fencing.

Hawaiian Seabirds (Band-Rumped Storm-Petrel, Hawaiian Petrell, Newell's Shearwater)

Hawaiian seabirds may potentially fly over the project action area to and from higher elevation nesting areas during seabird breeding (April-November) and fledgling season (September 15-December 15). New highway lighting and temporary construction night lighting can have the potential to attract adults and newly fledged juveniles traveling between their nests and the ocean. Juvenile seabirds are especially susceptible to light attraction and can become disoriented, sometimes leading to grounding or fallout, increasing the risk of mammalian predation and vehicle strikes.

Night work will not occur during seabird breeding and fledging seasons. Night lights used during construction will be approximately 15 feet tall. The number of lights used will depend on the contractor's means and methods, to ensure proper lighting for safety purposes. The lights will be narrow spectrum and shielded and directed downward. When not in use, the contractor will turn off the lights. The project scope also includes the installation of new permanent highway lighting. This highway lighting will also be on a narrow spectrum and shielded and directed downward. These highway lights are anticipated to be approximately 30 feet tall.

HDOT will implement the following recommendations to avoid or minimize light attraction to seabirds:

- No nightwork will occur during the fledgling season. To the extent practicable, the contractor will restrict activities to daylight hours during these times. For nightwork that will occur outside of the fledgling season:
    - Outdoor lights will be fully shielded so the bulb can only be seen from below.
    - Automatic motion sensor switches and controls will be on all outdoor lights or lights will be turned off when human activity is not occurring in the lighted area.
- Collisions as a result of the project are unlikely as no towers, fences, powerlines, guywires, or other cables are anticipated to be installed as a part of this Project.

<u>Hawaiian Waterbirds (Hawaiian Common Gallinule, Hawaiian Coot, Hawaiian Duck, Hawaiian Stilt)</u>

Although no Hawaiian waterbirds were found within the project action area during the survey, a Hawaiian Common Gallinule (alae ula) was spotted along waterways with hydrologic connectivity to the survey area. The streams intersecting the project action area and the wet turf, areas of standing water, and surrounding low growing vegetation within the project area could provide potential nesting and foraging habitat for Hawaiian waterbirds. HDOT will implement the following mitigation measures to reduce the impacts of the project on Hawaiian waterbirds:

- In areas where waterbirds are known to be present, the selected contractor will post and enforce reduced speed limits and inform project personnel and contractors about the potential presence of endangered species on-site.
- No in-water work is anticipated but relevant USFWS's Best Management Practices for Work in or Around Aquatic Environments will be incorporated into the Project design.
- A biological monitor familiar with the species' biology will conduct a Hawaiian waterbird nest survey in areas where vegetated streambanks would be disturbed prior to project initiation. The biological monitor will repeat the survey again within 3 days of project initiation and after any subsequent delay of work of 3 or more days (during which the birds may attempt to nest). If a nest or active brood is found, HDOT and/or the selected contractor will:
    - Contact the USFWS within 48 hours for further guidance.
    - Establish and maintain a 100-foot buffer around all active nests and/or broods until the chicks/ducklings have fledged. Potentially disruptive activities or habitat alteration within this buffer will not be conducted.

  - Have a biological monitor familiar with the species' biology be present on the project site during all construction or earth moving activities until the chicks/ducklings fledge to ensure that Hawaiian waterbirds and nests are not adversely impacted.
- If an endangered Hawaiian waterbird is present or flies into the area during ongoing activities, all activities within 100 feet (30 m) of the bird should cease; the bird should also not be approached. Work may continue after the bird leaves the area of its own accord.

Hawaiian Goose (Nene)

The nene is found on the island of Kauai and occupies a variety of habitats, including beach strand, shrubland, grassland, and lava rock at elevations ranging from coastal lowlands to the alpine areas. A nene was seen flying over the project action area during the survey and the project action area contains suitable habitat for foraging and nesting. HDOT will implement the following measures to avoid or reduce the impacts of the project on the nene:

- No nene will be approached, fed, or disturbed by any staff.
- If nene are observed loafing or foraging within the project area during breeding season (September through April), a biological monitor familiar with nene nesting behavior will survey for nests in and around the project area prior to the resumption of any work. The biological monitor will repeat any surveys after any subsequent delay of work of three (3) or more days (during which the birds may attempt to nest).
- All work will cease immediately if a nest is discovered within a radius of 150 feet of the proposed project before and/or after work begins, whereby the USFWS will be contacted for further guidance.
- In areas where nene are known to be present. The selected contractor will post and enforce reduced speed limits and inform project personnel and contractors about the potential presence of endangered species on-site.
- If a Hawaiian goose is observed in the area during construction activities, all activities within 100 feet (30 meters [m]) of the species should cease, and work should not continue until the species leaves the area on its own accord.

A 4(d) rule was established at the time the nene was downlisted to threatened status. Under the 4(d) rule, the following actions are not prohibited under the Act, provided the additional measures described in the downlisting rule are adhered to:

- Take by landowners, or their agents, conducting intentional harassment in the form of hazing or other deterrent measures not likely to cause direct injury or mortality, or nene surveys.
- Take that is incidental to conducting lawful control of introduced predators or habitat management activities for nene.
- Take by authorized law enforcement officers for the purpose of aiding or euthanizing sick, injured, or orphaned nene; disposing of dead specimens; and salvaging a dead specimen that may be used for scientific study.

Additionally, the project will implement the following non-species-specific measures:

- Good housekeeping practices and erosion-control device(s) will be employed at the project site to prevent debris and soil from leaving the site.
- Invasive species controls will be maintained in accordance with USFWS Pacific Island Fish and Wildlife Office (PIFWO) Invasive Species Biosecurity Protocols. For example:
    - Invasive species controls will be maintained to ensure that all materials transported from off-site are free of such species.
    - All construction equipment and vehicles will arrive at the work site for the first time in clean condition and free of: any soil; plants or plant parts, including seeds; insects, including eggs; and reptiles and amphibians, including their eggs. Similarly, all construction equipment and vehicles will also be cleaned after use on the Project site and before leaving the site. This is particularly important for equipment movement between the Project site and the other islands.
    - Invasive species found on stockpiled materials will be removed either chemically or mechanically.
- BMPs will be implemented in accordance with the documented approach as detailed in "*An Integrated Storm Water Management Approach and a Summary of Clear Water Diversion and Isolation Best Management Practices for Use in the State of Hawaii*" by the Federal Highway Administration and Hawaii Department of Transportation Practitioners Guide (2016) and/or the *Construction Best Management Practices Field Manual by the State of Hawaii Department of Transportation* (2008).

Request for Concurrence

With the implementation of the avoidance, minimization, and conservation measures described above, the FHWA has determined that the Kuhio Highway Intersection Improvement project *may affect, but is not likely to adversely affect*, the following species: Hawaiian Hoary Bat, Band-rumped Storm-Petrel, Hawaiian Petrel, Newell's Shearwater, Hawaiian Common Gallinule, Hawaiian Coot, Hawaiian Duck, Hawaiian Stilt, and Hawaiian Goose.

We respectfully request your concurrence with our determination and ask for your reply within sixty (60) days from the date of receipt of this letter. If you have any questions or require additional information, please contact the HDOT project manager, Mr. Joel Bautista, at (808) 241-3015 or by email at joel.o.bautista@hawaii.gov. Thank you for your assistance.

Sincerely,

Randall Haraguchi

Eric Fujikawa
(for) Kauai District Engineer

Enclosures

Attachment 1: Project Action Area Map
Attachment 2: IPaC Endangered Species List
Attachment 3: Flora and Fauna Report

Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road Southern Terminus

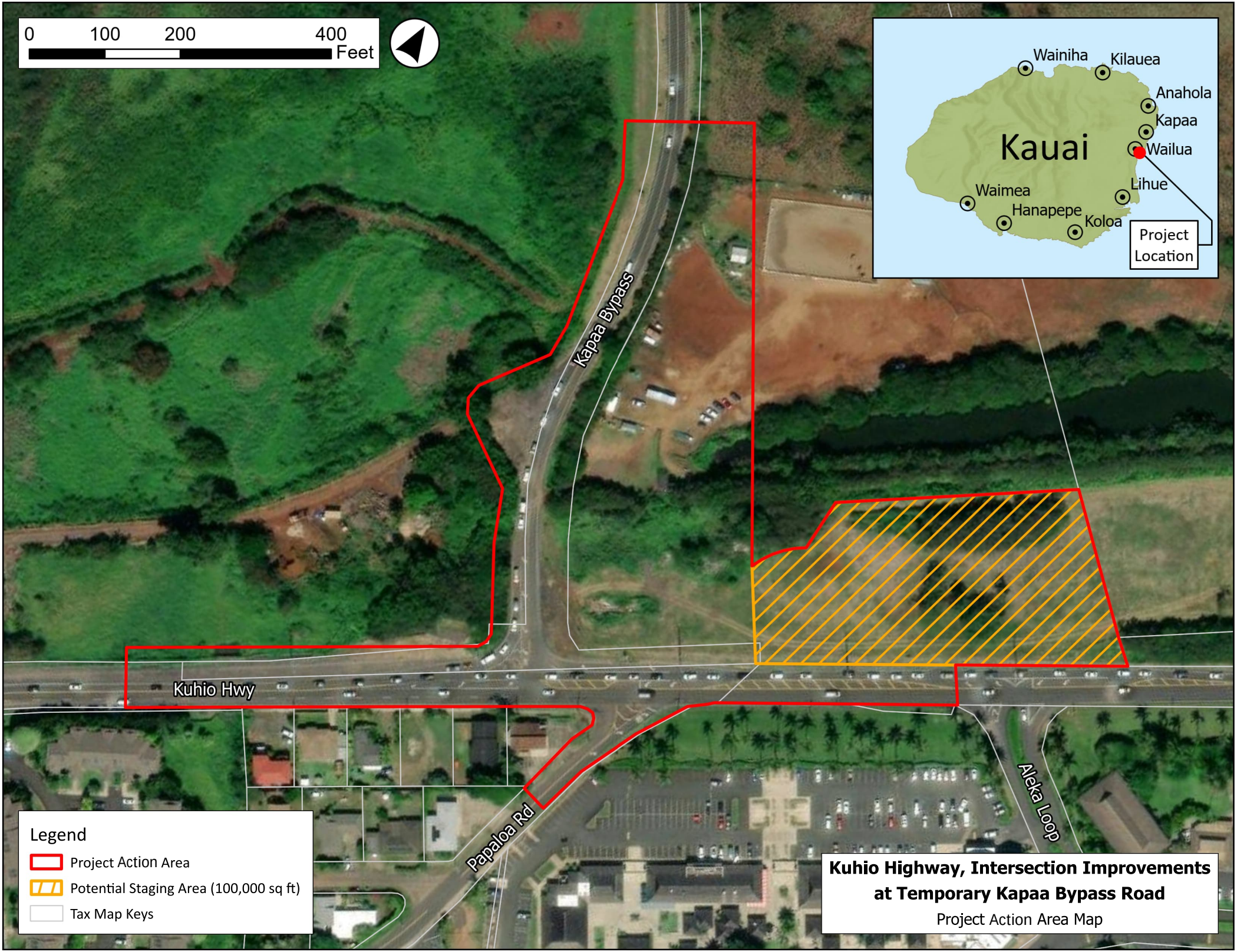
USFWS Section 7 Consultation Attachments

Attachment 1: Project Action Area Map
Attachment 2: IPaC Endangered Species List
Attachment 3: Flora and Fauna Report

Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road Southern Terminus

USFWS Section 7 Consultation Attachments

Attachment 1: Project Action Area Map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Kauai
Lihue
Waimea
Hanapepe
Koloa
Project Location
Kapaa Bypass
Kuhio Hwy
Papaloa Rd
Aleka Loop
Legend
Project Action Area
Potential Staging Area (100,000 sq ft)
Tax Map Keys
Kuhio Highway, Intersection Improvements at Temporary Kapaa Bypass Road
Project Action Area Map

Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road Southern Terminus

USFWS Section 7 Consultation Attachments

Attachment 2: IPaC Endangered Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish And Wildlife Office
300 Ala Moana Boulevard, Box 50088
Honolulu, HI 96850-5000
Phone: (808) 792-9400 Fax: (808) 792-9580

In Reply Refer To: 01/13/2026 18:09:10 UTC
Project Code: 2025-0147096
Project Name: Kuhio Highway Intersection Improvements

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened and endangered species, as well as designated critical habitat that may occur within the boundary of your proposed project and that may be affected by project related actions. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Please contact the Service's Pacific Islands Fish and Wildlife Office (PIFWO) at 808-792-9400 if you have any questions regarding your IPaC species list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may adversely affect threatened and endangered species and/or designated critical habitat.

Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a Biological

Evaluation, similar to a Biological Assessment, be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment or Biological Evaluation are described at 50 CFR 402.12.

Due to the significant number of listed species found on each island within PIFWO's regulatory jurisdiction, and the difficulty in accurately mapping ranges for species that we have limited information about, your species list may include more species than if you obtained the list directly from a Service biologist. We recommend you use the species links in IPaC to view the life history, habitat descriptions, and recommended avoidance and minimization measures to assist with your initial determination of whether the species or its habitat may occur within your project area. If appropriate habitat is present for a listed species, we recommend surveys be conducted to determine whether the species is also present. If no surveys are conducted, we err on the side of the species, by regulation, and assume the habitat is occupied. Updated avoidance and minimization measures for plants and animals, best management practices for work in or near aquatic environments, and invasive species biosecurity protocols can be found on the PIFWO website at: https://www.fws.gov/office/pacific-islands-fish-and-wildlife/library.

If a Federal agency determines, based on the Biological Assessment or Biological Evaluation, that a listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at: http://www.fws.gov/endangered/esa-library/index.

Non-federal entities can also use the IPaC generated species list to develop Habitat Conservation Plans (HCP) in accordance with section 10(a)(1)(B) of the Act. We recommend HCP applicants coordinate with the Service early during the HCP development process. For additional information on HCPs, the Habitat Conservation Planning handbook can be found at https://www.fws.gov/sites/default/files/documents/habitat-conservation-planning-handbook-entire.pdf.

Please be aware that wind energy projects should follow the Service’s wind energy guidelines (http://www.fws.gov/windenergy) for minimizing impacts to migratory birds. Listed birds and the Hawaiian hoary bat may also be affected by wind energy development and we recommend development of a Habitat Conservation Plan for those species, as described above. Guidance for minimizing impacts to migratory birds for projects including communications towers can be found at:

- http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers
- http://www.towerkill.com
- http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow

Fish and Wildlife Coordination Act: Any modification to freshwater or marine waters of the U.S. including impounding, diverting, deepening, controlling, or modification for any other purpose requires a Fish and Wildlife Coordination Act (FWCA) consultation with the U.S Fish and Wildlife Service, State/ Territorial wildlife agency (State of Hawaii Division of Aquatic

Resources, American Samoa’s Department of Marine and Wildlife Resources, Guam’s Division of Aquatic and Wildlife Resources, or the Northern Mariana Island’s Division of Fish and Wildlife) and the National Marine Fisheries Service. The Pacific Islands Fish and Wildlife Office in Honolulu should be notified of a FWCA consultation request with a project description and any relevant biological information in order to expedite the appropriate level of coordination and consultation needs.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation actions that benefit threatened and endangered species into their project planning to further the purposes of the Act in accordance with section 7(a)(1). Please include the Consultation Tracking Number associated with your IPaC species list in any request for consultation or correspondence about your project that you submit to our office. Please feel free to contact us at PIFWO_admin@fws.gov or 808-792-9400 if you need more current information or assistance regarding the potential impacts to federally listed species and federally designated critical habitat.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Bald & Golden Eagles
- Migratory Birds
- Wetlands

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Pacific Islands Fish And Wildlife Office
300 Ala Moana Boulevard, Box 50088
Honolulu, HI 96850-5000
(808) 792-9400

PROJECT SUMMARY

Project Code: 2025-0147096

Project Name: Kuhio Highway Intersection Improvements

Project Type: Road/Hwy - Maintenance/Modification

Project Description: The Project Action Area exists at the intersection of Kuhio Highway, Papaloa Road (North) and Kapaa Bypass Road in Kapaa on Kauai Island. The Project Action Area is approximately 8.96 acres and encompasses the Hawaii Belt Road right of way as well as some private TMK parcels mauka of the ROW. Staging will occur mauka of the Hawaii Belt Road ROW. The surrounding land uses are agricultural lands and urban lands. There are 3 wetlands within the project area.

The purpose of the project is to improve intersection functionality by combing the two unsignalized T intersections into one signalized intersection. This will be done by relocating Kapaa Bypass Road to where Papaloa Road intersects with Kuhio Highway. The project will also include installing new highway lights which will be shielded down and on a narrow spectrum.

The project area off of the road and staging area is densely vegetated and will require clearing. Staging areas will be restored to an improved condition after construction is completed.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@22.055385049999998,-159.32962726765373,14z



Counties: Kauai County, Hawaii

ENDANGERED SPECIES ACT SPECIES

There is a total of 21 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Hawaiian Hoary Bat *Lasiurus cinereus semotus*	Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/770
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/4L6PP4KSWFE4HFZOSRR6DPZNNI/documents/generated/6477.pdf

BIRDS

NAME	STATUS
Band-rumped Storm-petrel *Hydrobates castro*	Endangered

Population: USA (HI)
No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/1226
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/4L6PP4KSWFE4HFZOSRR6DPZNNI/documents/generated/6939.pdf

Hawaiian Common Gallinule *Gallinula galeata sandvicensis* — Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/6612
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/4L6PP4KSWFE4HFZOSRR6DPZNNI/documents/generated/6934.pdf

Hawaiian Coot (alae Ke`oke`o) *Fulica alai* — Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/7233
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/4L6PP4KSWFE4HFZOSRR6DPZNNI/documents/generated/6934.pdf

Hawaiian Duck *Anas wyvilliana* — Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/7712
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/4L6PP4KSWFE4HFZOSRR6DPZNNI/documents/generated/6934.pdf

Hawaiian Goose *Branta (=Nesochen) sandvicensis* — Threatened

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/1627
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/4L6PP4KSWFE4HFZOSRR6DPZNNI/documents/generated/6925.pdf

Hawaiian Petrel *Pterodroma sandwichensis* — Endangered

No critical habitat has been designated for this species.

NAME STATUS

Species profile: https://ecos.fws.gov/ecp/species/6746
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/4L6PP4KSWFE4HFZOSRR6DPZNNI/documents/generated/6939.pdf

Hawaiian Stilt *Himantopus mexicanus knudseni* — Endangered
No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/2082
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/4L6PP4KSWFE4HFZOSRR6DPZNNI/documents/generated/6934.pdf

Newell"s Shearwater *Puffinus newelli* — Threatened
No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/2048
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/4L6PP4KSWFE4HFZOSRR6DPZNNI/documents/generated/6939.pdf

Short-tailed Albatross *Phoebastria (=Diomedea) albatrus* — Endangered
No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/433

REPTILES

NAME STATUS

Hawksbill Sea Turtle *Eretmochelys imbricata* — Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/3656

FLOWERING PLANTS

NAME STATUS

`awikiwiki *Canavalia napaliensis* — Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/1325

Awiwi *Schenkia sebaeoides* — Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/7103

Carter's Panicgrass *Panicum fauriei var. carteri* — Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/5578

Cyperus pennatiformis — Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/6868

Ihi *Portulaca villosa* — Endangered
No critical habitat has been designated for this species.

NAME	STATUS
Species profile: https://ecos.fws.gov/ecp/species/4886	
Kadua st.-johnii	Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.	
Species profile: https://ecos.fws.gov/ecp/species/4337	
Makou *Peucedanum sandwicense*	Threatened
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.	
Species profile: https://ecos.fws.gov/ecp/species/5579	
Ohai *Sesbania tomentosa*	Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.	
Species profile: https://ecos.fws.gov/ecp/species/8453	
General project design guidelines: https://ipac.ecosphere.fws.gov/project/4L6PP4KSWFE4HFZOSRR6DPZNNI/documents/generated/7050.pdf	
Pu`uka`a *Cyperus trachysanthos*	Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.	
Species profile: https://ecos.fws.gov/ecp/species/7749	

FERNS AND ALLIES

NAME	STATUS
Microlepia strigosa var. mauiensis	Endangered
No critical habitat has been designated for this species.	
Species profile: https://ecos.fws.gov/ecp/species/4737	

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

BALD & GOLDEN EAGLES

Bald and Golden Eagles are protected under the Bald and Golden Eagle Protection Act [2] and the Migratory Bird Treaty Act (MBTA) [1]. Any person or organization who plans or conducts activities that may result in impacts to Bald or Golden Eagles, or their habitats, should follow appropriate regulations and consider implementing appropriate avoidance and minimization measures, as described in the various links on this page.

---

1. The Bald and Golden Eagle Protection Act of 1940.
2. The Migratory Birds Treaty Act of 1918.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Bald and Golden Eagles are protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act (MBTA). Any person or organization who plans or conducts activities that may result in impacts to Bald or Golden Eagles, or their nests, should follow appropriate regulations and implement required avoidance and minimization measures, as described in the various links on this page.

The data in this location indicates that no eagles have been observed in this area. This does not mean eagles are not present in your project area, especially if the area is difficult to survey. Please review the 'Steps to Take When No Results Are Returned' section of the Supplemental Information on Migratory Birds and Eagles document to determine if your project is in a poorly surveyed area. If it is, you may need to rely on other resources to determine if eagles may be present (e.g. your local FWS field office, state surveys, your own surveys).

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats, should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

MIGRATORY BIRDS

The Migratory Bird Treaty Act (MBTA) [1] prohibits the take (including killing, capturing, selling, trading, and transport) of protected migratory bird species without prior authorization by the Department of Interior U.S. Fish and Wildlife Service (Service).

---

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the "Probability of Presence Summary" below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
'apapane *Himatione sanguinea* This is a Bird of Conservation Concern (BCC) throughout its range in Hawaii and the Pacific Islands. https://ecos.fws.gov/ecp/species/9659	Breeds Dec 1 to Jul 31
Black Noddy *Anous minutus melanogenys* This is a Bird of Conservation Concern (BCC) throughout its range in Hawaii and the Pacific Islands. https://ecos.fws.gov/ecp/species/10559	Breeds Apr 1 to Nov 30
Black-footed Albatross *Phoebastria nigripes* This is a Bird of Conservation Concern (BCC) throughout its range in Hawaii and the Pacific Islands. https://ecos.fws.gov/ecp/species/8033	Breeds Apr 1 to Aug 31
Bulwer's Petrel *Bulweria bulwerii* This is a Bird of Conservation Concern (BCC) throughout its range in Hawaii and the Pacific Islands. https://ecos.fws.gov/ecp/species/10579	Breeds May 1 to Sep 30
Kaua'i 'amakihi *Chlorodrepanis stejnegeri* This is a Bird of Conservation Concern (BCC) throughout its range in Hawaii and the Pacific Islands. https://ecos.fws.gov/ecp/species/9654	Breeds Mar 15 to Aug 15
Laysan Albatross *Phoebastria immutabilis* This is a Bird of Conservation Concern (BCC) throughout its range in Hawaii and the Pacific Islands. https://ecos.fws.gov/ecp/species/11959	Breeds Nov 15 to Jun 15
Pomarine Jaeger *Stercorarius pomarinus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10458	Breeds elsewhere
Red-tailed Tropicbird *Phaethon rubricauda melanorhynchos* This is a Bird of Conservation Concern (BCC) throughout its range in Hawaii and the Pacific Islands. https://ecos.fws.gov/ecp/species/10563	Breeds Dec 15 to Oct 15
Sooty Shearwater *Ardenna grisea* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10417	Breeds elsewhere

NAME	BREEDING SEASON
Sooty Tern *Onychoprion fuscatus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10695	Breeds Mar 10 to Jul 31
Wandering Tattler *Tringa incana* This is a Bird of Conservation Concern (BCC) throughout its range in Hawaii and the Pacific Islands. https://ecos.fws.gov/ecp/species/11941	Breeds elsewhere

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

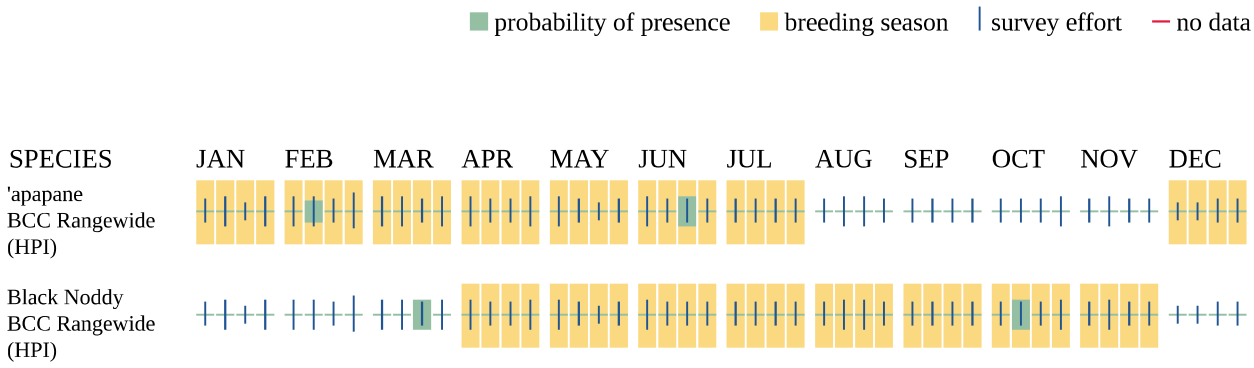
Probability of Presence (■)

Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season (■)
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data (–)
A week is marked as having no data if there were no survey events for that week.





Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

WETLANDS

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

FRESHWATER POND

- PUBHx

FRESHWATER EMERGENT WETLAND

- PEM1A

RIVERINE

- R4SBC

IPAC USER CONTACT INFORMATION

Agency: Private Entity
Name: Kamaluonalani Ogata
Address: 1001 Bishop Street Suite 2400
City: Honolulu
State: HI
Zip: 96813
Email kamalu.ogata@wsp.com
Phone: 8085662266

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Hawaii Department of Transportation
Name: Eric Fujikawa
Email: eric.i.fujikawa@hawaii.gov
Phone: 8082413015

Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road Southern Terminus

USFWS Section 7 Consultation Attachments

Attachment 3: Flora and Fauna Report

Flora and Fauna Survey Report for the Kapa‘a Roundabout Project, Kaua‘i

SEPTEMBER 2025

PREPARED FOR

WSP USA

PREPARED BY

SWCA Environmental Consultants

FLORA AND FAUNA SURVEY REPORT FOR THE KAPAʻA ROUNDABOUT PROJECT, KAUAʻI

Prepared for

WSP USA
1001 Bishop Street
Honolulu, Hawaii 96813
Attn: Dennis Silva, Jr.

Prepared by

SWCA Environmental Consultants
1200 Ala Moana Boulevard, Suite 380
Honolulu, Hawaiʻi 96814
(808) 548-7922
www.swca.com

SWCA Project No. 90495

September 2025

EXECUTIVE SUMMARY

The Hawaiʻi Department of Transportation is undertaking a project to construct a roundabout where the Kuhio Highway intersects the Kapaʻa Bypass, near the intersection of Kuhio Highway and Papaloa Street, in Kapaʻa, Kauaʻi. WSP USA commissioned SWCA Environmental Consultants to conduct a terrestrial flora and fauna survey for the proposed project, which was conducted on May 11, 2025.

Of the flora and fauna documented within the proposed project area, only one species is classified as a federally or state-listed threatened, endangered, proposed, or candidate species (collectively referred to as special-status species). This species—the nēnē, or Hawaiian goose (*Branta sandvicensis*)—was observed flying over the project area. The project area does not overlap with the federally designated critical habitat of any special-status species. However, foraging and nesting habitat for four endangered Hawaiian waterbirds—Hawaiian common gallinule or ʻalae ʻula (*Gallinula galeata sandvicensis*), Hawaiian coot or ʻalae keʻokeʻo (*Fulica alai*), Hawaiian duck or koloa maoli (*Anas wyvilliana*), and Hawaiian stilt or aʻeo (*Himantopus mexicanus knudseni*)—exists in the project area. Additionally, potential roosting trees for the Hawaiian hoary bat (*Lasiurus cinereus semotus*), a federally and state-listed endangered mammal, are present within the project area. Lastly, the special-status Hawaiian seabirds, band-rumped storm-petrel or ʻakeʻake (*Hydrobates castro*), Hawaiian petrel or ʻuaʻu (*Pterodroma sandwichensis*), Newell's shearwater or ʻaʻo (*Puffinus newelli*), and short-tailed albatross (*Phoebastria* [=*Diomedea*] *albatrus*), may transit over the project area.

This report outlines detailed avoidance and minimization measures to protect these endangered species. By adhering to these measures, the project is not expected to have a significant adverse effect on these special-status species, their habitats, or other terrestrial biological resources.

CONTENTS

1 Introduction 1
2 Regulatory Environment 1
2.1 Endangered Species Act 1
2.2 Migratory Bird Treaty Act 2
2.3 Hawai‘i Revised Statutes 195D 2
3 Site Information 2
4 Methods 4
5 Literature Review 4
6 Results 5
6.1 Flora 5
6.2 Vegetation and Land Cover Types 5
6.2.1 Ruderal 5
6.2.2 Nonnative Grassland 6
6.2.3 Riparian 6
6.2.4 Nonnative Secondary Forest 7
6.3 Fauna 8
6.3.1 Avifauna 8
6.3.2 Mammals 9
6.3.3 Terrestrial Reptiles and Amphibians 9
6.3.4 Insects and Other Invertebrates 9
6.4 Flora 9
6.5 Fauna 9
7 Discussion and Recommendations 12
7.1 Flora and Biosecurity Considerations 12
7.2 Fauna 13
7.2.1 Hawaiian Hoary Bat 13
7.2.2 Seabirds 13
7.2.3 Hawaiian Waterbirds 14
7.2.4 Hawaiian Goose or Nēnē 14
8 Conclusions 15
9 Literature Cited 16

Appendices

Appendix A. Vascular Plant Species Recorded During the May 11, 2025, Survey
Appendix B. Endangered and Threatened Flora and Fauna Species with the Potential to Occur in the Project Area

Appendix C. Biosecurity Guidelines
Appendix D. Best Management Practices for Work in Aquatic Environments

Figures

Figure 1. Location of the project area. 3
Figure 2. Typical ruderal vegetation in the project area. 5
Figure 3. Typical nonnative grassland in the project area. 6
Figure 4. Typical riparian vegetation in the project area. 7
Figure 5. Typical secondary forest in the project area. 8

Tables

Table 1. Kapa‘a Roundabout Project Flora and Fauna Literature Review 4
Table 2. Birds Observed in and near the Project Area on May 11, 2025 8
Table 3. Special-Status Species Listed in the USFWS IPaC Search Results and their Potential to Occur in the Project Area 10

1 INTRODUCTION

The Hawai‘i Department of Transportation is undertaking a project to construct a roundabout within a 8.9-acre area at the intersection of Kuhio Highway and the Kapa‘a Bypass Road, near the intersection of Kuhio Highway and Papaloa Road in Kapa‘a, on Kaua‘i Island.

WSP USA commissioned SWCA Environmental Consultants (SWCA) to conduct a terrestrial flora and fauna survey for the proposed project, which was conducted on May 11, 2025. The specific purpose of this survey was to locate populations of special-status species and identify any critical habitat for these species in the project area.

The methods and results of this survey, and measures to avoid and minimize impacts on special-status species as part of project implementation, are presented herein.

2 REGULATORY ENVIRONMENT

This section describes laws and regulations applicable to aquatic and terrestrial flora and fauna in the context of the project.

2.1 Endangered Species Act

The Endangered Species Act of 1973, as amended (ESA), is regulated by the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration National Marine Fisheries Service. It protects wildlife and plant species that have been listed as threatened or endangered and is designed to conserve the ecosystems on which species depend. Candidate species, which may be listed in the near future, are not afforded protection under the ESA until they are formally listed as endangered or threatened.

Section 9 of the ESA and the rules promulgated under Section 4(d) of the ESA prohibit the unauthorized take of any endangered or threatened species of wildlife listed under the ESA. Under the ESA, the term *take* means “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect species listed as endangered or threatened, or to attempt to engage in any such conduct.” As defined in regulations, the term *harm* means “an act that actually kills or injures wildlife; it may include significant habitat modification or degradation, which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering” (50 Code of Federal Regulations [CFR] 17.3). The rules define *harass* to mean “an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent, as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering” (50 CFR 17.3).

The ESA affords maximum legal protections to species listed as threatened or endangered under the law and provides authorization for incidental take permits for take that occurs incidental to otherwise legal operations. To comply with federal laws, additional measures must be taken to ensure that take of federally listed species does not occur. Any fatality of a listed species should be reported to the USFWS and the Hawai‘i Department of Land and Natural Resources, Division of Forestry and Wildlife as soon as possible, and an incident report should be filed within 24 hours of detection.

The ESA also provides for the designation of critical habitat for listed species if there are areas of habitat believed to be essential to conservation of the species. Critical habitat can be designated for a single species or a group of species. A critical habitat designation does not necessarily restrict further development but prevents federal actions from destroying or adversely modifying that habitat.

2.2 Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918, as amended (MBTA), is regulated by the USFWS and prohibits the take of migratory birds. A list of birds protected under MBTA is published under 50 CFR 10.13. Unless permitted by regulations, under the MBTA, “it is unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess, offer to sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product” (16 United States Code 703–712). The MBTA provides no process for authorizing incidental take of MBTA-protected birds. As a result, birds that are not covered under the ESA that may be adversely affected by the project cannot be covered by take authorizations. Regardless, incidental take of individual MBTA-protected species is unlikely to adversely affect MBTA-protected species as a whole; however, any take of MBTA-protected species should be documented and reported in a similar manner as any endangered or threatened species of wildlife listed under the ESA.

2.3 Hawai‘i Revised Statutes 195D

The purpose of Hawai‘i Revised Statutes (HRS) 195D is “to ensure the continued perpetuation of indigenous aquatic life, wildlife, and land plants, and their habitats for human enjoyment, for scientific purposes, and as members of ecosystems” and is regulated by the Hawai‘i Department of Land and Natural Resources, Division of Forestry and Wildlife. HRS 195D-4 states that any endangered or threatened species of fish or wildlife recognized by the ESA shall be so deemed by the state statute. Like the ESA, the unauthorized take of such endangered or threatened species is prohibited (HRS 195-D-4(e)), but incidental take licenses can be obtained (HRS 195D-21). In addition to species protected under the ESA, rules adopted under HRS 195D-4 allow for the listing of indigenous species as threatened or endangered for the following reasons:

- Habitat destruction or alteration (current or predicted)
- Overexploitation
- Disease or predation
- Lack of regulatory mechanisms
- Other factors threatening the species’ continued existence

Determinations are made based on all available sources of data (scientific, commercial, and other) and consultation with appropriate agencies (federal, state, and county) and interested organizations and parties.

3 SITE INFORMATION

The project area is within the *ahupua‘a* (land division) of Olohena, in the *moku* (district) of Kawaihau on the *mokupuni* (island) of Kaua‘i (Figure 1). The project area is where Kuhio Highway intersects the Kapa‘a Bypass Road. Mean annual rainfall for the project area is approximately 42 inches (106 centimeters). Rainfall is typically highest between October and March and lowest between April and September (Frazier et al. 2016).



Figure 1. Location of the project area.

4 METHODS

On May 11, 2025, two SWCA biologists conducted a comprehensive survey of the proposed project area (see Figure 1). The survey was conducted on foot and documented all vascular plant, vertebrate (birds, mammals, and amphibians), and macroinvertebrate (gastropods and arthropods) species within the project area. The survey specifically focused on locating populations of special-status species; however, acoustic or in-person surveys for the endangered Hawaiian hoary bat or ‘ope‘ape‘a (*Lasiurus cinereus semotus*), or nighttime surveys for listed seabird species or insects were not conducted. Identification of birds was aided by 10 × 42–millimeter binoculars, as well as auditory vocalization identifications. Any signs of animals, such as scat or tracks, were also noted.

5 LITERATURE REVIEW

During the preparation for the field survey, SWCA conducted a literature review to evaluate the historic land use of the project site, background on the project, and the presence of special-status species, their habitats, and sensitive natural communities within the project area. This literature review encompassed a thorough search of referenced scientific journals; technical journals and reports; environmental assessments; environmental impact statements; newspaper articles; relevant government documents; USFWS online data, including the Information for Planning and Consultation (IPaC) website (USFWS 2025); and unpublished data that provide insight into the project area’s natural history and ecology. SWCA also reviewed available geospatial data, aerial imagery, and topographic maps of the project area. Literature and other resources reviewed for this project are described in Table 1.

Table 1. Kapa‘a Roundabout Project Flora and Fauna Literature Review

Document (Author)	Relevance
Recovery Plan for the Hawaiian Hoary Bat (Lasiurus cinereus semotus) (USFWS 1998)	Describes the current understanding, threat status, recovery strategy, and criteria for delisting Hawaiian hoary bat.
Hawaiian Goose (Nēnē) (*Branta sandvicensis*) (Banko et al. 1999)	Describes the current understanding regarding habitat and diet preferences, and breeding biology of nēnē.
Recovery Plan for Hawaiian Waterbirds, Second Revision (USFWS 2011)	Describes the current understanding, threat status, recovery strategy, and criteria for delisting endangered Hawaiian waterbirds. Also describes federally listed waterbird locations on Maui.
*Band-Rumped Storm-Petrel (*Oceanodroma castro*) Hawai‘i Distinct Population Segment 5-Year Review Summary and Evaluation* (USFWS 2021)	Describes the current understanding, threat status, and criteria for delisting band-rumped storm-petrel.
*Hawaiian Petrel (*Pterodroma sandwichensis*) 5-Year Review Summary and Evaluation* (USFWS 2022)	Describes the current understanding, threat status, and criteria for delisting Hawaiian petrel.
‘A‘o (Newell’s shearwater, Puffinus newelli*) 5-Year Review* (USFWS 2024)	Describes the current understanding, threat status, and criteria for delisting Newell’s shearwater.
*Short-tailed Albatross (*Phoebastria albatrus*) 5-Year Review* (USFWS 2020)	Describes the current understanding, threat status, and criteria for delisting short-tailed albatross.
USFWS Information for Planning and Consultation (IPaC) (USFWS 2025)	Produces a list of special-status species with potential to occur in the specified project area.

6 RESULTS

6.1 Flora

In all, 31 vascular plant species were recorded in the project area, one of which, glossy nightshade (*Solanum americanum*) is native to the Hawaiian Islands. No special-status plant species were observed in the project area. Appendix A provides a list of the vascular plant species observed during the survey.

6.2 Vegetation and Land Cover Types

The vegetation in the project area consists of four vegetation types—ruderal, nonnative grassland, riparian, and nonnative secondary forest—described in detail below.

6.2.1 *Ruderal*

Ruderal vegetation was prevalent throughout much of the project area, particularly in locations frequently disturbed by roadsides, domestic livestock, or other activities. Weedy plant species were most common in this vegetation type. Guineagrass (*Urochloa maxima*) was the most prevalent, along with a mix of nonnative weeds such as false ragweed (*Parthenium hysterophorus*), sensitive plant (*Mimosa pudica*), and swollen fingergrass (*Chloris barbata*) (Figure 2).



Figure 2. Typical ruderal vegetation in the project area.

6.2.2 *Nonnative Grassland*

Areas that have undergone less frequent disturbance along the roadside or in adjacent pastures contained nonnative grasslands dominated by guineagrass. Woody species within this vegetation type were uncommon (Figure 3).



Figure 3. Typical nonnative grassland in the project area.

6.2.3 *Riparian*

Riparian vegetation was found in the project area where streams and ditches are present. The upper banks of these areas were dominated by koa haole (*Leucaena leucocephala*) and Java plum (*Syzygium cumini*). In the shallow channels, mixed weedy species were present on the channel floor. Some of the species found in these areas include sourbush (*Pluchea carolinensis*), cayenne porterweed (*Stachytarpheta cayennensis*), and umbrella sedge (*Cyperus involucratus*) (Figure 4).



Figure 4. Typical riparian vegetation in the project area.

6.2.4 *Nonnative Secondary Forest*

Secondary forest occurs in the project area along road edges and other areas where disturbance is less frequent. It occurs as a mix of various nonnative tree species such as koa haole, Java plum, Christmas berry (*Schinus terebinthifolius*), and bingabing (*Macaranga tanarius*). The understory in this vegetation type is frequently sparse or is occupied by guineagrass (Figure 5).



Figure 5. Typical secondary forest in the project area.

6.3 Fauna

6.3.1 *Avifauna*

One special-status species, nēnē or Hawaiian goose (*Branta sandvicensis*), was observed flying over the project area. Additionally, five nonnative bird species were noted during the survey (Table 2). These nonnative species are common in disturbed, low-elevation areas on Kaua‘i.

Table 2. Birds Observed in and near the Project Area on May 11, 2025

Common Name	Scientific Name	Status*	MBTA Species (Yes or No)
Cattle egret	*Bubulcus ibis*	NN	Yes
Common myna	*Acridotheres tristis*	NN	No
Feral chicken	*Gallus gallus*	NN	No
Nēnē	*Branta sandvicensis*	E	No
Spotted dove	*Spilopelia chinensis*	NN	No
Zebra dove	*Geopelia striata*	NN	No

* E = endemic, NN = nonnative permanent resident

Endangered Hawaiian waterbirds were not detected in the field survey, although one waterbird, Hawaiian common gallinule or ‘alae ‘ula (*Gallinula galeata sandvicensis*), was seen along waterways with hydrologic connectivity to the survey. Overall, the streams intersecting the project area provide potential nesting and foraging habitat for all special-status Hawaiian waterbirds: Hawaiian common gallinule or

‘alae ‘ula, Hawaiian coot or ‘alae ke‘oke‘o (*Fulica alai*), Hawaiian duck or koloa maoli (*Anas wyvilliana*), and Hawaiian stilt or a‘eo (*Himantopus mexicanus knudseni*). Similarly, special-status Hawaiian seabirds were not observed in the project area but may potentially fly over the project area to and from higher elevation nesting areas during the seabird breeding and fledging season. These seabirds are band-rumped storm-petrel or ‘ake‘ake (*Hydrobates castro*), Hawaiian petrel or ‘ua‘u (*Pterodroma sandwichensis*), Newell’s shearwater or ‘a‘o (*Puffinus newelli*), and short-tailed albatross (*Phoebastria* [*=Diomedea*] *albatrus*).

Additionally, potential roosting trees for the Hawaiian hoary bat, a federally and state-listed endangered mammal, are present within the project area.

6.3.2 *Mammals*

Feral pigs (*Sus scrofa*) were observed within the project area. Although house mice (*Mus musculus*) and rats (*Rattus* spp.) were not detected, they are likely to be present within the site. Additionally, habitat for foraging and roosting by the federally and state-endangered Hawaiian hoary bat exists in the project area, primarily within the riparian and nonnative secondary forest vegetation types, making it likely that this species is present at least periodically within the site.

6.3.3 *Terrestrial Reptiles and Amphibians*

No reptiles or amphibians were detected. No terrestrial reptiles and amphibians are native to Hawai‘i.

6.3.4 *Insects and Other Invertebrates*

During the survey, no native insects or other invertebrates were observed. However, one nonnative invertebrate species, the apple snail (*Pomacea canaliculata*), was recorded.

Special-Status Species and Critical Habitat

During the May 11, 2025, survey, one special-status species—the Hawaiian goose (nēnē)—was observed flying over the project area. Suitable foraging and nesting habitat for this species is present within the project area, indicating it may occur there periodically. One species protected under the MBTA—the cattle egret (*Bubulcus ibis*)—was also observed during the survey. According to the USFWS IPaC database (USFWS 2025), 10 vascular plant and 11 federally threatened and endangered animal species have ranges that overlap with the project area (Appendix B). An assessment of the likelihood of these species occurring within the project area is provided below and summarized in Table 3.

6.4 Flora

No USFWS-designated critical habitat for special-status plant species overlaps with the project area. Of the 10 vascular plant species identified through the USFWS IPaC database search (see Table 3, Appendix B), none are considered likely to occur in the project area due to past clearance of native vegetation and the land’s subsequent use for intensive agriculture and grazing.

6.5 Fauna

No USFWS-designated critical habitat for special-status wildlife overlaps with the project area. Of the 11 fauna species identified through the USFWS IPaC database search as potentially occurring in or passing through the area (see Table 3, Appendix B), five federally endangered species—the Hawaiian hoary bat,

Hawaiian common gallinule, Hawaiian coot, Hawaiian duck, Hawaiian goose, and Hawaiian stilt—have a high likelihood of occurring in or near the project area, including in grasslands, roost trees, ephemeral ponds or puddles, and riparian areas (Figures 3 and 4). All other special-status species listed by the USFWS have a low to very low likelihood of occurrence, or are otherwise not present within the project area (see Table 3).

Table 3. Special-Status Species Listed in the USFWS IPaC Search Results and their Potential to Occur in the Project Area

Species Common Name (*Scientific Name*)	Status	Habitat Within the Project Area	Likelihood of Occurring within the Project Area
Plants (vascular species only)			
‘Awikiwiki (*Canavalia napaliensis*) Awiwi (*Schenkia sebaeoides*) Carter's panicgrass (*Panicum fauriei* var. *carteri*) *Cyperus pennatiformis*; Ihi (*Portulaca villosa*) *Kadua st.-johnii*; *Microlepia strigosa* var. *mauiensis* Ohai (*Sesbania tomentosa*) Pu`uka`a (*Cyperus trachysanthos*)	Endangered	These species occupy a broad range of Hawaiian habitats, from dry coastal dunes, rocky cliffs, and talus slopes to sandy wetlands, mud flats, and mesic to wet forests. They are found from sea level to over 1,800 meters, often in exposed, rocky, or salt-spray environments, as well as periodically wet lowlands and upland forests. Although some of these habitats are present within the project area, the habitats have undergone significant disturbance due to historical habitat modification and land disturbance.	**Not present.** These species are not considered to occur within the project area due to factors such as the species not occurring on the island of Kaua‘i and/or within the area of Kaua‘i where the project site is located, and unsuitability of the disturbed habitat present in the parcel.
Makou (*Peucedanum sandwicense*)	Threatened		
Mammals			
Hawaiian hoary bat (*Lasiurus cinereus semotus*)	Endangered	Most of the available documentation suggests that this elusive bat roosts in both native and nonnative trees equal to or greater than 15 feet (4.6 meters) among trees in areas near forests. Areas of suitable habitat for foraging were noted during the survey, and bats could roost in the tree species within and near the project area.	**High.** Likely to fly over, forage, and possibly roost in trees within the project area (see Figures 4 and 5).

Species Common Name (*Scientific Name*)	**Status**	**Habitat Within the Project Area**	**Likelihood of Occurring within the Project Area**
Avifauna			
Seabirds			
Band-rumped storm-petrel (*Oceanodroma castro*) Hawaiian petrel; (*Pterodroma sandwichensis*) Short-tailed albatross (*Phoebastria* [=*Diomedea*] *albatrus*)	Endangered	According to a 2002 report, an estimated 171–221 nesting pairs of band-rumped storm petrel exist on Kaua`i, primarily along the Nā Pali Coast and Waimea Canyon cliffs (e.g., Pōhakuao, Nu‘ulolo, and Kalalau) (Wood et al. 2002; Raine et al. 2017; USFWS 2021). No nesting habitat for this species exists in the project area, but the species could transit over the project site. Hawaiian petrel breeds in high-elevation, forested, or rocky sites, including Nā Pali Reserve and upper Limahuli on Kaua‘i. (Troy et al. 2017). No nesting habitat for this species exists in the project area, but the species could transit over the project site. Short-tailed albatross breeds mainly on small island groups south of Japan, with about 80% nesting on Torishima Island (USFWS 2020), and is occasionally seen on Midway Atoll. Outside the breeding season, the species ranges across the temperate and subarctic North Pacific, from Japan to California, typically staying near islands and coastlines. As it nests elsewhere in the world, the species will not nest within the project site and has a low likelihood of flying over the project area.	**Low.** These species could potentially fly over the project area, but they are highly unlikely to land or nest at the project site.
Newell’s shearwater (*Puffinus auricularis newelli*)	Threatened	Newell’s shearwater nests in burrows beneath dense forest ferns and roots on steep mid- to high-altitude slopes (e.g., Alaka‘i–Nā Pali) (USFWS 2019; Ainley et al 2020). No nesting habitat for this species exists in the project area, but the species could transit over the project site.	

Species Common Name (*Scientific Name*)	Status	Habitat Within the Project Area	Likelihood of Occurring within the Project Area
Waterbirds			
Hawaiian coot (*Fulica americana alai*) Hawaiian duck (*Anas wyvilliana*) Hawaiian common gallinule (*Gallinula galeata sandvicensis*) Hawaiian stilt (*Puffinus auricularis newelli*) Hawaiian goose (nēnē; *Branta sandvicensis*)	Endangered	Hawaiian coot, Hawaiian duck, Hawaiian common gallinule, and Hawaiian stilt can be found nesting, foraging, and flying over agricultural lands on Kaua‘i, especially in or near managed wetlands, streams and rivers, taro fields, irrigation networks, and fallow wet fields (Engilis and Pratt 1993; Reed and Oring 1993; USFWS 2011). Areas of open pasture, including seasonally wet areas, and riparian wetlands are present within the project area and could provide habitat for all five species. Nēnē will forage and transit across agricultural zones, particularly where open grasslands or food sources exist. Pasturelands can support both foraging and occasional nesting, especially in less disturbed areas. (Banko et al. 1999).	**Moderate to High.** The project area contains both pasture and riparian wetlands that could provide habitat for all five endangered wetland bird species.
Reptiles			
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered	Hawksbill sea turtles are marine species that haul out on beaches to rest. No suitable habitat for this species is present in the project area.	**Very low.** This species is highly unlikely to occur within the project area, as the project site is not directly connected to marine waters.

7 DISCUSSION AND RECOMMENDATIONS

The following relevant avoidance and mitigation measures are provided to reduce or eliminate project-related impacts and to avoid adverse effects on any special-status species that may periodically occur within the project area. These measures should be implemented as part of the project.

7.1 Flora and Biosecurity Considerations

The vegetation type and species identified during the survey are not considered unique, and the one native plant species recorded at the site is not a special-status species. More than 90% of the vegetation cover observed in the project area consists of nonnative plant species. The proposed project is not expected to have a significant, adverse impact on botanical resources.

Several factors may have contributed to the limited number of native vascular plant species observed at the site during the survey, including previous land use for ranching and cropping, as well as the dominant presence of invasive, nonnative plants such as Guinea grass and koa haole, and others. Nonetheless, based on the survey results and historical land use of this area, the proposed project is not expected to have a significant adverse impact on botanical resources.

Weedy nonnative plant species are common in the project area. Most of these weedy species are widespread in Hawai‘i, and their control is not expected to result in a significant decrease in their number or distribution. However, construction activities are known to spread invasive species to new areas through the movement of vehicles and materials. For this reason, Appendix C provides guidelines on

minimizing the risk of unintentionally introducing invasive species to the project site and the island of Kaua‘i.

7.2 Fauna

7.2.1 *Hawaiian Hoary Bat*

The Hawaiian hoary bat is found on Kaua‘i in native, nonnative, agricultural, and developed landscapes (U.S. Department of Agriculture 2009; USFWS 1998). This species forages in open, wooded, and linear habitats across a wide range of vegetation types. As insectivores, this bat is frequently observed foraging over streams, reservoirs, and wetlands, extending up to 300 feet (about 91 meters [m]) offshore (U.S. Department of Agriculture 2009). Hawaiian hoary bats typically roost in trees taller than 15 feet (4.6 m) within either dense canopy foliage or in the subcanopy when the canopy is sparse, allowing open access for launching into flight (Gorresen et al. 2013; U.S. Department of Agriculture 2009).

Direct impacts to bats could occur during vegetation removal if a juvenile bat that is too small to fly but too large to be carried by a parent is present in a tree or branch that is cut down. To prevent direct impacts to Hawaiian hoary bat, the following measures are recommended:

- No trees taller than 15 feet (4.6 m) in the project area should be trimmed or removed between June 1 and September 15 when flightless juvenile bats may be roosting in the trees.
- To minimize the risk of entanglement for the Hawaiian hoary bat, any fences installed as part of the project should include a barbless top-strand wire in place of barbed wire.

7.2.2 *Seabirds*

Major threats to the endangered band-rumped storm-petrel or ‘ake‘ake, Hawaiian petrel or ‘ua‘u, threatened Newell’s shearwater or ‘a‘o, and short-tailed albatross due to project activities include the attraction of adults (all four seabird species) and newly fledged juveniles (band-rumped storm-petrel, Hawaiian petrel, and Newell’s shearwater) of these species to bright lights while transiting between their nest sites and the ocean. Juvenile birds are particularly susceptible to light attraction and can become disoriented, sometimes resulting in grounding (Mitchell et al. 2005). Many grounded birds are vulnerable to mammalian predators or being struck by vehicles. The following recommendations are provided to avoid and minimize the light attraction of these seabird species to the project area:

- Construction activity should be restricted to daylight hours as much as practicable during both the seabird breeding (April–November) and fledging (September 15–December 15) seasons to avoid the use of nighttime lighting that could attract seabirds.
- All outdoor lights should be shielded to prevent upward radiation. This has been shown to reduce the potential for seabird attraction (Telfer et al. 1987).
- Outside lights that are not needed for security and safety should be turned off from dusk through dawn during the fledgling fallout period (September 15–December 15).
- Automatic motion sensor switches and controls should be installed on all outdoor lights or lights should be turned off when human activity is not occurring in the lighted area.

To avoid and minimize the likelihood of seabirds colliding with fences, powerlines, and other structures near nesting colonies, the following measures should be implemented as part of the project:

- Where fences extend above vegetation, three strands of polytape should be integrated into the fence to increase visibility.
- For powerlines, guywires, and other cables, exposure should be minimized above vegetation height and vertical profile.

7.2.3 *Hawaiian Waterbirds*

Habitat for endangered Hawaiian common gallinule or ‘alae‘ula, Hawaiian stilt or a‘eo, Hawaiian coot or ‘alae ke‘oke‘o, and Hawaiian duck or koloa maoli, including areas of wet turf, areas of standing water, and surrounding low-growing vegetation, exists in the project area. The following best management practices are recommended during construction activities to avoid effects on listed waterbirds:

- In areas where vegetated streambanks would be disturbed, waterbird nest searches should be conducted by a qualified biologist before any work is conducted and after any subsequent delay in work of 3 or more days (during which birds may attempt nesting).
- If a nest with eggs or chicks is discovered, work should cease within 100 feet (30 m) of the nest and the following actions should be taken:
    - Contact the USFWS within 48 hours for further guidance.
    - Do not conduct potentially disruptive activities or habitat alteration within this 100-foot (30-m) buffer.
    - Have a biological monitor that is familiar with the species’ biology present on the project site during all construction or earth-moving activities until the chicks/ducklings fledge to ensure that Hawaiian waterbirds and nests are not adversely impacted.
- If an endangered Hawaiian waterbird is present or flies into the area during ongoing activities, all activities within 100 feet (30 m) of the bird should cease; the bird should also not be approached. Work may continue after the bird leaves the area of its own accord.
- In areas where waterbirds are known to be present, reduced speed limits should be posted and enforced, and project personnel and contractors should be informed about the presence of endangered species on-site.
- Applicable *Best Management Practices for Work in Aquatic Environments* (Appendix D) should be integrated into the project design.

7.2.4 *Hawaiian Goose or Nēnē*

The Hawaiian goose occupies a variety of habitats, including beach strand, shrubland, grassland, and lava rock, at elevations ranging from coastal lowlands to alpine areas. They are found on the islands of Hawai‘i, Maui, Moloka‘i, and Kaua‘i (Banko 1988; Banko et al. 1999). The geese feed on plant material, with their diet largely dependent on the vegetative composition of their surrounding habitats. Their food primarily consists of leaves and seeds of grasses and sedges, leaves and flowers of various herbaceous composites, and fruits from several shrub species (Banko et al. 1999; Black et al. 1997). Hawaiian geese appear to be opportunistic in their choice of food plants, provided the plants meet their nutritional needs (Banko et al. 1999; Woog and Black 2001). They have an extended breeding season, with eggs reported in all months except May, June, and July, although most nest during the rainy (winter) season between October and March (Banko et al. 1999; Kear and Berger 1980).

Suitable habitat for foraging and nesting was noted during the surveys. To prevent impacts to the Hawaiian goose, the following measures are recommended:

- If a Hawaiian goose is observed in the area during construction activities, all activities within 100 feet (30 meters [m]) of the species should cease, and work should not continue until the species leaves the area on its own accord.
- In areas where the Hawaiian goose is known to occur, post and implement reduced speed limits, and inform project personnel about the presence of the Hawaiian goose.
- Do not approach, feed, or disturb nēnē.
- If nēnē are observed loafing or foraging within the project area during the breeding season (September–April), have a biologist familiar with nēnē nesting behavior survey for nests in and around the project area prior to the resumption of any work. Repeat surveys after any subsequent delay of work of 3 or more days during which the birds may attempt to nest.
- Cease all work immediately and contact the Service for further guidance if a nest is discovered within a radius of 150 feet (45 m) of the proposed project, or a previously undiscovered nest is found within the 150-foot (45-m) radius after work begins.

8 CONCLUSIONS

A survey of the 8.9-acre roundabout project area documented one special-status species—the Hawaiian goose (nēnē). The project site does not overlap with federally designated critical habitat, but several additional species may occur, at least periodically, within the project area, including the Hawaiian common gallinule (‘alae ‘ula), Hawaiian coot (‘alae ke‘oke‘o), Hawaiian duck (koloa maoli), Hawaiian stilt (a‘eo), and Hawaiian hoary bat. Special-status seabirds such as the band-rumped storm-petrel (‘ake‘ake), Hawaiian petrel (‘ua‘u), Newell’s shearwater (‘a‘o), and short-tailed albatross may also fly over the area. No special-status plants were observed, and none are likely to occur due to the project site’s highly modified condition. By implementing the avoidance and minimization measures outlined in this report, the project is not expected to have significant adverse effects on terrestrial biological resources.

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APPENDIX A

Vascular Plant Species Recorded During the May 11, 2025, Survey

Table A-1 provides a checklist of plant species observed by SWCA on May 11, 2025, during surveys of the Kapa‘a Roundabout project area. The plant names are arranged alphabetically by family and then by species into two groups: monocots and dicots. The taxonomy and nomenclature of the flowering plants are in accordance with Wagner et al. (1999) and Staples and Herbst (2005). Recent name changes are those recorded in Wagner et al. (2012).

Table A-1. Vascular Plants Observed within the Project Area on May 11, 2025

Family	Scientific Name and Authorship	Hawaiian and/or Common Name	Status*
Monocots			
Arecaceae	*Cocos nucifera* L.	niu, ololani, coconut	P
Cyperaceae	*Cyperus involucratus* Rottb.	umbrella sedge, ‘ahu‘awa haole, pu‘uka‘a haole	X
Poaceae	*Chloris barbata* Sw.	swollen fingergrass, mau‘u lei	X
Poaceae	*Dactyloctenium aegyptium* (L.) Willd.	beach wiregrass	X
Poaceae	*Urochloa maxima* (Jacq.) R.D.Webster	guineagrass	X
Poaceae	*Urochloa mutica* (Forssk.) T.Q.Nguyen	California grass, Para grass	X
Dicots			
Amaranthaceae	*Alternanthera pungens* Kunth	khaki weed	X
Anacardiaceae	*Schinus terebinthifolius* Raddi	Christmas berry, wilelaiki, nani o Hilo (Moloka‘i)	X
Asteraceae	*Parthenium hysterophorus* L.	false ragweed, Santa Maria	X
Asteraceae	*Pluchea carolinensis* (Jacq.) G.Don	sourbush, marsh fleabane	X
Boraginaceae	*Heliotropium procumbens* var. *depressum* (Cham.) Fosberg		X
Brassicaceae	*Lepidium virginicum* L.	pepperwort, peppergrass	X
Capparaceae	*Cleome gynandra* L.	wild spider flower, spider wisp, honohina, ‘ili‘ohu	X
Convolvulaceae	*Ipomoea obscura* (L.) Ker Gawl.	morning glory	X
Convolvulaceae	*Merremia tuberosa* (L.) Rendle	wood rose, pilikai	X
Euphorbiaceae	*Euphorbia hirta* L.	hairy spurge, garden spurge, koko kahiki	X
Euphorbiaceae	*Macaranga tanarius* (L.) Müll.Arg.	bingabing	X
Fabaceae	*Canavalia cathartica* Thouars	maunaloa	X
Fabaceae	*Desmanthus pernambucanus* (L.) Thell.	slender mimosa, virgate mimosa	X
Fabaceae	*Indigofera spicata* Forssk.	creeping indigo	X
Fabaceae	*Leucaena leucocephala* (Lam.) de Wit	koa haole	X
Fabaceae	*Macroptilium atropurpureum* (DC.) Urb.		X
Fabaceae	*Mimosa pudica* var. *unijuga* (Duchass. & Walp.) Griseb.	sensitive plant, sleeping grass, pua hilahila	X
Malvaceae	*Malvastrum coromandelianum* subsp. *coromandelianum*	false mallow	X
Malvaceae	*Sida rhombifolia* L.		X
Moraceae	*Ficus microcarpa* L.f.	Chinese banyan, Malayan banyan	X
Myrtaceae	*Syzygium cumini* (L.) Skeels	Java plum	X
Onagraceae	*Ludwigia octovalvis* (Jacq.) P.H.Raven	primrose willow, kāmole, alohalua, kāmole lau li‘i, kāmole lau nui	P?

Family	Scientific Name and Authorship	Hawaiian and/or Common Name	Status*
Solanaceae	*Solanum americanum* Mill.	glossy nightshade, pōpolo, ‘olohua, polopolo, pōpolohua (Ni‘ihau)	I?
Verbenaceae	*Stachytarpheta cayennensis* (Rich.) Vahl	ōwī, oï	X
Verbenaceae	*Stachytarpheta jamaicensis* (L.) Vahl	Jamaica vervain, ōwī, oï	X

Notes: I? = probably indigenous but possibly naturalized, P = Polynesian introduced, P? = probably Polynesian introduced but possibly introduced in historic times, X = nonnative.

APPENDIX B

Endangered and Threatened Flora and Fauna Species with the Potential to Occur in the Project Area

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish And Wildlife Office
300 Ala Moana Boulevard, Box 50088
Honolulu, HI 96850-5000
Phone: (808) 792-9400 Fax: (808) 792-9580

In Reply Refer To: 07/03/2025 19:19:12 UTC
Project Code: 2025-0003528
Project Name: Kuhio Highway Intersection Improvements

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened and endangered species, as well as designated critical habitat that may occur within the boundary of your proposed project and that may be affected by project related actions. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Please contact the Service's Pacific Islands Fish and Wildlife Office (PIFWO) at 808-792-9400 if you have any questions regarding your IPaC species list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may adversely affect threatened and endangered species and/or designated critical habitat.

Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a Biological

Evaluation, similar to a Biological Assessment, be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment or Biological Evaluation are described at 50 CFR 402.12.

Due to the significant number of listed species found on each island within PIFWO's regulatory jurisdiction, and the difficulty in accurately mapping ranges for species that we have limited information about, your species list may include more species than if you obtained the list directly from a Service biologist. We recommend you use the species links in IPaC to view the life history, habitat descriptions, and recommended avoidance and minimization measures to assist with your initial determination of whether the species or its habitat may occur within your project area. If appropriate habitat is present for a listed species, we recommend surveys be conducted to determine whether the species is also present. If no surveys are conducted, we err on the side of the species, by regulation, and assume the habitat is occupied. Updated avoidance and minimization measures for plants and animals, best management practices for work in or near aquatic environments, and invasive species biosecurity protocols can be found on the PIFWO website at: https://www.fws.gov/office/pacific-islands-fish-and-wildlife/library.

If a Federal agency determines, based on the Biological Assessment or Biological Evaluation, that a listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at: http://www.fws.gov/endangered/esa-library/index.

Non-federal entities can also use the IPaC generated species list to develop Habitat Conservation Plans (HCP) in accordance with section 10(a)(1)(B) of the Act. We recommend HCP applicants coordinate with the Service early during the HCP development process. For additional information on HCPs, the Habitat Conservation Planning handbook can be found at https://www.fws.gov/sites/default/files/documents/habitat-conservation-planning-handbook-entire.pdf.

Please be aware that wind energy projects should follow the Service’s wind energy guidelines (http://www.fws.gov/windenergy) for minimizing impacts to migratory birds. Listed birds and the Hawaiian hoary bat may also be affected by wind energy development and we recommend development of a Habitat Conservation Plan for those species, as described above. Guidance for minimizing impacts to migratory birds for projects including communications towers can be found at:

- http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers
- http://www.towerkill.com
- http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow

Fish and Wildlife Coordination Act: Any modification to freshwater or marine waters of the U.S. including impounding, diverting, deepening, controlling, or modification for any other purpose requires a Fish and Wildlife Coordination Act (FWCA) consultation with the U.S Fish and Wildlife Service, State/ Territorial wildlife agency (State of Hawaii Division of Aquatic

Resources, American Samoa’s Department of Marine and Wildlife Resources, Guam’s Division of Aquatic and Wildlife Resources, or the Northern Mariana Island’s Division of Fish and Wildlife) and the National Marine Fisheries Service. The Pacific Islands Fish and Wildlife Office in Honolulu should be notified of a FWCA consultation request with a project description and any relevant biological information in order to expedite the appropriate level of coordination and consultation needs.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation actions that benefit threatened and endangered species into their project planning to further the purposes of the Act in accordance with section 7(a)(1). Please include the Consultation Tracking Number associated with your IPaC species list in any request for consultation or correspondence about your project that you submit to our office. Please feel free to contact us at PIFWO_admin@fws.gov or 808-792-9400 if you need more current information or assistance regarding the potential impacts to federally listed species and federally designated critical habitat.

Attachment(s):

- Official Species List

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Pacific Islands Fish And Wildlife Office
300 Ala Moana Boulevard, Box 50088
Honolulu, HI 96850-5000
(808) 792-9400

PROJECT SUMMARY

Project Code: 2025-0003528

Project Name: Kuhio Highway Intersection Improvements

Project Type: Road/Hwy - Maintenance/Modification

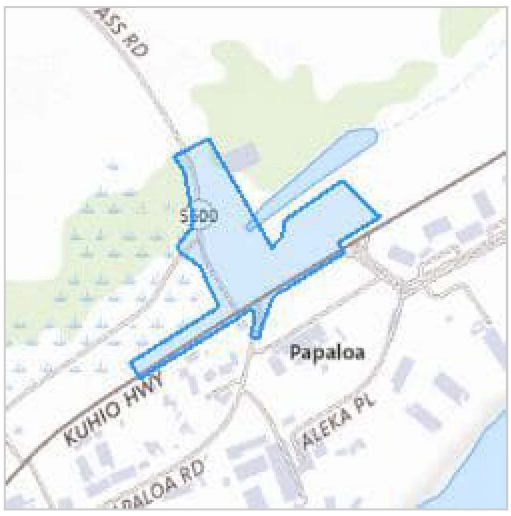
Project Description: The Project Action Area exists at the intersection of Kuhio Highway, Papaloa Road (North) and Kapaa Bypass Road in Kapaa on Kauai Island. The Project Action Area is approximately 8.96 acres and encompasses the Hawaii Belt Road Right of way as well as some private TMK parcels mauka of the ROW. Staging will occur mauka of the Hawaii Belt Road ROW. The surrounding land uses are agricultural lands and urban lands. There are 3 wetlands within the project area.

The purpose of the project is to improve intersection functionality by combing the two unsignalized T intersections into one signalized intersection. This will be done by relocating Kapaa Bypass Road to where Papaloa Road intersects with Kuhio Highway. The project will also include installing new highway lights which will be shielded down and on a narrow spectrum.

The project area off of the road and staging area is densely vegetated and will require clearing. Staging areas will be restored to an improved condition after construction is completed.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@22.055385049999998,-159.32962726765373,14z



Counties: Kauai County, Hawaii

ENDANGERED SPECIES ACT SPECIES

There is a total of 21 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Hawaiian Hoary Bat *Lasiurus cinereus semotus*	Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/770
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/6477.pdf

BIRDS

NAME	STATUS
Band-rumped Storm-petrel *Hydrobates castro*	Endangered

Population: USA (HI)
No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/1226
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/6939.pdf

Hawaiian Common Gallinule *Gallinula galeata sandvicensis* — Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/6612
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/6934.pdf

Hawaiian Coot (alae Ke`oke`o) *Fulica alai* — Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/7233
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/6934.pdf

Hawaiian Duck *Anas wyvilliana* — Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/7712
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/6934.pdf

Hawaiian Goose *Branta (=Nesochen) sandvicensis* — Threatened

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/1627
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/6925.pdf

Hawaiian Petrel *Pterodroma sandwichensis* — Endangered

No critical habitat has been designated for this species.

NAME STATUS

Species profile: https://ecos.fws.gov/ecp/species/6746
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/6939.pdf

Hawaiian Stilt *Himantopus mexicanus knudseni* Endangered
No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/2082
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/6934.pdf

Newell"s Shearwater *Puffinus newelli* Threatened
No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/2048
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/6939.pdf

Short-tailed Albatross *Phoebastria (=Diomedea) albatrus* Endangered
No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/433

REPTILES

NAME STATUS

Hawksbill Sea Turtle *Eretmochelys imbricata* Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/3656

FLOWERING PLANTS

NAME STATUS

`awikiwiki *Canavalia napaliensis* Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/1325

Awiwi *Schenkia sebaeoides* Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/7103

Carter's Panicgrass *Panicum fauriei var. carteri* Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/5578

Cyperus pennatiformis Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/6868

Ihi *Portulaca villosa* Endangered
No critical habitat has been designated for this species.

NAME	STATUS
Species profile: https://ecos.fws.gov/ecp/species/4886	
Kadua st.-johnii	Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.	
Species profile: https://ecos.fws.gov/ecp/species/4337	
Makou *Peucedanum sandwicense*	Threatened
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.	
Species profile: https://ecos.fws.gov/ecp/species/5579	
Ohai *Sesbania tomentosa*	Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.	
Species profile: https://ecos.fws.gov/ecp/species/8453	
General project design guidelines: https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/7050.pdf	
Pu`uka`a *Cyperus trachysanthos*	Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.	
Species profile: https://ecos.fws.gov/ecp/species/7749	

FERNS AND ALLIES

NAME	STATUS
Microlepia strigosa var. mauiensis	Endangered
No critical habitat has been designated for this species.	
Species profile: https://ecos.fws.gov/ecp/species/4737	

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

IPAC USER CONTACT INFORMATION

Agency: Private Entity
Name: Isabella McRae
Address: 1001 Bishop Street
Address Line 2: Suite 2400
City: Honolulu
State: HI
Zip: 96813
Email isabella.mcrae@wsp.com
Phone: 8084458535

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Hawaii Department of Transportation
Name: Eric Fujikawa
Email: eric.i.fujikawa@gawaii.gov
Phone: 8082413015

APPENDIX C

Biosecurity Guidelines

SWCA recommends the following invasive species minimization measures to avoid the unintentional introduction or transport of invasive species to Kaua‘i:

- All construction equipment and vehicles arriving from outside of Kaua‘i should be washed and inspected before entering the project area.
- Construction materials arriving from outside of Kaua‘i should also be washed and/or visually inspected (as appropriate) for excessive debris, plant materials, and invasive or harmful nonnative species (plants, amphibians, reptiles, and insects).
- Inspection and cleaning activities should be conducted at a designated location before entering the project area. The inspectors should be qualified botanists and/or entomologists able to identify invasive species that are of concern relevant to the point of origin of the equipment, vehicle, or material.
- When possible, raw materials (e.g., gravel, rock, soil) should be purchased from a local supplier on Kaua‘i to avoid introducing nonnative species not yet present on the island.
- If landscaping occurs as part of the project, native Hawaiian plants or noninvasive, nonnative plants should be used to the maximum extent possible. Additional information on selecting appropriate (noninvasive) plants for landscaping can be obtained from the following online sources:
    - Plant Pono: https://plantpono.org/
    - Hawaiian Ecosystems at Risk project (HEAR) Alternatives to Invasives: Phttp://www.hear.org/alternativestoinvasives/pdfs/mcaac_hpwra_a2i_list.pdf
    - HEAR What Not to Plant: http://www.hear.org/oisc/oahuearlydetectionproject/pdfs/oedposterwhatnottoplant.pdf

APPENDIX D

Best Management Practices for Work in Aquatic Environments

U.S. Fish and Wildlife Service
Recommended Standard Best Management Practices

The U.S. Fish and Wildlife Service (USFWS) recommends the following measures to be incorporated into project planning to avoid or minimize impacts to fish and wildlife resources. Best Management Practices (BMPs) include the incorporation of procedures or materials that may be used to reduce either direct or indirect negative impacts to aquatic habitats that result from project construction-related activities. These BMPs are recommended in addition to, and do not over-ride any terms, conditions, or other recommendations prepared by the USFWS, other federal, state or local agencies. If you have questions concerning these BMPs, please contact the USFWS Aquatic Ecosystems Conservation Program at 808-792-9400.

1. Authorized dredging and filling-related activities that may result in the temporary or permanent loss of aquatic habitats should be designed to avoid indirect, negative impacts to aquatic habitats beyond the planned project area.

2. Dredging/filling in the marine environment should be scheduled to avoid coral spawning and recruitment periods, and sea turtle nesting and hatching periods. Because these periods are variable throughout the Pacific islands, we recommend contacting the relevant local, state, or federal fish and wildlife resource agency for site specific guidance.

3. Turbidity and siltation from project-related work should be minimized and contained within the project area by silt containment devices and curtailing work during flooding or adverse tidal and weather conditions. BMPs should be maintained for the life of the construction period until turbidity and siltation within the project area is stabilized. All project construction-related debris and sediment containment devices should be removed and disposed of at an approved site.

4. All project construction-related materials and equipment (dredges, vessels, backhoes, silt curtains, etc.) to be placed in an aquatic environment should be inspected for pollutants including, but not limited to; marine fouling organisms, grease, oil, etc., and cleaned to remove pollutants prior to use. Project related activities should not result in any debris disposal, non-native species introductions, or attraction of non-native pests to the affected or adjacent aquatic or terrestrial habitats. Implementing both a litter-control plan and a Hazard Analysis and Critical Control Point plan (HACCP – see https://www.fws.gov/policy/A1750fw1.html) can help to prevent attraction and introduction of non-native species.

5. Project construction-related materials (fill, revetment rock, pipe, etc.) should not be stockpiled in, or in close proximity to aquatic habitats and should be protected from erosion (*e.g.*, with filter fabric, etc.), to prevent materials from being carried into waters by wind, rain, or high surf.

6. Fueling of project-related vehicles and equipment should take place away from the aquatic environment and a contingency plan to control petroleum products accidentally spilled during the project should be developed. The plan should be retained on site with the person responsible for compliance with the plan. Absorbent pads and containment booms should be stored on-site to facilitate the clean-up of accidental petroleum releases.

7. All deliberately exposed soil or under-layer materials used in the project near water should be protected from erosion and stabilized as soon as possible with geotextile, filter fabric or native or non-invasive vegetation matting, hydro-seeding, etc.

Appendix A-3
Regulatory Coordination and Correspondence

National Marine Fisheries Service (NMFS) Endangered Species Act Section 7

U.S. Department of Transportation
Federal Highway Administration

Federal Highway Administration
Hawaii Division
&
National Oceanic and Atmospheric Administration
Pacific Islands Regional Office Protected Resources Division

ENDANGERED SPECIES ACT SECTION 7 PROGRAMMATIC CONSULTATION
HI-WAYSLOPES NOTIFICATION AND VERIFICATION FORM

This form constitutes informal consultation and a request for concurrence under the Standard Local Operating Procedures for Endangered Species in Hawaii (HI-waySLOPES). The Federal Highway Administration (FHWA) is requesting verification from the National Oceanic and Atmospheric Administration (NOAA) that the above referenced project meets all requirements of the Standard Local Operating Procedures for Endangered Species in Hawaii Programmatic Consultation (HI-waySLOPES). The FHWA determined the proposed action is not likely to adversely affect species listed under the Endangered Species Act or their designated critical habitat administered by the National Marine Fisheries Service (NMFS). The project sponsor will be required to comply with the HI-waySLOPES conservation measures and activity-specific best management practices (BMPs) to avoid effects to threatened and endangered marine species.

Date of Request:
Date of Requested NMFS Response:
Federal-aid Project No.: NH-056-1(066)
NOAA PIRO Reference No.: TBD
Project Sponsor (HDOT or LPA): **HDOT**
Project Manager, Name, Phone, & Email: Eric Fujikawa, 808-241-3015, eric.i.fujikawa@hawaii.gov
Project Title: **Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road**
Project Location (attach a map): **Kapaa, Kauai Island (See Attachment 1: Project Location Map)**
Project Latitude and Longitude (approximate): **22°03'18.4"N, 159°19'46.9"W**
Water Body Adjacent or Above: **Untitled Wetland Areas (R4SBC, PEM1A, PUBHx). See Attachment 2: Wetlands map.**
Project Description (Scope of Work, if more space is needed, please attach description to form.): **The State of Hawai'i Department of Transportation (HDOT) is planning improvements to Kuhio Highway at its intersections with Papaloa Road and Kapaa Bypass Road.** **The HDOT is currently evaluating realigning the southern terminus of Kapaa Bypass Road at Kuhio Highway to intersect with the existing intersection of Kuhio Highway and Papaloa Road (North) near the Coconut Marketplace. The realignment will consolidate the two (2) existing T intersections into a single full access intersection. In addition to consolidating the intersections, the realignment will provide the opportunity to allow left turns from Papaloa Road (North) onto Kuhio Highway. Installation of approximately 30-foot tall, safety standard compliant highway lights is also proposed as a part of this project. The purpose of the intersection improvements is to improve safety and connectivity of the road and ease traffic in the area.** **The project area is approximately 8.96 acres and includes the Kuhio Highway ROW and private-owned parcels. Construction staging will occur on a private parcel in the northeast portion of the project area, mauka of Kuhio Highway. Vegetation clearing will occur to allow for staging. After construction, the staging areas will be restored to an improved condition.**

COVERED ACTIVITIES:
Please select the activities included in the scope of work for the project. More detailed information about the activities is included in the Biological Evaluation.

- [X] Road repair, resurfacing, and/or reconstruction
- [ ] Bridge repair, rehabilitation, and/or replacement
- [X] Grading and establishment of staging and storage areas
- [ ] Geotechnical Drilling
- [X] Grading of access roads and traffic detours

NOAA SPECIES/CRITICAL HABITAT IN ACTION AREA:
Please select the species and/or designated critical habitat that occurs in the action area.

- [X] Green sea turtle (*Chelonia mydas*), Central North Pacific DPS – threatened
- [X] Hawksbill sea turtle (*Eretmochelys imbricate*) – endangered
- [X] Hawaiian monk seal (*Monachus schauinslandi*) – endangered
- [X] Hawaiian monk seal (*Monachus schauinslandi*) – critical habitat

Please provide justification, description of marine environment to be impacted, additional BMPs, special conditions and/or additional avoidance and minimization measures the applicant has proposed in order to comply with the HI-waySLOPES programmatic consultation and to ensure the proposed project is not likely to adversely affect endangered or threatened species under NMFS jurisdiction or to destroy or adversely modify critical habitat. Attach map and drawings.

The project area lies approximately 1,000 feet inland of the shoreline and the designated Critical Monk Seal Habitat and Proposed Critical Green Sea Turtle Habitat. Land between the shoreline and the project area is urbanized and developed. The project area does not overlap with any sandy beach. See Attachment 1: Project Area Map. According to the U.S. Fish and Wildlife Service's National Wetland Inventory, project activities will overlap with five freshwater wetlands of three different classifications (Freshwater Emergent Wetland- PEM1A; Freshwater pond- PUBHx; and Riverine-R4SBC). None of these wetlands directly connect with the marine environment and only the freshwater pond is permanently flooded. No in-water work is anticipated to occur during the project.

Given the project's distance from the shoreline and actions, the project is not likely to adversely affect species listed under the Endangered Species Act or their critical habitat administered by the National Marine Fisheries Services (NMFS), such as the Green Sea Turtle and Hawaiian Monk Seal.

CONSERVATION MEASURES:
All applicable conservation measures shall be included in the Plans or Specifications.

All projects covered under HI-waySLOPES shall implement the following conservation measures:

1. Constant vigilance shall be kept for the presence of ESA-listed marine species (sea turtles and Hawaiian monk seals) during all aspects of the action.
2. A responsible party (i.e., permittee/site manager/project supervisor) shall designate a competent observer to search/monitor work sites and the areas adjacent to the authorized work area for ESA-listed marine species.
3. Work shall be postponed or halted when ESA-listed marine species are within 50 yards.
4. A pollution and erosion control plan for the project site and adjacent areas must be prepared and carried out. As a minimum, this plan shall include:
    a. Proper installation and maintenance of silt fences/curtains, sausages, equipment diapers, or drip pans.
    b. A contingency plan to control and clean spilled petroleum products and other toxic materials.
    c. Appropriate materials to contain and clean potential spills will be stored at the work site, and be readily available.
    d. All project-related materials and equipment placed in the water will be free of pollutants.
    e. Daily pre-work inspections of heavy equipment for cleanliness and leaks, with all heavy equipment operations postponed or halted until leaks are repaired and equipment is cleaned.
    f. Fueling of project-related vehicles and equipment will take place at least 50 feet away from the water and within a containment area, preferably over an impervious surface.
5. BMPs shall be implemented in accordance with An Integrated Storm Water Management Approach and a Summary of Clear Water Diversion and Isolation Best Management Practices for Use in the State of Hawaii, by the Federal Highway Administration and Hawaii Department of Transportation Practitioners Guide (2016) or the Construction Best Management Practices Field Manual by the State of Hawaii Department of Transportation (2008).

Does the project have in-water work?

- [ ] Yes
- [X] No

If yes, then the following conservation measures shall be implemented:

1. All objects will be lowered to the bottom in a controlled manner. This can include the use of buoyancy controls such as lift bags, or the use of cranes, winches, or other equipment that affect positive control over the rate of descent.
2. Special Attention shall be given to ensure that no ESA-listed marine species are within 50 yards of maintenance dredging, in-water excavation and movement of large armor stones, and benthic core sampling, and that those operations will immediately shut-down should any ESA-listed species enter within that range.
3. Full-depth silt curtains (or alternative as described in justification) shall be installed around all work sites with the potential to disturb and mobilize sediments. This will contain mobilized sediments in the marine environment and reduce the potential for elevated turbidity.

COVERED ACTIVITIES:
Please select the activities included in the scope of work for the project. More detailed information about the activities is included in the Biological Evaluation.

- [X] Road repair, resurfacing, and/or reconstruction
- [ ] Bridge repair, rehabilitation, and/or replacement
- [X] Grading and establishment of staging and storage areas
- [ ] Geotechnical Drilling
- [X] Grading of access roads and traffic detours

NOAA SPECIES/CRITICAL HABITAT IN ACTION AREA:
Please select the species and/or designated critical habitat that occurs in the action area.

- [X] Green sea turtle (*Chelonia mydas*), Central North Pacific DPS – threatened
- [X] Hawksbill sea turtle (*Eretmochelys imbricate*) – endangered
- [X] Hawaiian monk seal (*Monachus schauinslandi*) – endangered
- [X] Hawaiian monk seal (*Monachus schauinslandi*) – critical habitat

Please provide justification, description of marine environment to be impacted, additional BMPs, special conditions and/or additional avoidance and minimization measures the applicant has proposed in order to comply with the HI-waySLOPES programmatic consultation and to ensure the proposed project is not likely to adversely affect endangered or threatened species under NMFS jurisdiction or to destroy or adversely modify critical habitat. Attach map and drawings.

The project area lies approximately 1,000 feet inland of the shoreline and the designated Critical Monk Seal Habitat and Proposed Critical Green Sea Turtle Habitat. Land between the shoreline and the project area is urbanized and developed. The project area does not overlap with any sandy beach. See Attachment 1: Project Area Map. According to the U.S. Fish and Wildlife Service's National Wetland Inventory, project activities will overlap with five freshwater wetlands of three different classifications (Freshwater Emergent Wetland- PEM1A; Freshwater pond- PUBHx; and Riverine-R4SBC). None of these wetlands directly connect with the marine environment and only the freshwater pond is permanently flooded. No in-water work is anticipated to occur during the project.

Given the project's distance from the shoreline and actions, the project is not likely to adversely affect species listed under the Endangered Species Act or their critical habitat administered by the National Marine Fisheries Services (NMFS), such as the Green Sea Turtle and Hawaiian Monk Seal.

RECOMMENDATION BY PROJECT SPONSOR:

The Project Sponsor recommends to FHWA that the proposed project be considered consistent with HI-waySLOPES **programmatic consultation.** Additionally, the Project Sponsor agrees to implement the applicable conservation measures and agrees to re-consult if there is any change in the description of the project or new information reveals that the effects of the proposed action may affect ESA-listed species in a manner or extent not previously considered, or a new species or critical habitat is designated that may be affected by the proposed action.

Recommended by HDOT and/or LPA Project Manager:

Signature:	Date: 10/29/2025

FHWA DETERMINATION:

FHWA has determined that the proposed project meets all requirements of the HI-waySLOPES and that the proposed action is not likely to adversely affect species listed under the Endangered Species Act or their designated critical habitat administered by the NMFS. The FHWA requests concurrence from NMFS with this determination.

FHWA Signature:	Date: 11/3/25

NMFS CONCURRENCE:

☒ NMFS concurs with the FHWA determination that the proposed project is consistent with HI-waySLOPES, as described and checked above.

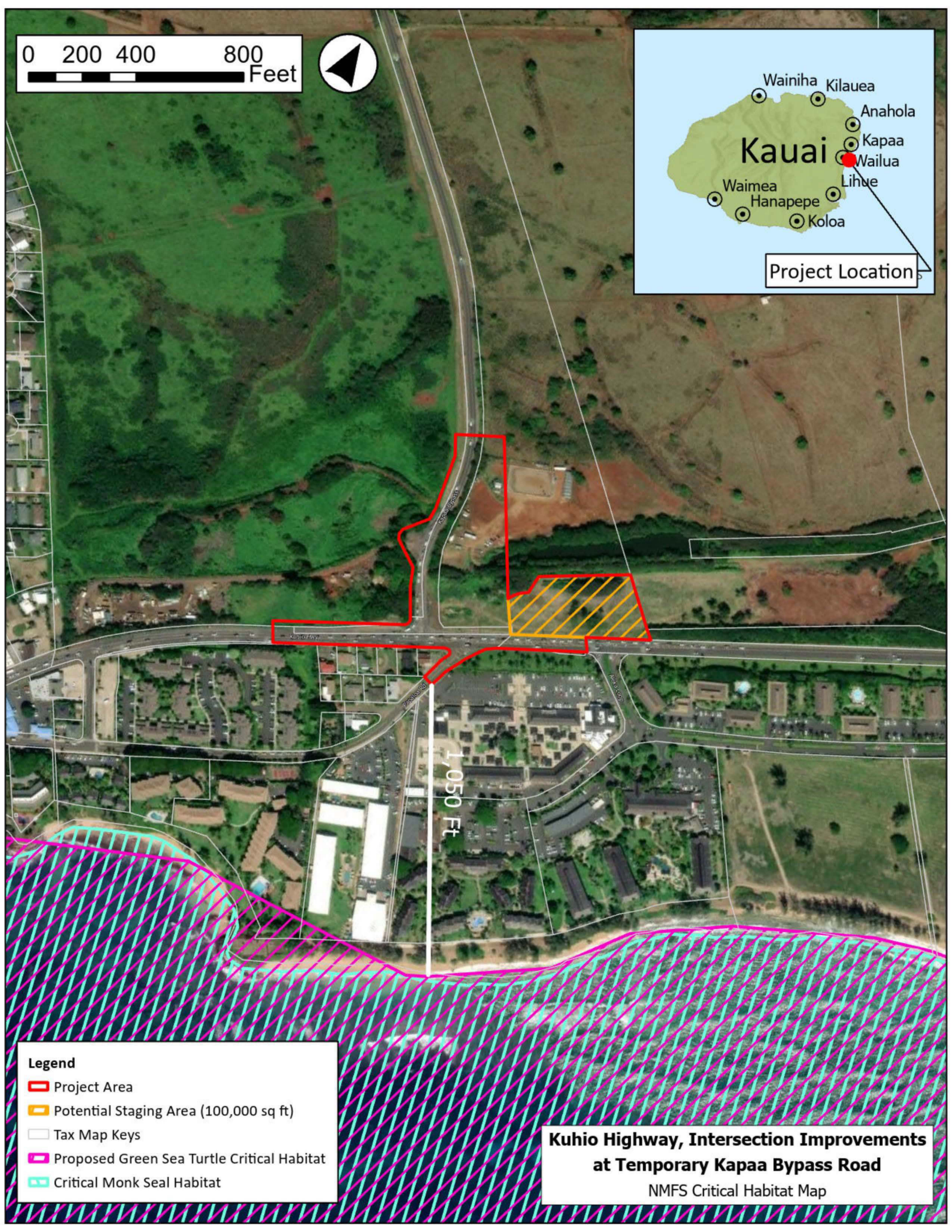
☐ NMFS does not concur with the FHWA determination that the project is consistent with HI-waySLOPES, as described and checked above, and requests an individual Section 7 consultation.

NMFS Signature:	Date: 11/3/25

ATTACHMENTS:

Please select documents attached to form.

- [X] Project Location Map
- [ ] Project Description
- [ ] Drawings
- [X] Photos
- [ ] Other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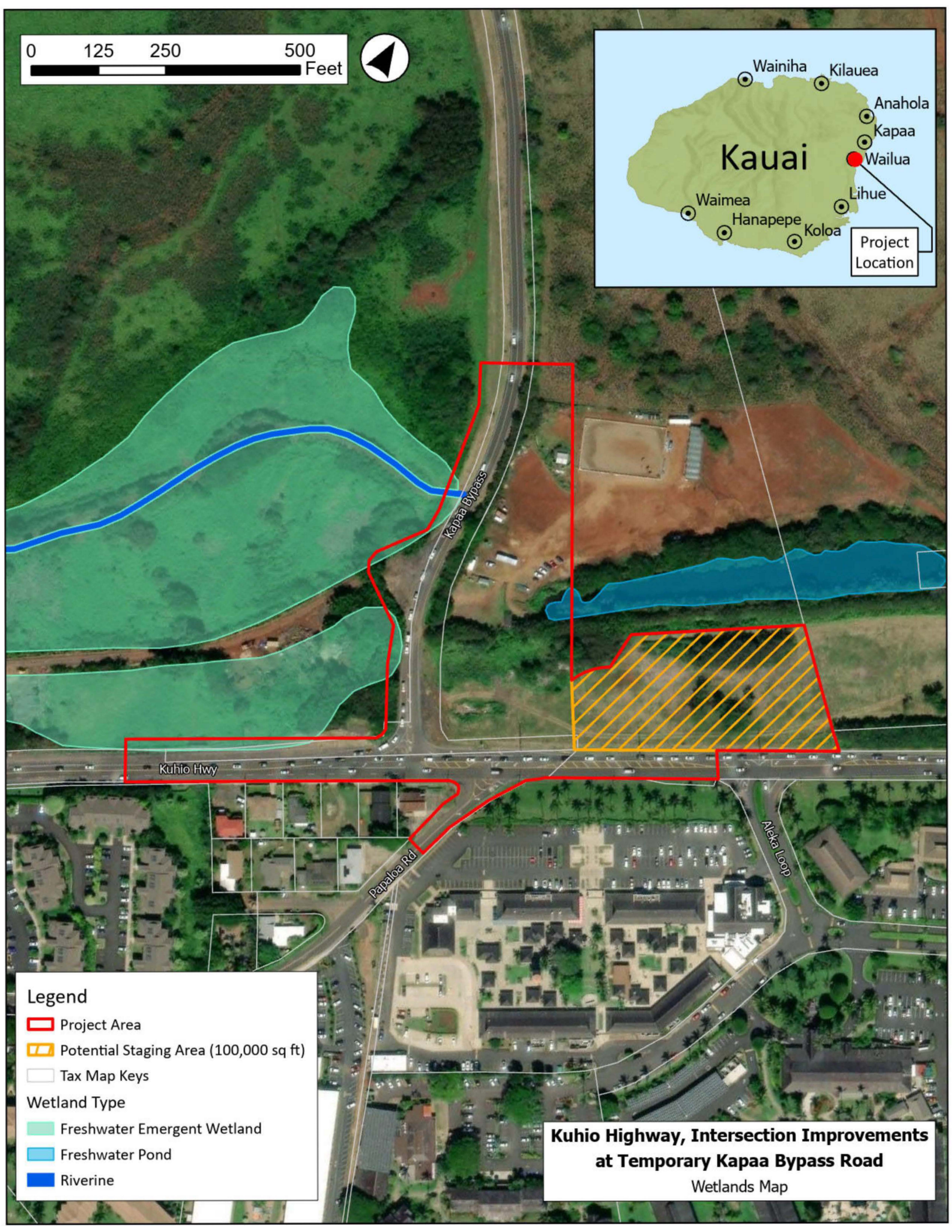
Feet
Wainiha
Kilauea
Anahola
Kauai
Kapaa
Wailua
Lihue
Waimea
Hanapepe
Koloa
Project Location
1,050 Ft
Legend
Project Area
Potential Staging Area (100,000 sq ft)
Tax Map Keys
Proposed Green Sea Turtle Critical Habitat
Critical Monk Seal Habitat
Kuhio Highway, Intersection Improvements at Temporary Kapaa Bypass Road
NMFS Critical Habitat Map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Wainiha
Kilauea
Anahola
Kapaa
Kauai
Wailua
Lihue
Waimea
Hanapepe
Koloa
Project Location
Kapaa Bypass
Kuhio Hwy
Papaloa Rd
Aleka Loop
Legend
Project Area
Potential Staging Area (100,000 sq ft)
Tax Map Keys
Wetland Type
Freshwater Emergent Wetland
Freshwater Pond
Riverine
Kuhio Highway, Intersection Improvements at Temporary Kapaa Bypass Road
Wetlands Map



Kuhio Highway, facing west-southwest.

Source: Keala Pono, 2024



Source: Keala Pono, 2024

Kuhio Highway, facing northeast.



Source: Keala Pono, 2024

Kapaa Bypass Road and dirt shoulder, facing north.



Source: Keala Pono, 2024

Staging Area, facing southeast

Appendix A-3
Regulatory Coordination and Correspondence

NMFS Essential Fish Habitat

U.S. Department of Transportation
Federal Highway Administration

Hawaii Federal-Aid Division

June 17, 2025

300 Ala Moana Blvd, Rm 3-229
PO Box 50206
Honolulu, Hawaii 96850
Phone: (808) 541-2700
FHWA-Hawaii.Intake@dot.gov

In Reply Refer To:
HDA-HI

Ms. Sarah Malloy
Regional Administrator, Pacific Islands Regional Office
National Oceanic and Atmospheric Administration
NOAA Inouye Regional Center, NMFS/PIRO
1845 Wasp Boulevard, Building 176
Honolulu, HI 96818

Subject: Magnuson-Stevens Fishery Conservation and Management Act
Essential Fish Habitat Consultation
Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road Southern Terminus
Federal-aid Project No. NH-056-1(066)

Dear Ms. Malloy:

The Federal Highway Administration (FHWA), in cooperation with the State of Hawaii Department of Transportation (HDOT), is planning the Kuhio Highway Intersection Improvements project. Pursuant to Section 305(b)(2)(4) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), the FHWA is requesting Essential Fish Habitat (EFH) consultation with the National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) for the proposed project. With the implementation of best management practices (BMPs), the FHWA proposes that the project will have no more than minimal adverse effects on EFH and managed species.

Description of the Proposed Action

The proposed intersection improvements are located at the intersection of Kuhio Highway and Papaloa Road (North) and Kuhio Highway and Kapaa Bypass Road intersection in Kapaa near the Coconut Marketplace. The subject intersection is approximately 1000 feet from the closest EFH. The proposed project area coordinates are 22°03’18.4”N, 159°19’46.9”W.

HDOT is currently evaluating realigning the southern terminus of Kapaa Bypass Road at Kuhio Highway to intersect the existing intersection of Kuhio Highway with Papaloa Road (North). The realignment would consolidate the two (2) existing T intersections into a single full access intersection. In addition to consolidating the intersections, the realignment would provide the opportunity to allow left turns from Papaloa Road (North) onto Kuhio Highway. Installation of approximately 30-foot tall, safety standard compliant highway lights is also proposed as a part of this project. The purpose of these intersection improvements is to improve safety and connectivity of the road and ease traffic in the area.

The proposed action area is approximately 8.96 acres and consists of the highway right-of-way, privately owned TMK parcels. Construction staging would occur in approximately 2.3 acres of the project area in the northeast portion of the project area, mauka of Kuhio Highway. Vegetation clearing may be required to access and use the staging area. Please see enclosed Attachment 1: Project Location Map.

Most work would occur during the weekday daytime hours; however, the length of the project necessitates night work to minimize traffic impacts on the surrounding community and reduce the length of the project schedule. Construction is estimated to start some time in 2027 and take 2 years to complete.

Equipment

The contractor would use various types of roadway construction vehicles and equipment which may include the following but would be at the discretion of the selected contractor: excavator, backhoe, loader, concrete truck, crane, roller, paver, and drill rig. The contractor is required to monitor noise and emission levels from all construction activities relating to vehicles, construction equipment and power tools.

Analysis of Potential Adverse Effects on EFH and Managed Species

The Magnuson-Stevens Act requires that each federal agency consult with regard to any federal action that may adversely affect EFH (16 U.S.C. 1855(b)(2)).

The Magnuson-Stevens Act defines EFH as "those waters and substrate necessary to fish for spawning, breeding or growth to maturity" (50 CFR 600.10). Based on this definition, the Fishery Management Councils, who are charged with developing fishery management plans for their respective regions, are able to approach fish stock management based on place or ecosystem rather than species. Utilizing best available scientific information, the Western Pacific Regional Fishery Management Council has established EFH for Bottomfish and Seamount Groundfish, Crustaceans, Precious Corals, Coral Reef Ecosystems, and Pelagics. The Management Unit Species (MUS) and life stages found in these waters include eggs, larvae, juveniles, and adults of Bottomfish, Crustacean, and Pelagic MUS. Specific types of habitats considered as EFH include coral reef, patch reefs, hard substrate, artificial substrate, seagrass beds, soft substrate, lagoon, estuarine, surge zone, deep-slope terraces and pelagic/open ocean.

Management Unit Species	**EFH for Eggs and Larvae**	**EFH for Juveniles and Adults**
Bottomfish	Water column down to 400 meters depth from shoreline out to the 200-mile U.S. Exclusive Economic Zone (EEZ) boundary.	Water column and all bottom from shoreline down to 400 meters depth.
Seamount Groundfish	Water column down to 200 meters depth of all EEZ waters bounded by 29 degree–35 degree North and 171 degree East – 179 degree West.	Water column down to 200 meters depth of all EEZ waters bounded by 29 degree–35 degree North and 171 degree East – 179 degree West.

Pelagics	Water column down to 200 meters depth from shoreline out to EEZ boundary.	Water column down to 1,000 meters depth from shoreline out to EEZ boundary.
Precious Corals	Known precious coral beds in the Hawaiian Islands located at: Keāhole point, between Miloli‘i and South Point, the ‘Au‘au Channel, Makapu‘u, Ka‘ena point, the southern border of Kaua‘i, Wespac bed, Brooks bank bed, and 180 Fathom Bank.	Known precious coral beds in the Hawaiian Islands located at: Keāhole point, between Miloli‘i and South Point, the ‘Au‘au Channel, Makapu‘u, Ka‘ena point, the southern border of Kaua‘i, Wespac bed, Brooks bank bed, and 180 Fathom Bank.
Coral Reef Ecosystems	Water column and all bottom down to 100 meters depth from shoreline out to EEZ boundary.	Water column and all bottom down to 100 meters depth from shoreline out to EEZ boundary.
Crustaceans	Lobsters/crab: water column down to 150 meters depth from shoreline out to EEZ boundary. Deepwater shrimp: outer reef slopes between 300-700 meters depth.	Lobsters/crab: bottom from shoreline down to 100 meters depth Deepwater shrimp: outer reef slopes between 550-700 meters depth.

Source: (Essential Fish Habitat in the Pacific Islands, 2024)

The possible sources of adverse impacts to EFH which may be relevant to this project include coastal construction and nutrient loading. Potential adverse impacts of these activities include biological availability of toxic substances, contaminant runoff, and sediment runoff. However, given the project location’s distance to the EFH and project scope, potential effects (direct and indirect) to Essential Fish Habitats are unlikely.

The proposed project location is approximately 1,000 feet inland from the nearest EFH and is likely too geographically distant to produce potential adverse effects to EFH from the proposed action. See enclosed Attachment 3: Site Photos. Additionally, although the U.S. Fish and Wildlife Service’s National Wetland Inventory identified wetlands within the project area, no in-water work is anticipated to occur during the project. Additionally, these wetlands do not directly connect with the ocean. See Attachment 4: Wetlands Map. With the implementation of proposed BMPs (described in the following section), the project is not likely to result in any direct or indirect impediment to the life cycles of managed species. BMPs would control both direct and indirect impacts to EFH from construction activities.

Project Best Management Practices and Avoidance and Minimization Measures

BMPs would be implemented during construction to minimize the potential for impacts to water quality and EFH. BMPs for in-water and land-based construction would be implemented in accordance with the documented approach, *An Integrated Storm Water Management Approach and A Summary of Clear Water Diversion and Isolation Best Management Practices for Use in the State of Hawaii* by the Federal Highway Administration and Hawaii Department of Transportation Practitioners Guide (2016) or the *Construction Best Management Practices Field Manual* by the State of Hawaii Department of Transportation (2021).

Specific BMPs and minimization measures to be implemented include

1. Waste Management – Concrete wastes, solid wastes, and any sanitary/septic wastes will be located away from and managed to assure no contamination to the critical habitats and discharge will be prevented from going into the ground and the water.

2. Vehicle and Equipment Management – All vehicles and equipment cleaning, maintenance, and refueling will be located away from and managed to assure no contamination. Invasive species controls shall be maintained to ensure that all materials transported from off-site are free of such species.

3. Storm Water Management and Erosion Control – Site-specific storm water BMPs will be implemented and/or installed at the road staging and work areas to prevent water quality degradation associated with storm water runoff. The Contractor will be required to install and maintain BMPs as part of the proposed project. The Contractor will be required to prevent any debris from falling into the water. Stormwater BMPs include maintaining equipment in good working order and storing materials and equipment with absorbent materials between equipment and waterbodies. Drip pans would also be required to be maintained beneath construction equipment.

4. The project will stop work during storms or heavy rains to minimize the amount of dirt and debris entering the marine environment.

5. The HDOT Standard Specification for Road and Bridge Construction Section 209 Temporary Water Pollution, Dust, and Erosion Control will be followed.

6. The project will require temporary construction laydown areas. Stockpiling, storage, and equipment staging will utilize appropriate BMPs to prevent potential surface runoff from laydown area.

7. Invasive species controls shall be maintained to ensure that all materials transported from off-site are free of such species.

8. A plan will be developed for managing equipment, materials, and job site conditions in the event of approaching foul weather (e.g., tropical storms and hurricanes). This plan may outline potential removal of equipment and materials or measures to adequately secure equipment and materials.

Request for Concurrence

Based on the nature of the proposed work and implementation of the proposed BMPs, the FHWA believes there will be no more than minimal adverse effects to EFH and managed species. We are seeking concurrence that the proposed action will have no more than minimal adverse effects to EFH and managed species. We respectfully request your response within 30 days of receipt of this letter.

If you have any questions, please feel free to contact Meesa Otani, Transportation Engineer, at (808) 541-2316 or by email at meesa.otani@dot.gov. Thank you for your assistance.

Sincerely yours,

Digitally signed by
MEESA T. OTANI
Date: 2025.06.17
08:04:18 -10'00'

for Richelle M. Takara, P.E.
Division Administrator

Enclosures

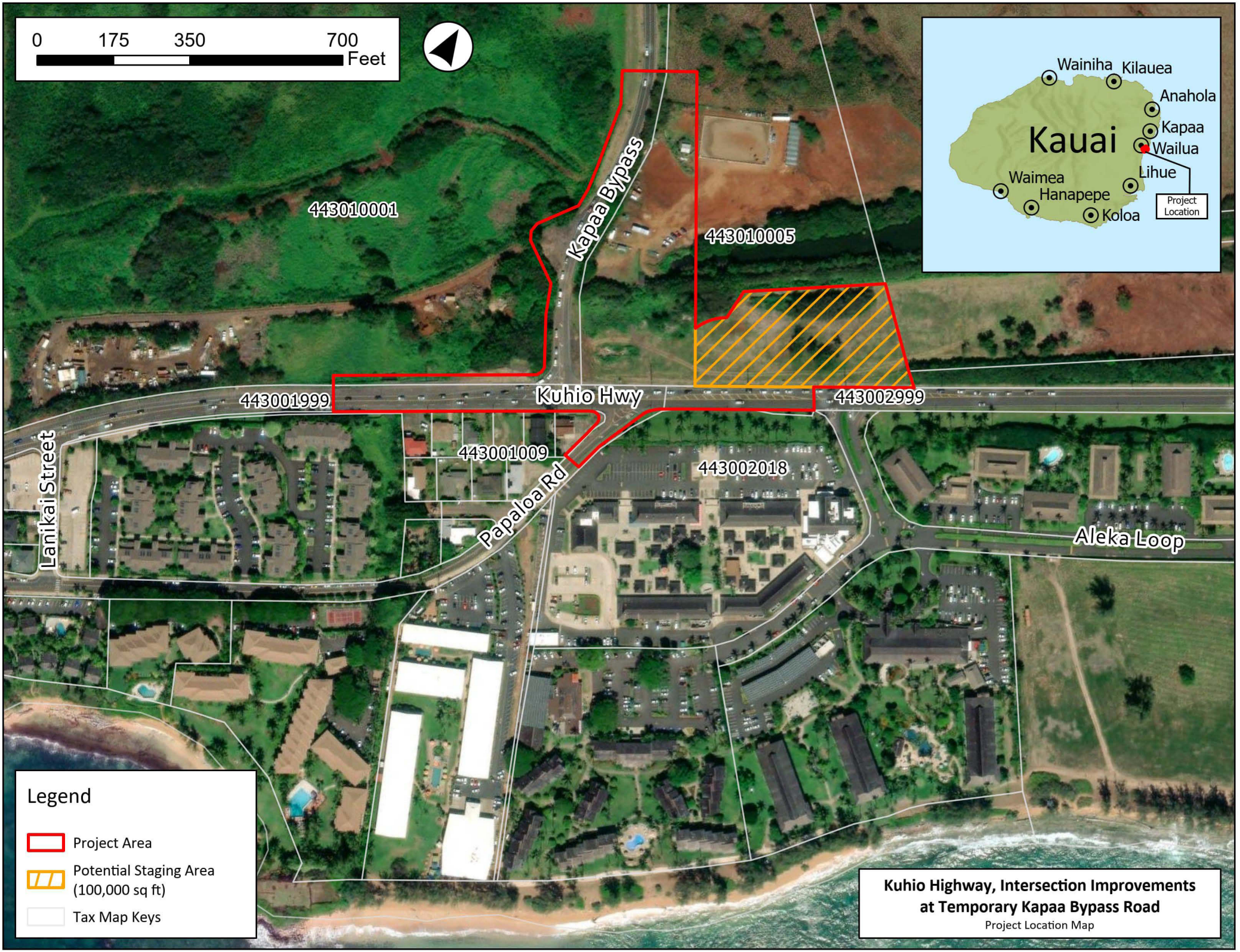
cc: Eric Fujikawa, HDOT, HWY-K
Lawrence Laus, HDOT, HWY-DE

Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road Southern Terminus

Attachment 1: Project Location Map
Attachment 2: EFH Mapper Report
Attachment 3: Site Photos
Attachment 4: Wetlands Map

Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road Southern Terminus

Attachment 1: Project Location Map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Lanikai Street
Aleka Loop
Wainiha
Kilauea
Anahola
Kauai
Kapaa
Wailua
Lihue
Waimea
Hanapepe
Koloa
Project Location
Legend
Project Area
Potential Staging Area (100,000 sq ft)
Tax Map Keys
Kuhio Highway, Intersection Improvements at Temporary Kapaa Bypass Road
Project Location Map

Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road Southern Terminus

Attachment 2: EFH Mapper Report

Attachment 2:EFH Mapper Report

EFH Data Notice

Essential Fish Habitat (EFH) is defined by textual descriptions contained in the fishery management plans developed by the regional fishery management councils. In most cases mapping data can not fully represent the complexity of the habitats that make up EFH. This report should be used for general interest queries only and should not be interpreted as a definitive evaluation of EFH at this location. A location-specific evaluation of EFH for any official purposes must be performed by a regional expert. Please refer to the following links for the appropriate regional resources.

Query Results

Degrees, Minutes, Seconds: Latitude = 22º 3' 4" N, Longitude = 160º 40' 20" W
Decimal Degrees: Latitude = 22.051, Longitude = -159.328

The query location intersects with spatial data representing EFH and/or HAPCs for the following species/management units.

EFH

Link	Data Caveats	Species/Management Unit	Lifestage(s) Found at Location	Management Council	FMP
		Amberjack / Black Jack / Sea Bass	Eggs, Post-Hatch	Western Pacific	Bottomfish and Seamount Groundfish
		Blue Stripe Snapper / Gray Jobfish	Eggs, Post-Hatch, Post-Settlement/Sub-Adult/Adult	Western Pacific	Bottomfish and Seamount Groundfish
		Giant Trevally	Eggs, Post-Hatch, Post-Settlement/Sub-Adult/Adult	Western Pacific	Bottomfish and Seamount Groundfish
		Main Hawaiian Islands Coral Reef Ecosystem	ALL	Western Pacific	
		Pink Snapper	Eggs, Post-Hatch	Western Pacific	Bottomfish and Seamount Groundfish
		Red Snapper / Longtail Snapper / Yellowtail Snapper / Pink Snapper / Snapper	Eggs, Post-Hatch	Western Pacific	Bottomfish and Seamount Groundfish
		Silver Jaw Jobfish / Thicklip Trevally	Eggs, Post-Hatch	Western Pacific	Bottomfish and Seamount Groundfish

Pacific Salmon EFH

No Pacific Salmon Essential Fish Habitat (EFH) were identified at the report location.

Atlantic Salmon

No Atlantic Salmon were identified at the report location.

HAPCs

No Habitat Areas of Particular Concern (HAPC) were identified at the report location.

EFH Areas Protected from Fishing

No EFH Areas Protected from Fishing (EFHA) were identified at the report location.

Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road Southern Terminus

Attachment 3: Site Photos

Attachment 3: Site Photos



Kuhio Highway, facing west-southwest.

Source: Keala Pono, 2024



Source: Keala Pono, 2024

Kuhio Highway, facing northeast.



Source: Keala Pono, 2024

Kapaa Bypass Road and dirt shoulder, facing north.

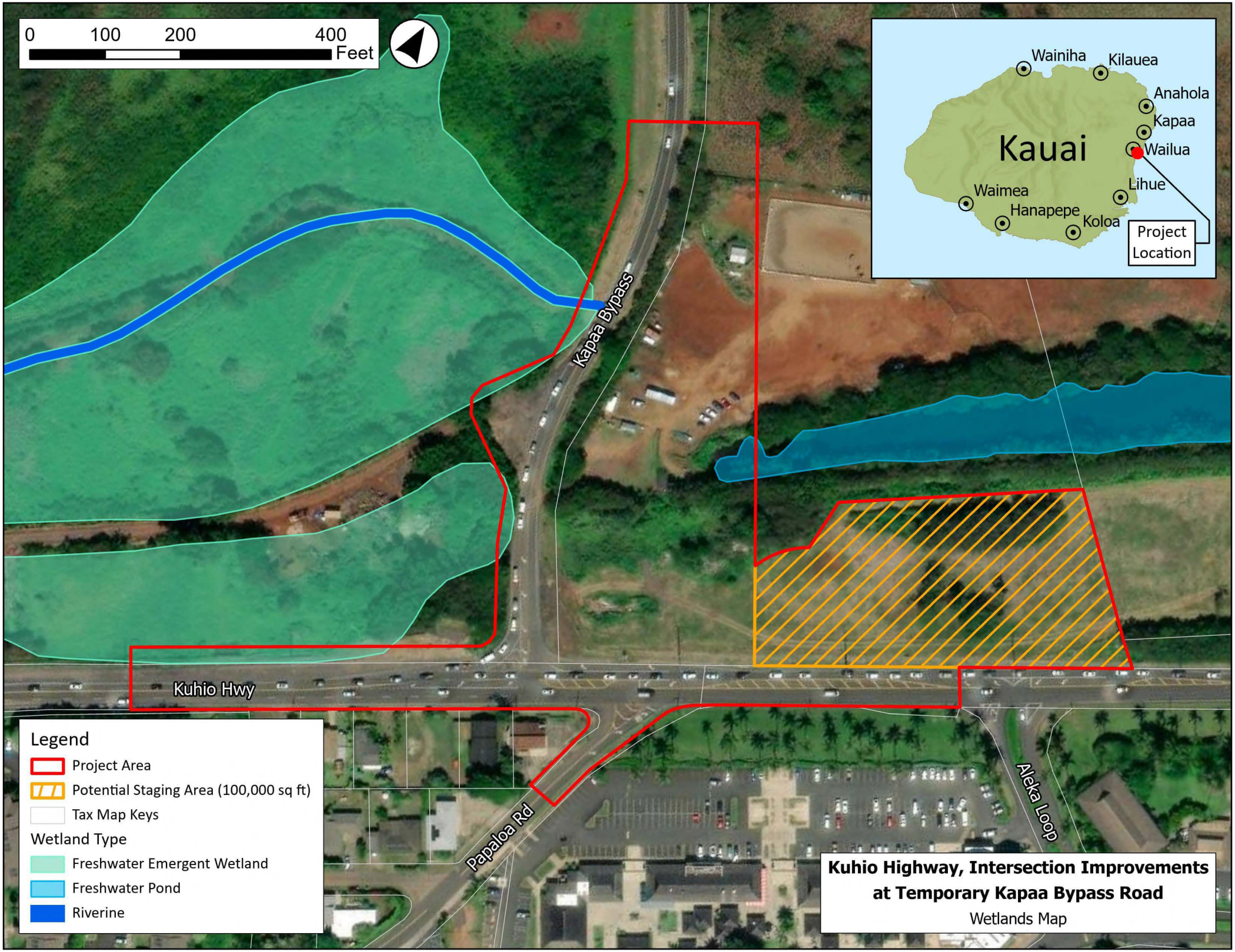


Source: Keala Pono, 2024

Staging Area, facing southeast

Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road Southern Terminus

Attachment 4: Wetlands Map


0
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Feet
Wainiha
Kilauea
Anahola
Kapaa
Wailua
Kauai
Lihue
Waimea
Hanapepe
Koloa
Project Location
Kapaa Bypass
Kuhio Hwy
Papaloa Rd
Aleka Loop
Legend
Project Area
Potential Staging Area (100,000 sq ft)
Tax Map Keys
Wetland Type
Freshwater Emergent Wetland
Freshwater Pond
Riverine
Kuhio Highway, Intersection Improvements at Temporary Kapaa Bypass Road
Wetlands Map

Silva Jr, Dennis

From: Fujikawa, Eric I <eric.i.fujikawa@hawaii.gov>
Sent: Wednesday, June 25, 2025 1:31 PM
To: Urasaki, Randall; Silva Jr, Dennis
Cc: Aguinaldo, Jeff J; McClellan, Malie
Subject: FW: NH-056-1(066) Kuhio Highway Intersection Improvements EFH Consultation

Sharing for your records

From: Otani, Meesa (FHWA) <meesa.otani@dot.gov>
Sent: Wednesday, June 25, 2025 1:02 PM
To: Alexandria Barkman - NOAA Federal <alexandria.barkman@noaa.gov>
Cc: Fujikawa, Eric I <eric.i.fujikawa@hawaii.gov>; Aguinaldo, Jeff J <Jeff.J.Aguinaldo@hawaii.gov>; Laus, Lawrence M <lawrence.m.laus@hawaii.gov>; Ron Dean - NOAA Federal <ron.dean@noaa.gov>
Subject: [EXTERNAL] RE: NH-056-1(066) Kuhio Highway Intersection Improvements EFH Consultation

Thank you Alex!

From: Alexandria Barkman - NOAA Federal <alexandria.barkman@noaa.gov>
Sent: Wednesday, June 25, 2025 12:35 PM
To: Otani, Meesa (FHWA) <meesa.otani@dot.gov>
Cc: eric.i.fujikawa@hawaii.gov; jeff.j.aguinaldo@hawaii.gov; Laus, Lawrence M <lawrence.m.laus@hawaii.gov>; Ron Dean - NOAA Federal <ron.dean@noaa.gov>
Subject: Re: NH-056-1(066) Kuhio Highway Intersection Improvements EFH Consultation

CAUTION: This email originated from outside of the Department of Transportation (DOT). Do not click on links or open attachments unless you recognize the sender and know the content is safe.

Hi Meesa,
Thank you for the requested information and for working with HDOT to ensure the CR can be implemented.
The EFH consultation for NH-056-1(066) Kuhio Highway Intersection Improvements is complete.

Alex

On Wed, Jun 25, 2025 at 7:30 AM Otani, Meesa (FHWA) <meesa.otani@dot.gov> wrote:

> Hi Alex,
>
> Thank you for the quick response.
>
> HDOT can implement the additional conservation recommendation:

Conservation Recommendation 1: If vegetation clearing is required to access the equipment staging area, revegetate the area upon completion of the project to reduce exposed sediments that may increase runoff.

Please let me know if you have any questions.

Thank you!

Meesa

From: Alexandria Barkman - NOAA Federal <alexandria.barkman@noaa.gov>
Sent: Tuesday, June 24, 2025 11:11 AM
To: Otani, Meesa (FHWA) <meesa.otani@dot.gov>
Cc: eric.i.fujikawa@hawaii.gov; jeff.j.aguinaldo@hawaii.gov; Laus, Lawrence M <lawrence.m.laus@hawaii.gov>; Ron Dean - NOAA Federal <ron.dean@noaa.gov>
Subject: Re: NH-056-1(066) Kuhio Highway Intersection Improvements EFH Consultation

CAUTION: This email originated from outside of the Department of Transportation (DOT). Do not click on links or open attachments unless you recognize the sender and know the content is safe.

Aloha Meesa,
The National Marine Fisheries Service (NMFS), Pacific Islands Regional Office, received the Federal Highway Administration's (hereafter, FHWA) essential fish habitat (EFH) consultation request and EFH Assessment (EFHA) for the Kuhio Highway Intersection Improvements project on June 17, 2025. After reviewing the consultation enclosures, we have determined that there may be adverse effects to EFH. In the EFH Assessment (EFHA) you have outlined best management practices (BMPs) that, when adhered to and implemented, will be suitable to ensure that most adverse effects to EFH will be no more than minimal. We are providing a conservation recommendation under the EFH provisions under Section 305(b)(4)(A) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), to help the USACE further avoid, minimize, offset for, or otherwise mitigate adverse effects to EFH.

Project Description

The proposed project involves intersection improvements on Kuhio Highway, Kauaʻi to improve safety, connectivity, and traffic in the area. Work will take place at the intersections of Kuhio Highway and both Papaloa and Kapaa Bypass Roads in Kapaa, Kauaʻi, Hawaiʻi. The Hawaiʻi Department of Transportation is currently consolidating the two existing T intersections into a single intersection. Project equipment may include an excavator, backhoe, loader, concrete truck, crane, roller, paver, and/or drill rig. Highway lights will also be installed. The proposed action area is approximately 8.96 acres and consists of the highway right-of-way and privately owned parcels. Construction staging would occur in approximately 2.3 acres of the project area mauka of Kuhio Highway. Vegetation clearing may be required to access and use the staging

area. Construction is estimated to start some time in 2027 and take 2 years to complete. Most work will be done during daytime hours, but night work may be required to minimize traffic impacts.

Essential Fish Habitat

The marine water column from the surface to a depth of 3,281 ft from the shoreline to the outer boundary of the EEZ (200 nautical miles), and the seafloor from the shoreline out to a depth of 2,296 ft around each of the Hawaiian Islands, have been designated as EFH. As such, the water column and bottom of the Pacific Ocean around Kauai are designated as EFH, and support various life stages for the management unit species (MUS) identified under the Western Pacific Fishery Management Council's Pelagic and Hawai'i Archipelago Fishery Ecosystem Plans. The MUS and life stages found in these waters include eggs, larvae, juveniles, and adults of Bottomfish, Crustacean, and Pelagic MUS. Specific types of habitat considered as EFH include coral reef, patch reefs, hard substrate, artificial substrate, seagrass beds, soft substrate, lagoon, estuarine, surge zone, deep-slope terraces and pelagic/open ocean.

Baseline Condition

The proposed project area coordinates are 22°03'18.4"N, 159°19'46.9"W. The action area is approximately 1000 feet from the nearest shoreline. There will be no in-water work.

Adverse Effects

Construction that occurs in coastal areas or streams can end up affecting aspects of EFH downstream from where a project occurs. Stressors that affect water quality through either increased turbidity or contamination can, in turn, affect flora and fauna over time and space (Minton 2017).

Sedimentation: Land-based work can result in exposed sediment that runs off into nearby waters. Increased turbidity can elicit short- and long-term responses from aquatic organisms depending on the quantity, quality, and duration of suspended sediment exposure (Kjelland et al. 2015). If the project results in a net increase in road surface area, the increased amount of impervious surface could lead to increased runoff of sediments long-term. Additionally, vegetation clearing could increase the amount of exposed sediments, increasing introduction of sediments to nearby waters. Coral reef organisms are easily smothered by sediment and can experience both physiological and lethal responses to concentrations below 10 milligrams (mg)/cm^2/day and 10 mg/Liter (L) (Tuttle and Donahue 2022). Adverse effects from deposited sediment can occur as low as 1 mg/cm^2/day for larvae and 4.9 mg/cm^2/day for adult tissue (Tuttle and Donahue 2022). Suspended sediment levels of 10 mg/L can lead to reduced growth rates and levels of 3.2 mg/L can cause bleaching and tissue mortality (Tuttle and Donahue 2022), although corals show considerable interspecific variability. Increased turbidity can cause changes in fish behavior, including altered predator-prey relationships (Higham et al. 2015). There will not be any in-water work for this project, reducing the risk of increased turbidity impacting EFH.

Chemical Contamination: Use of machinery on land can lead to accidental spills or leaks of petroleum products. Accidental chemical spills could introduce toxicants to the marine environment through runoff, especially during storms. Contaminants can have a variety of lethal and sublethal effects on

habitat-forming marine organisms, including alteration of growth, interference with reproduction, disruption of metabolic processes, and changes in behavior. These adverse effects can cascade through ecosystems, altering species composition and ecosystem functions and services. Some pollutants are environmentally persistent and can take years or even decades to biodegrade, and others can bioaccumulate or biomagnify through the food chain, eventually posing a direct threat to human health. Contaminant concentrations in fishes are linked to locations with increased urbanization and military history (Nalley et al. 2021; 2023a). The action area is not directly next to a stream or the shoreline, reducing the risk of chemical contamination to nearby waters.

Nutrient Loading: Construction along coasts can result in nutrient loading to occur both during and after construction. If the project results in a net increase in road surface area, the increased amount of impervious surface could lead to increased runoff. The decline of coral reefs close to urbanized areas has been considered to be promoted by anthropogenic nutrient enrichment of reef waters (D'Angelo and Wiedenmann 2014). Coral reef ecosystems thrive in oligotrophic, or nutrient-poor, waters, and nutrient enrichment has been shown to negatively affect coral reef ecosystems directly and indirectly (Nalley et al. 2023b). Exposure to elevated nutrients can cause a shift to an assemblage dominated by algae (Lapointe 1997; Dudgeon et al. 2010). Nutrient enrichment can also lead to increased abundances of invasive algae that outcompete native algae in areas with nutrient pollution (Dulai et al. 2023).

FHWA-proposed BMPs

FHWA has proposed to implement many BMPs that will minimize potential adverse impacts to EFH. These BMPs include development of a plan for managing equipment, materials, and job site conditions in the event of approaching foul weather, equipment cleaning, maintenance, and refueling away from water, and BMPs to prevent discharge of waste or debris into the water.

FHWA Conclusion

With the implementation of FHWA provided BMPs and minimization measures, the FHWA determined that the project will have no more than minimal adverse effects on EFH and MUS.

NMFS Conclusion

NMFS agrees with the FHWA's determination that the proposed action will adversely affect EFH, but the adverse effects are expected to be no more than minimal.

Conservation Recommendation

Pursuant to Section 305(b)(4)(A) (as described by 50 CFR 600.920 and 600.925(b)) of the MSA, we provide the following conservation recommendation that when implemented, will ensure that potential adverse effects to EFH at the proposed action areas are avoided, minimized, and offset.

Conservation Recommendation 1: If vegetation clearing is required to access the equipment staging area, revegetate the area upon completion of the project to reduce exposed sediments that may increase runoff.

Conclusion

The FHWA proposed mitigation measures are suitable to ensure that most adverse effects to EFH will be no more than minimal. We have provided an EFH conservation recommendation that will further help FHWA effectively avoid and minimize adverse effects to EFH if fully implemented.

Please be advised that regulations (Section 305(b)(4)(B)) to implement the EFH provisions of the Magnuson-Stevens Act require that federal activities agencies provide a written response to this letter within 30 days. The final response must include a description of measures to be required to avoid, mitigate, or offset the adverse effects of the proposed activities. If the response is inconsistent with our EFH conservation recommendation, an explanation of the reason for not implementing the recommendation must be provided at least 10 days prior to final approval of the activities.

Please contact me at alexandria.barkman@noaa.gov or (808) 725-5150 with any comments or questions you may have. Thank you for coordinating on this proposed action.

Regards,

Alex

Literature cited

D'Angelo, C., and Wiedenmann, J. 2014. Impacts of nutrient enrichment on coral reefs: new perspectives and implications for coastal management and reef survival. *Current Opinion in Environmental Sustainability*, 7, 82-93.

Dudgeon, S.R., Aronson, R.B., Bruno, J.F. and Precht, W.F. 2010. Phase shifts and stable states on coral reefs. *Marine Ecology Progress Series*, 413, pp.201-216.

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Nalley, E.M., Pirkle, C.M., Schmidbauer, M.C., Lewis, C.J., Dacks, R.S., Thompson, M.D. Sudnovsky, M.D., Whitney, J.L., and Donahue M.J. 2023a. Trophic and spatial patterns of contaminants in fishes from the Republic of the Marshall Islands in the equatorial Pacific. *Chemosphere*, 314:137593.

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Tuttle, L.J., and Donahue, M.J. 2022. Effects of sediment exposure on corals: A systematic review of experimental studies. *Environmental Evidence*, *11*(1):1-33.

On Mon, Jun 23, 2025 at 7:46 AM Alexandria Barkman - NOAA Federal <alexandria.barkman@noaa.gov> wrote:

> Hi Meesa,
>
> Will the Kuhio Highway Intersection Improvements result in an increase in impervious surface area, and if so, is there an estimate of the increased area?
>
> Thanks!
>
> Alex

On Wed, Jun 18, 2025 at 10:15 AM Alexandria Barkman - NOAA Federal <alexandria.barkman@noaa.gov> wrote:

> Aloha Meesa,
>
> NMFS PIRO received your request for an abbreviated EFH consultation for the Kuhio Highway Intersection Improvements. I will reach out if I have any questions as I review the project. A response to the request will be provided by July 17.
>
> Regards,
>
> Alex
>
> On Tue, Jun 17, 2025 at 8:08 AM 'Otani, Meesa (FHWA)' via _NMFS PIR ESHESA <efhesaconsult@noaa.gov> wrote:
>
> > Good morning,
> >
> > Attached is the EFH consultation for the Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road Southern Terminus project on Kauai.
> >
> > Please let me know if you have any questions.
> >
> > Thank you!
> >
> > Meesa Otani
> >
> > Transportation Engineer
> >
> > Federal Highway Administration, Hawaii Division Office
> >
> > 300 Ala Moana Blvd. Rm. 3-229, Box 50206
> >
> > Honolulu, Hawaii 96850
> >
> > (808) 541-2316 | meesa.otani@dot.gov
> >
> > Call me on Teams
> >
> > Chat with me on Teams

--

Alexandria Barkman, PhD.

EFH Consulting Biologist, PIRO Protected Resources Division

NOAA Fisheries | U.S. Department of Commerce
Office: (808) 725-5150

www.fisheries.noaa.gov



--

Alexandria Barkman, PhD.

EFH Consulting Biologist, PIRO Protected Resources Division

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Office: (808) 725-5150

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--

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--

Alexandria Barkman, PhD.
EFH Consulting Biologist, PIRO Protected Resources Division
NOAA Fisheries | U.S. Department of Commerce
Office: (808) 725-5150

www.fisheries.noaa.gov



Appendix A-3
Regulatory Coordination and Correspondence

Hawaii Revised Statutes Chapter 195D

This is an example 195D letter sent to DAR. A letter identical in content was sent to DOFAW.

JOSH GREEN, M.D.
GOVERNOR
KE KIA'ĀINA

EDWIN H. SNIFFEN
DIRECTOR
KA LUNA HO'OKELE

Deputy Directors
Nā Hope Luna Ho'okele
DREANALEE K. KALILI
TAMMY L. LEE
CURT T. OTAGURO
ROBIN K. SHISHIDO

STATE OF HAWAI'I | KA MOKU'ĀINA 'O HAWAI'I
DEPARTMENT OF TRANSPORTATION | KA 'OIHANA ALAKAU
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

HWY-K 4.250282

September 9, 2025

TO: DAWN N.S. CHANG, DIRECTOR
DEPARTMENT OF LAND AND NATURAL RESOURCES

ATTN: BRIAN NEILSON, ADMINISTRATOR
DIVISION OF AQUATIC RESOURCES

FROM: ERIC FUJIKAWA
DISTRICT ENGINEER

SUBJECT: HAWAII REVISED STATUTES (HRS) CHAPTER 195D CONSULTATION
HRS CHAPTER 343 ENVIRONMENTAL ASSESSMENT CONSULTATION
KUHIO HIGHWAY INTERSECTION IMPROVEMENTS AT TEMPORARY KAPAA BYPASS ROAD SOUTHERN TERMINUS
KAPAA, KAUAI ISLAND, STATE OF HAWAII
KUHIO HIGHWAY RIGHT-OF-WAY (4) 4-3-001:999; (4) 4-3-002:999; AND (4) 4-3-010:999 AND TMKS (4) 4-3-010:001 AND (4) 4-3-010:005
FEDERAL AID PROJECT NO. NH-056-1(066)

The State of Hawaii Department of Transportation Highways Division (HDOT), in cooperation with the Federal Highway Administration (FHWA), is proposing the Kuhio Highway Intersection Improvements in Kapaa, Kauai. See Attachment 1: Project Area Map. In accordance with State guidelines for preparing environmental review documents, HDOT is requesting that your office share any pertinent information related to Hawaii Revised Statutes (HRS) Chapter 195D resources. Specifically, we are interested in (a) threatened and endangered species that may be present in or pass through the project area, (b) the presence of identified critical habitat for any species in the area, and (c) any other input or concerns you have regarding the proposed project.

HDOT is preparing an Environmental Assessment (EA) in compliance with HRS Chapter 343, Hawaii's environmental impact statement law, to evaluate and disclose the project's potential environmental impacts and identify any potential permitting requirements. At this time, HDOT is seeking input on the project information provided below, as well as information related to any environmental, social, or economic concerns related to the project or project area.

The Federal Highway Administration (FHWA) is providing funding for these improvements. Therefore, the project is considered a Federal action, which triggers Federal requirements including the National Environmental Policy Act (NEPA) and Section 7 of the Endangered

Species Act. The U.S. Fish and Wildlife Service and National Marine Fisheries Service are also being consulted.

Overview of the Proposed Project
The HDOT is currently evaluating realigning the southern terminus of Kapaa Bypass Road at Kuhio Highway to intersect with the existing intersection of Kuhio Highway with Papaloa Road (North) near the Coconut Marketplace. The realignment will consolidate the two (2) existing T-intersections into a single full-access intersection. In addition to consolidating the intersections, the realignment will provide the opportunity to allow left turns from Papaloa Road (North) onto Kuhio Highway. The installation of approximately 30-foot tall, safety standard compliant highway lights is also proposed as a part of this project. These intersection improvements will improve safety and connectivity of the road and ease traffic in the area.

The project area is approximately 8.96 acres and includes the Kuhio Highway ROW and two privately-owned TMK parcels. Construction staging will occur within the northeast portion of the project area, on private land mauka of Kuhio Highway. See Attachment 1: Project Area Map and Attachment 2: Site Photos. Staging within this parcel and other construction activities may require vegetation removal.

This project will require nightwork to reduce traffic impacts on the surrounding community; however, no nightwork will occur during seabird fledgling season (September 15 through December 15). At this time, the amount of construction lights is unknown and will depend on the selected Contractor's means and methods. To reduce the chance that lighting could disorient seabirds, construction lighting would be shielded down towards the ground and would use a narrow-spectrum bulbs. All lights will be turned off when human activity is not occurring in the lighted area, or automatic motion sensor switches and controls on all outdoor lights will be installed.

Existing Environment in the Project Area
The project area is located in Kapaa, on the Island of Kauai. The surrounding land uses include agricultural lands and urban lands.

SWCA Environmental Consultants (SWCA) prepared a Draft Flora and Fauna Survey Report for the project in July 2025. The report presents the findings of a botanical and wildlife survey, conducted on May 11, 20255, to document species and biological issues of concern. The report includes discussion regarding the presence or habitat of species that are State or Federally listed as threatened, endangered, or a candidate species for listing (collectively known as special-status species).

During the Survey Report, no special-status plant species were identified within the project area and only one plant species native to the Hawaiian Islands, glossy nightshade (*Solanum americanum*), was recorded. Vegetation types in the area consisted of ruderal, nonnative grassland, riparian, and nonnative secondary forest. The only special-status animal species identified within the project area during the survey was the Endangered Hawaiian goose or Nene

(*Branta sandvicensis*) which was observed flying over the area. While no other special-status animal species were identified within the project area, a Hawaiian common gallinule, or alae ula (*Gallinula galeata sandvicensis*) was seen along waterways with hydrologic connectivity to the survey.

Potential nesting and foraging habitat for special-species waterbirds [Hawaiian common gallinule; Hawaiian coot or alae keokeo (*Fulicia alai*); Hawaiian duck or koloa maoli (*Anas wyvilliana*); and Hawaiian stilt or aeo (*Himantopus mexicanus knudseni*)] was identified within the project area. According to the National Wetland Inventory, within the project area there exist three wetland types: an intermittent riverine (R4SBC), a freshwater temporarily flooded emergent wetland (PEM1A), and a permanently flooded, excavated freshwater pond (PUBHx). See Attachment 3: Wetlands Map. Best Management Practices (BMPs) will be implemented in accordance with the following methods: *An Integrated Storm Water Management Approach and a Summary of Clear Water Diversion and Isolation Best Management Practices for Use in the State of Hawaii*, by the Federal Highway Administration and *Hawaii Department of Transportation Practitioners Guide* (2016) or the *Construction Best Management Practices Field Manual* by the State of Hawaii Department of Transportation (2021).

The Survey Report also identified potential roosting trees for the Hawaiian hoary bat or opeapea (*Lasiurus cinereus semotus*). Additionally, the is the potential that special-status Hawaiian seabirds [band-rumped storm-petrel or akeake (*Hydrobates castro*); Hawaiian petrel or auu (*Pterodroma sandwichensis*); and Newell's shearwater (*Puffinus newelli*)] may fly over the project area to and from higher elevation nesting areas during seabird breeding and fledging season.

Your Request Input

Pursuant to HRS Chapter 195D, we request your input on the threatened and endangered species and/or designated critical habitat within the vicinity of the project area. Pursuant to an HRS Chapter 343 review, we also respectfully ask for your opinion on the likely impact of the project based on the potential issues of the locations considering the proposed construction activities and schedule.

Please contact Mr. Eric Fujikawa, Project Manager, at eric.i.fujikawa@hawaii.gov should you have any questions. We would appreciate a written response within 30 days of receipt of this letter. We look forward to working with you on these needed improvements.

Enclosures

Kuhio Highway Intersection Improvements
HRS 195D Consultation

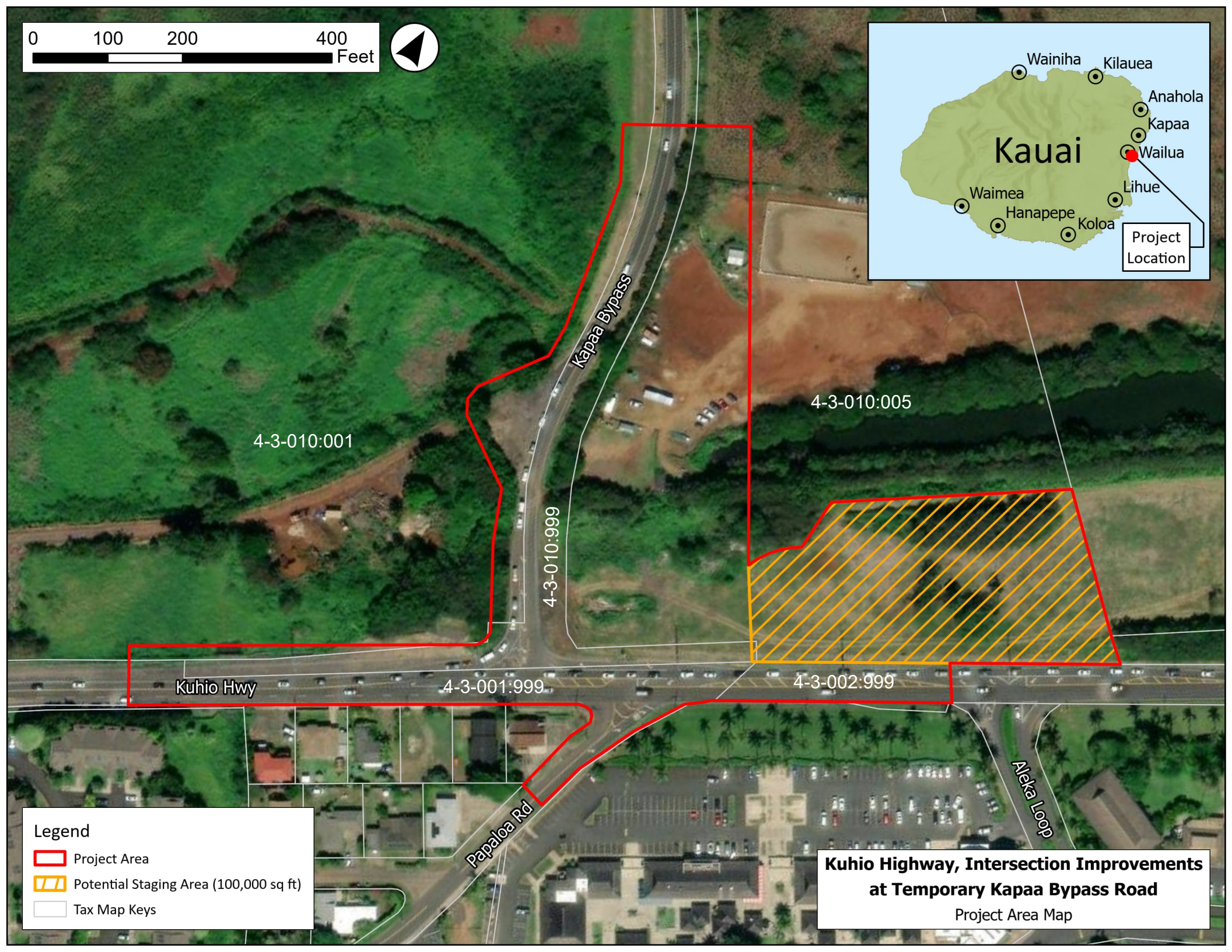
Attachments

Attachment 1: Project Area Map
Attachment 2: Site Photos
Attachment 3: Wetlands Map

Kuhio Highway Intersection Improvements
HRS 195D Consultation

Attachments

Attachment 1: Project Area Map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Feet
Wainiha
Kilauea
Anahola
Kapaa
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Kauai
Lihue
Waimea
Hanapepe
Koloa
Project Location
Kapaa Bypass
4-3-010:001
4-3-010:005
4-3-010:999
Kuhio Hwy
4-3-001:999
4-3-002:999
Papaloa Rd
Aleka Loop
Legend
Project Area
Potential Staging Area (100,000 sq ft)
Tax Map Keys
Kuhio Highway, Intersection Improvements at Temporary Kapaa Bypass Road
Project Area Map

Kuhio Highway Intersection Improvements
HRS 195D Consultation

Attachments

Attachment 2: Site Photos



Kuhio Highway, facing west-southwest.

Source: Keala Pono, 2024



Source: Keala Pono, 2024

Kuhio Highway, facing northeast.



Source: Keala Pono, 2024

Kapaa Bypass Road and dirt shoulder, facing north.



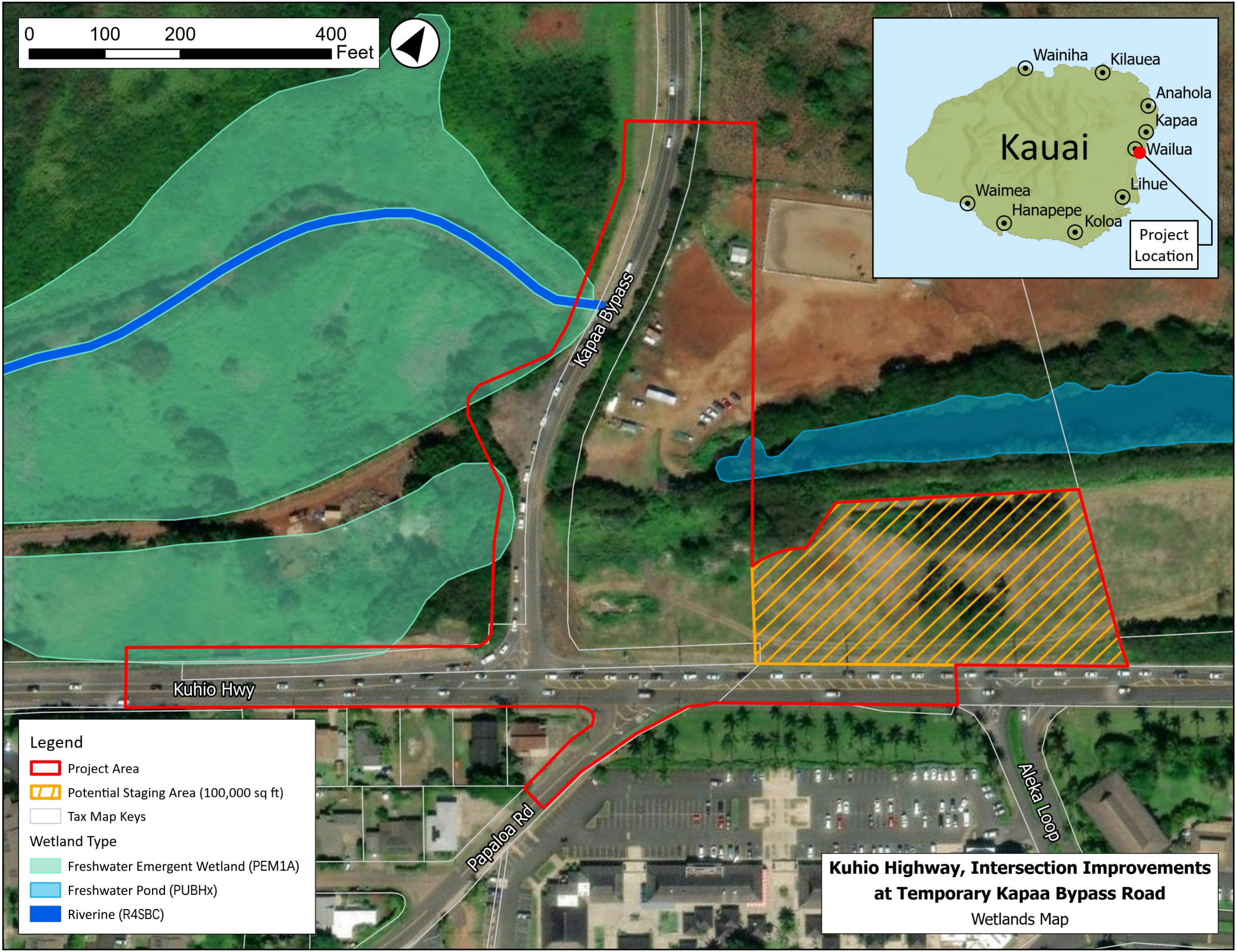
Source: Keala Pono, 2024

Staging Area, facing southeast

Kuhio Highway Intersection Improvements
HRS 195D Consultation

Attachments

Attachment 3: Wetlands Map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Kapaa Bypass
Kuhio Hwy
Papaloa Rd
Aleka Loop
Kauai
Wainiha
Kilauea
Anahola
Kapaa
Wailua
Lihue
Waimea
Hanapepe
Koloa
Project Location
Legend
Project Area
Potential Staging Area (100,000 sq ft)
Tax Map Keys
Wetland Type
Freshwater Emergent Wetland (PEM1A)
Freshwater Pond (PUBHx)
Riverine (R4SBC)
Kuhio Highway, Intersection Improvements at Temporary Kapaa Bypass Road
Wetlands Map

Appendix A-3
Regulatory Coordination and Correspondence

Coastal Zone Management Coordination

From: Mendes, Debra L
Sent on: Thursday, December 4, 2025 12:12:03 PM
To: Silva Jr, Dennis
CC: Fujikawa, Eric I; Bautista, Joel O; Aguinaldo, Jeff J; Urasaki, Randall; Teodoro, Lean
Subject: Re: Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road CZM

Follow up: Flag for follow up
Follow up status: Completed
Completed on: Friday, December 12, 2025 2:37:00 PM

Aloha Dennis,
Based on the information you provided, I believe that the proposed activity may have the following triggers for federal consistency review:
• **HDOT Receipt and Use of federal financial assistance** for the increase in the right-of-way
• **HDOT Activity requiring a federal permit** (depending on the type of federal permit, this trigger may be covered by a blanket federal consistency determination)

Prior to submitting this project to our office, I recommend that HRS 343 and NEPA compliance be initiated so that the assessment of all potential cultural and environmental impacts can be completed and appropriate mitigation measures developed.

Thank you.

Debra Mendes
Planner | Coastal Zone Management Program
Office of Planning & Sustainable Development
(808) 587-2840

STATE OF HAWAI'I
OFFICE OF PLANNING & SUSTAINABLE DEVELOPMENT
Leiopapa A Kamehameha
235 South Beretania Street, 6th Floor · Honolulu, Hawai'i · 96813
PO Box 2359 · Honolulu, Hawai'i · 96804-2359
Phone (808) 587-2846 · Fax (808) 587-2824

From: Silva Jr, Dennis <Dennis.SilvaJr@wsp.com>
Sent: Wednesday, December 3, 2025 8:39 AM
To: Mendes, Debra L <debra.l.mendes@hawaii.gov>
Cc: Fujikawa, Eric I <eric.i.fujikawa@hawaii.gov>; Bautista, Joel O <joel.o.bautista@hawaii.gov>; Aguinaldo, Jeff J <Jeff.J.Aguinaldo@hawaii.gov>; Urasaki, Randall M. <randall.urasaki@wsp.com>; Teodoro, Lean <Lean.Teodoro@wsp.com>
Subject: [EXTERNAL] Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road CZM

Aloha Debra,

I'm writing to request a brief project review to confirm whether a CZM Consistency Review is needed for the **Kuhio Highway Intersection Improvements at Temporary Kapaa Bypass Road** project. The State of Hawaii Department of Transportation, Highways Division (HDOT) is proposing the project, which is located in the Kapaa – Wailua District on the island of Kauai. The Federal Highways Administration (FHWA) is providing funding for these improvements.

A Draft and Final Environmental Assessment (EA) in compliance with both the Hawaii Revised Statutes (HRS) Chapter 343 and the National Environmental Policy Act (NEPA) are anticipated for this project.
The proposed improvements are located along Kuhio Highway (State Route 56) at the intersection of Papaloa Road (North) and Kapaa Bypass Road. The proposed improvements include the following:

- Consolidating two existing T intersections into a single full access intersection to accommodate left turns from Papaloa Road (North) onto Kuhio Highway.
- Installing approximately 30-foot tall, safety standard compliant highway lights.
- Relocating overhead utilities (e.g., telephone, cable, electrical, street lightings).

- Permanently acquiring additional ROW from private properties (approximately one acre).
- Clearing vegetation for installing a temporary construction staging area.

The project area, including the construction staging area, encompasses approximately 8.96 acres and includes the Kuhio Highway right-of-way (ROW) and two privately-owned parcels (TMK Nos. (4) 4-3-010:001, and :005). The temporary staging area is roughly 2.3 acres and is located on a private parcel in the northeast portion of the project area, mauka of Kuhio Highway. The staging area will be cleared of vegetation, used for stockpiling, and may include ground disturbance activities. Following construction, all staging and work areas will be restored to their original condition.

The Papaloa Road ROW and Kuhio Highway ROW windward of the current Papaloa Road intersection is within the Special Management Area (SMA). The rest of the project area (TMK (4) 4-3-010: 001, 005, and the rest of the Kuhio Highway ROW) sits outside of the SMA. Approximately 0.87 acres of the project area is located within the SMA. The project area is located 0.19 miles north of the Pacific Ocean. See attached Wetlands and SMA Map.
No streams exist within the project area. However, according to the U.S. Fish and Wildlife Services (USFWS) National Wetlands Inventory (NWI) Mapper, three different wetland classifications exist within the project area. Kaloko Marsh, a palustrine emergent persistent wetland (PEM1A) temporarily flooded with surface freshwater, exists mauka of Kuhio Highway and leeward of Kapaa Bypass Road. This wetland is present for brief periods lasting from days to weeks during the growing season. Outside of growing season, the water table typically situates well below ground surface. Within this wetland lies a seasonally flooded riverine wetland (R4SBC). In addition, a Palustrine unconsolidated bottom wetland (PUBHx) exists mauka of Kuhio Highway but windward of Kapaa Bypass Road. This wetland is flooded year-round and formed from human excavation. See attached Wetlands and SMA Map.
The Preferred Action Alternative is a two-lane roundabout, which will realign the southern terminus of Temporary Kapaa Bypass Road at Kuhio Highway to intersect with the existing intersection of Kuhio Highway and Papaloa Road near the Coconut Marketplace. The project is unlikely to significantly impact existing wetlands in the project area. Construction impacts may include increased surface runoff and erosion, but these impacts will be short-term in nature. Once construction is complete, any construction debris will be removed. Best Management Practices (BMPs) will also be implemented during construction to minimize the potential for impacts to water quality. HDOT is consulting with the U.S. Army Corps of Engineers (USACE) to coordinate if a Department of the Army (DA) permit is required.

In addition, while installing a two-lane roundabout will increase the present pavement area and increase surface runoff, the existing drainage systems would not be altered. It is estimated that existing drainage patterns would remain similar, so the Preferred Action Alternative would not adversely impact adjacent and downstream properties or coastal waters. The roadway runoff is not likely to have any permanent effects on water quality. Appropriate erosion control measures and site specific BMPs would be implemented to prevent dust, fuel, oil, and cement from discharging or leaching onto nearby surface water and the ocean.
If you feel this is enough information, would you please confirm whether a CZM Consistency Review is required for this action? If it would be better to discuss further by phone, please feel free to call Joel Bautista, HDOT Project Manager at (808) 241-3015 or email at joel.o.bautista@hawaii.gov.

Mahalo,

Dennis Silva, Jr., AICP
Senior Lead Environmental Planner

Direct + 1 808-566-2274
Mobile + 1 808-347-3999
Main +1808-531-7094

WSP
1001 Bishop Street, Suite 2400
Honolulu, Hawaii 96813

wsp.com



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Appendix A-3
Regulatory Coordination and Correspondence

Special Management Area Determination

JOSH GREEN, M.D.
GOVERNOR
KE KIA'ĀINA

EDWIN H. SNIFFEN
DIRECTOR
KA LUNA HO'OKELE

Deputy Directors
Nā Hope Luna Ho'okele
DREANALEE K. KALILI
TAMMY L. LEE
CURT T. OTAGURO
ROBIN K. SHISHIDO

STATE OF HAWAI'I | KA MOKU'ĀINA 'O HAWAI'I
DEPARTMENT OF TRANSPORTATION | KA 'OIHANA ALAKAU
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

HWY-K 4.250264

August 19, 2025

VIA EMAIL: ridica@kauai.gov

TO: ROMIO IDICA
COASTAL ZONE MANAGEMENT (CZM) PLANNER
COUNTY OF KAUAI, DEPARTMENT OF PLANNING

FROM: for Randall Haraguchi
ERIC FUJIKAWA
DISTRICT ENGINEER

SUBJECT: SPECIAL MANAGEMENT AREA DEPARTMENTAL DETERMINATION
KUHIO HIGHWAY INTERSECTION IMPROVEMENTS AT
TEMPORARY KAPAA BYPASS ROAD, ISLAND OF KAUAI,
STATE OF HAWAII, FEDERAL AID PROJECT NO. NH-056-1(066)
TAX MAP KEY (TMK) PARCELS: KUHIO HIGHWAY ROADWAY
RIGHT-OF-WAY (ROW) (4) 4-3-001:999 AND (4) 4-3-002:999 AND
TMKS (4)4-3-010:001; (4) 4-3-010:005.

The State of Hawaii Department of Transportation (HDOT) is currently evaluating the intersection realignment of the southern terminus of Kapaa Bypass Road and Kuhio Highway to intersect with the existing intersection of Kuhio Highway and Papaloa Road (North) near the Coconut Marketplace. It is anticipated that safety standard compliant highway lights will also be installed in the project area. The realignment will consolidate the two (2) existing T-intersections into a single full access intersection. The realignment will facilitate left turns from Papaloa Road (North) onto Kuhio Highway, allow left turns from Kuhio Highway onto Papaloa Road (North), improve safety and connectivity for pedestrians and bicyclists, and help ease traffic in the area.

The project area is approximately 8.96 acres and includes Kuhio Highway ROW and two privately owned parcels: TMK (4) 4-3-010:001, and TMK (4) 4-3-010:005. Approximately 0.87 acres of the project area is located within the SMA (see Attachment). The project area extends approximately 1330 feet along Kuhio Highway. The project area width extends approximately 640 feet along Kapaa Bypass Road and 180 feet along Papaloa Road. The temporary staging area, which will be occupied for up to one (1) year, is in the northeast portion of the project area, mauka of Kuhio Highway, on the private parcel TMK (4) 4-3-010:005.

Attachment

Docusign Envelope ID: 5F4CF7FC-6E24-4587-99B3-B8C18FFA4EBA

DEPARTMENT OF PLANNING | COUNTY OF KAUA'I

DEPARTMENTAL DETERMINATION REQUEST FORM

Fill out and e-mail this form plus supporting documentation in Adobe PDF format to: planningdepartment@kauai.gov

FOR DEPARTMENTAL USE ONLY

DD#_____

INTAKE BY_____ DATE_____

PAU_____ BY_____

TMK NUMBER:	Kuhio Highway, Kapaa Bypass, Papaloa Rd Right-of-Way
NAME OF OWNER*:	4-3-010:005 (My Kapaa LLC), 4-3-010:001 (My Kapaa LL
PHYSICAL ADDRESS OF PROPERTY:	Kuhio Highway and Kapaa Bypass Road
CONTACT PHONE:	Eric I. Fujikawa, HDOT, District Engineer
CONTACT E-MAIL:	eric.i.fujikawa@hawaii.gov

TYPE OF DETERMINATION REQUESTED (Please Check Applicable):

- O A. Clarification or interpretation of enforcement relating existing permitting conditions imposed either by the Planning Director or Planning Commission
- O B. Confirmation of Additional Dwelling Unit availability on a parcel
- O C. Voluntary Cancellation or Withdrawal of Permits and Permit Applications
- O D. Confirmation of Non-conformities or Pre-CZO status for a parcel
- O E. Confirmation or Clarification of previous Director or Departmental Determinations
- O F. Boundary interpretation
- O G. Confirmation of any open violations on the property
- ◉ H. Applicability of Special Management Area "Development" definition to a proposed use
- O I. Applicability of zoning review/permitting for a proposed use or structure

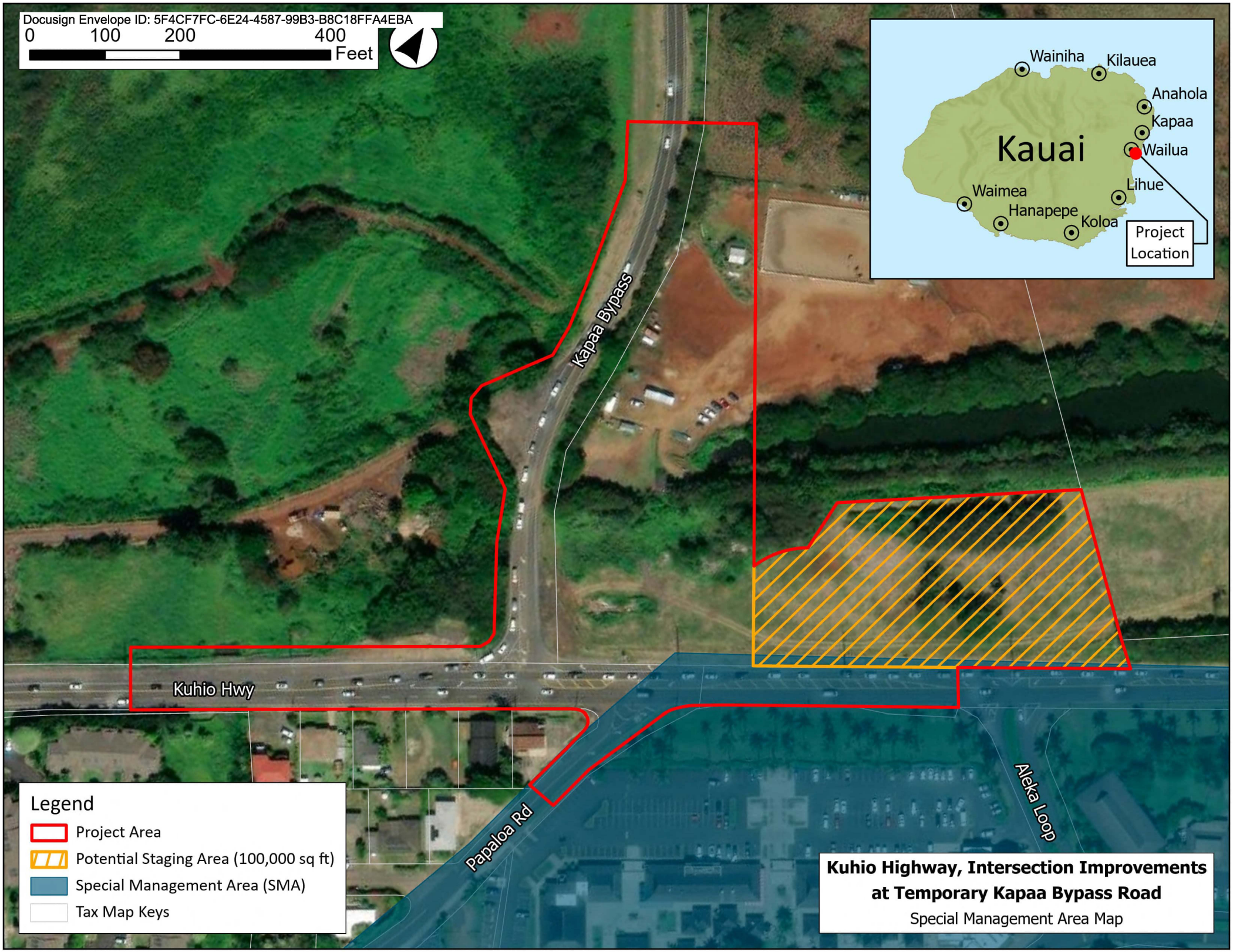
* I am the legal title holder to the property and have 100% or more legal or equitable interest in the parcel of record, have written authorization to act as an agent for the property owner with 100% or more legal or equitable interest in the parcel of record or am leasing the property (please attach proper authorization documents). By signing below I understand a determination is only a regulatory interpretation by a government official which could be subject to appeal or challenge. I further understand a determination does not necessarily bind the County to specifically perform in such a manner if relied upon by the applicant in the course of its development or construction activities. **I further understand that reliance on a determination is at my own risk and recognize I must rely on my own due diligence.**

The Department reserves discretion to not respond to a request in writing.

Sophie von Haselberg Signed by: 7ECAE6891E93417... 7/24/2025

Print Name and Signature DATE

Docusign Envelope ID: 5F4CF7FC-6E24-4587-99B3-B8C18FFA4EBA



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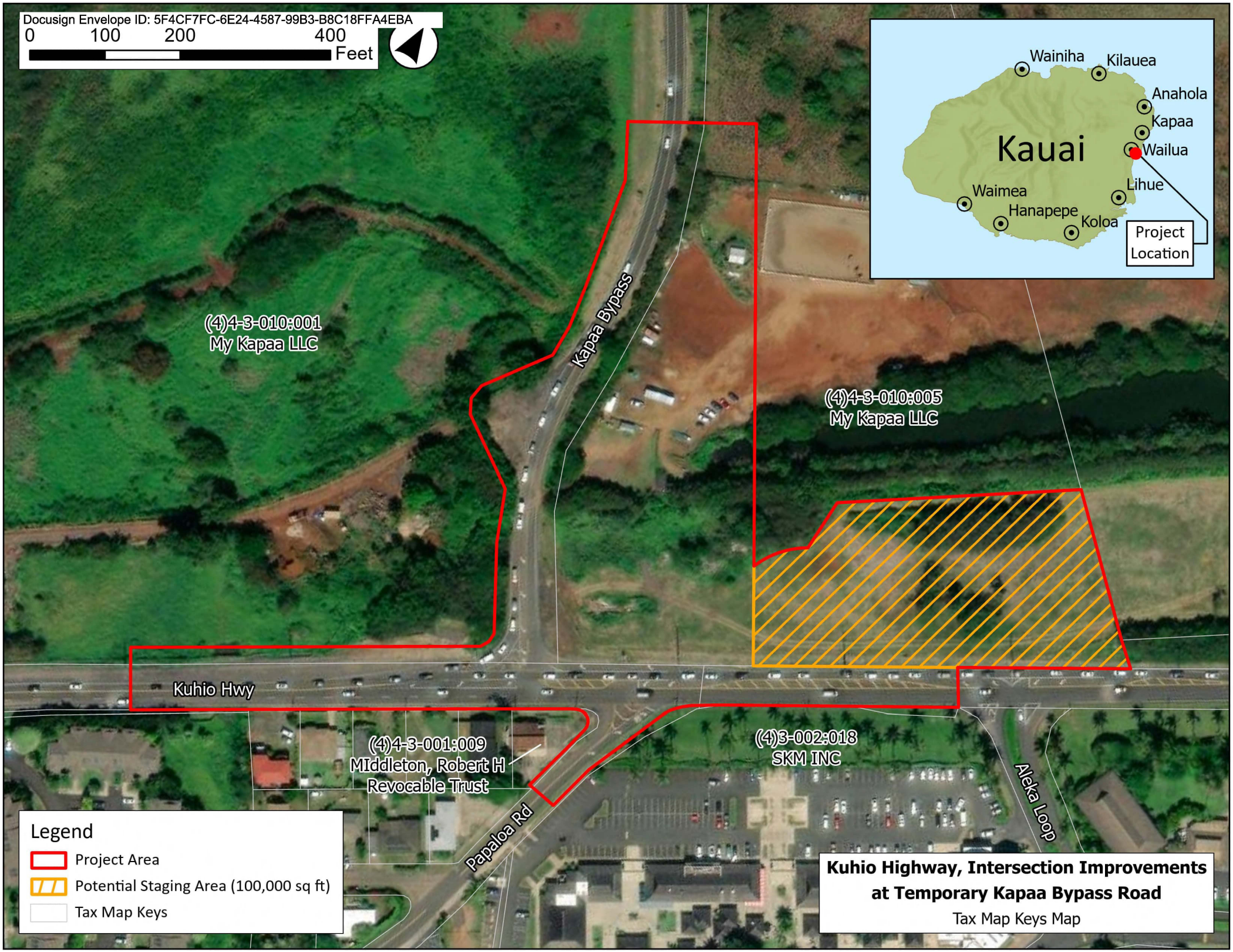


Kuhio Highway, Intersection Improvements at Temporary Kapaa Bypass Road

Tax Map Keys Map

DEPARTMENT OF PLANNING
KA'ĀINA HULL, DIRECTOR
JODI A. HIGUCHI SAYEGUSA, DEPUTY DIRECTOR

DEREK S.K. KAWAKAMI, MAYOR
REIKO MATSUYAMA, MANAGING DIRECTOR

August 19, 2025

ERIC FUJIKAWA
Contact email: eric.i.fujikawa@hawaii.gov

RE: **Departmental Determination DD-2026-1**
Applicability of Special Management Area "Development" definition to a proposed use.
TMK: (4) 4-3-010:005.
Kapa'a, Kaua'i

The Planning Department has received and reviewed your request for a Departmental Determination regarding the subject parcel, as reflected in your submittal dated July 24, 2026. Please note the following:

The Hawai'i Department of Transportation (HDOT) is evaluating a project that will include a temporary staging area in the northeast portion of the site, placed as close to the area of work as possible, for up to one year during construction. The work involves realigning the southern terminus of Kapaa Bypass Road to connect directly with Kuhio Highway at the existing Papaloa Road (North) intersection near the Coconut Marketplace. This improvement will consolidate two existing T-intersections into one full-access intersection, improve traffic flow and safety, and add highway lighting that meets current standards.

SMA DETERMINATION

The proposed work, involving the realignment of the southern terminus of the Kapa'a Bypass Road to connect with Kūhiō Highway at Papaloa Road (North), would not be considered "development" as defined in Hawai'i Revised Statues HRS §205A-22(Q), which states:

> *"(Q) Installation, maintenance, repair, and replacement of public pedestrian and bicycle facilities, including sidewalks, paths, bikeways, crosswalks, stairs, ramps, traffic control barriers, signs, signals, and associated improvements."*

It also noted that the proposed staging area is in proximity of the work area and is outside of the County of Kaua'i's Special Management Area.

Should you have further questions regarding this matter, please contact staff Planner Romio Idica at 808.241.4056. Aloha!

Jodi Higuchi Sayegusa (Aug 20, 2025 15:40:57 HST)

JODI A. HIGUCHI SAYEGUSA
Deputy Director

Appendix A-3
Regulatory Coordination and Correspondence

Conservation District Use Application Coordination

JOSH GREEN, M.D.
GOVERNOR
KE KIA'ĀINA

EDWIN H. SNIFFEN
DIRECTOR
KA LUNA HO'OKELE

Deputy Directors
Nā Hope Luna Ho'okele
DREANALEE K. KALILI
TAMMY L. LEE
CURT T. OTAGURO
ROBIN K. SHISHIDO

STATE OF HAWAI'I | KA MOKU'ĀINA 'O HAWAI'I
DEPARTMENT OF TRANSPORTATION | KA 'OIHANA ALAKAU
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

HWY-K 4.250096

March 13, 2025

VIA EMAIL: michael.cain@hawaii.gov

TO: DAWN N. S. CHANG, CHAIRPERSON
DEPARTMENT OF LAND AND NATURAL RESOURCES

ATTN: MICHAEL CAIN
ADMINISTRATOR
OFFICE OF CONSERVATION AND COASTAL LANDS

FROM: ERIC FUJIKAWA
DISTRICT ENGINEER

SUBJECT: CONSERVATION DISTRICT USE APPLICATION (CDUA)
REQUEST FOR DETERMINATION
KUHIO HIGHWAY INTERSECTION IMPROVEMENTS
SOUTH OLOHENA AHUPUAA, PUNA MOKU, ISLAND OF KAUAI
FEDERAL-AID PROJECT NO. NH-056-1(066)
KUHIO HIGHWAY RIGHT-OF-WAY (ROW): (4) 4-3-001:999 AND (4) 4-3-002:999 AND TMK PARCELS (4) 4-3-010:001 AND (4)4-3-010:005

The Hawaii Department of Transportation (HDOT) is proposing to renovate the intersection between Kuhio Highway (State Route 56), Kapaa Bypass, and Papaloa Road near the Coconut Marketplace in Kapaa, Kauai. The intersection coordinates are approximately 22°03'18.40" N, 159°19'46.90" W. The existing intersection contains two unsignalized T intersections.

The purpose of the proposed intersection improvements is to increase safety and connectivity of the road while easing traffic in the area. HDOT is currently evaluating realigning, the southern terminus of Kapaa Bypass Road at Kuhio Highway to intersect with the existing intersection of Kuhio Highway with Papaloa Road (North). The realignment will consolidate the two (2) existing T intersections into a single, full access intersection. In addition to consolidating the intersections, the realignment will provide the opportunity to allow left turns from Papaloa Road (North) onto Kuhio Highway. Installation of approximately 30-foot tall, safety standard compliant highway lights is also proposed as a part of this project.

The project area is approximately 8.96 aces and includes the Kuhio Highway ROW and two privately-owned parcels. Staging and stockpiling will take place in an approximately

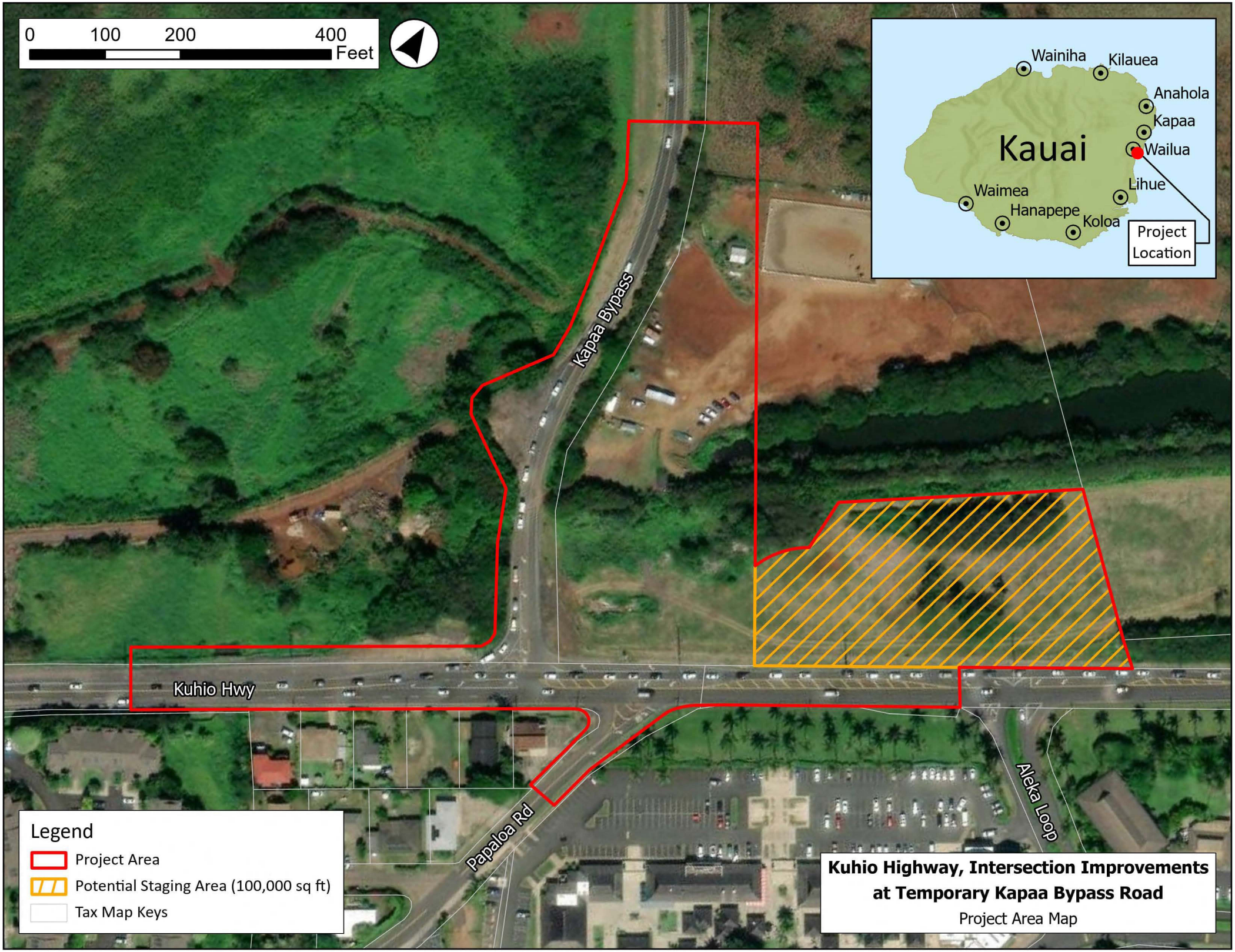
2.3 acre area in the northeast portion of the project area, mauka of the ROW, in a private TMK parcel. See Attachment 1: Project Area Map. The project area is located almost entirely within the Agricultural State Land Use District (SLUD), with a small portion of the project located within the Urban (SLUD). See Attachment 2: State Land Use District Map. A portion the project area, mostly consisting of the HDOT ROW, is located within the Special Management Area. See Attachment 3: Special Area Management Map.

To reduce traffic impacts to the surrounding community, nightwork is anticipated to occur during the duration of the project. The estimated start of construction is 2027 for two (2) years.

Although the project is not located within a Conservation District, it is located in the vicinity of the coast. We request your determination if a Conservation District Use Permit Application (CDUA) is required for this project.

Should you have any questions on the project or if any additional information is needed to make this determination, contact the HDOT Project Manager, Eric Fujikawa via email at eric.i.fujikawa@hawaii.gov.

Enclosures
Project Area Map
State Land Use District Map
Special Management Area Map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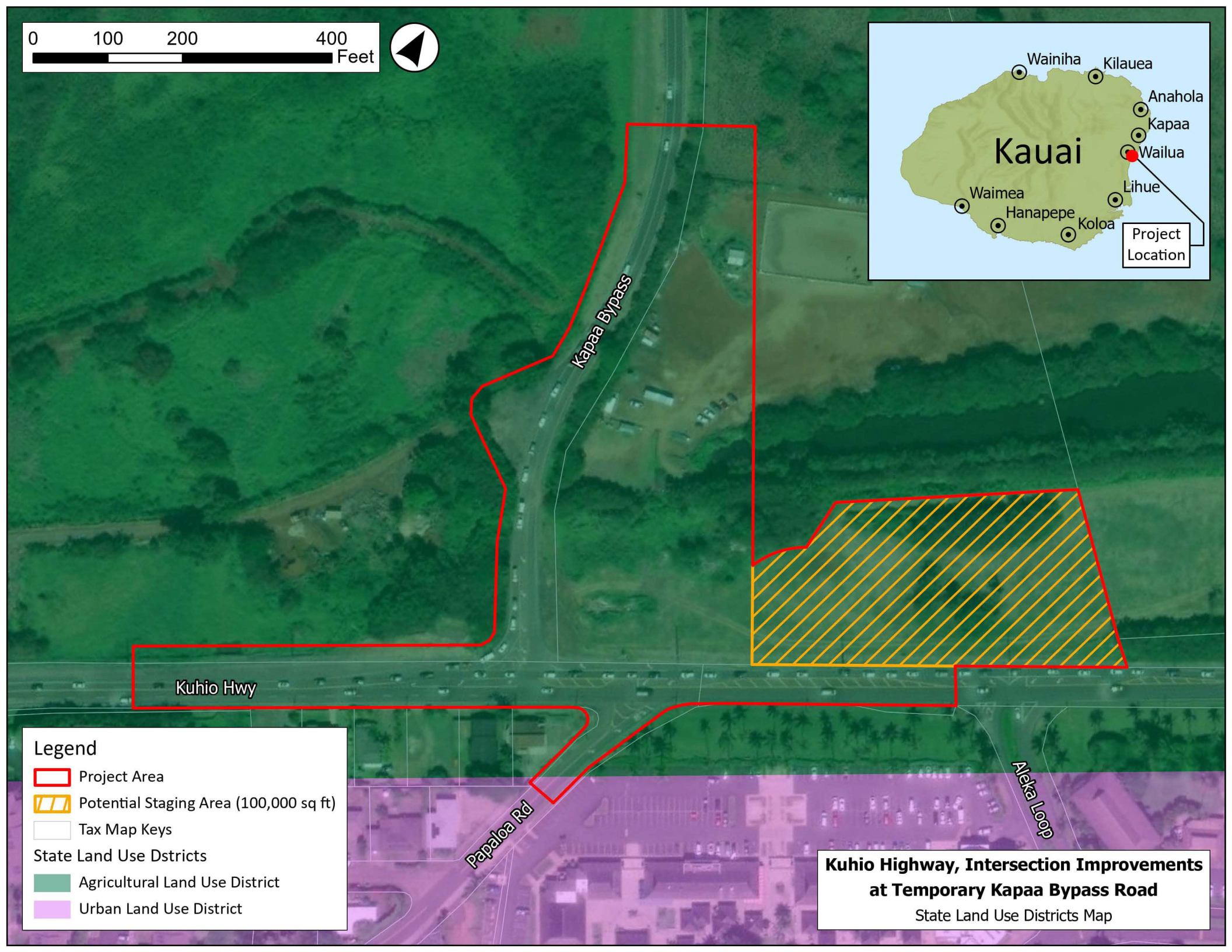
Koloa
Project Location
Kapaa Bypass
Kuhio Hwy
Papaloa Rd
Aleka Loop
Legend
Project Area
Potential Staging Area (100,000 sq ft)
Tax Map Keys
Kuhio Highway, Intersection Improvements at Temporary Kapaa Bypass Road
Project Area Map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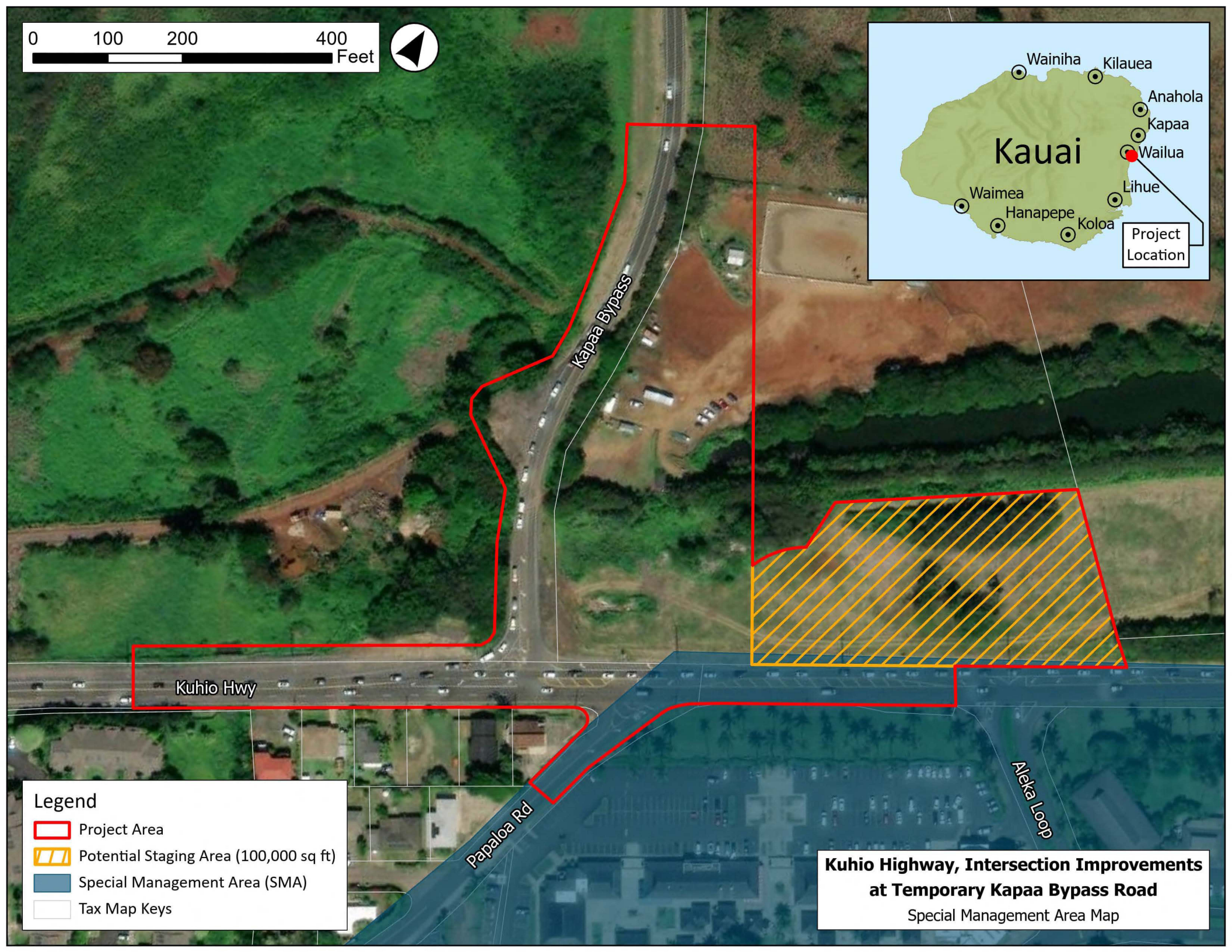
Agricultural Land Use District
Urban Land Use District
Kuhio Highway, Intersection Improvements at Temporary Kapaa Bypass Road
State Land Use Districts Map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Kuhio Hwy
Papaloa Rd
Aleka Loop
Legend
Project Area
Potential Staging Area (100,000 sq ft)
Special Management Area (SMA)
Tax Map Keys
Kuhio Highway, Intersection Improvements at Temporary Kapaa Bypass Road
Special Management Area Map

Silva Jr, Dennis

From: Cain, Michael <michael.cain@hawaii.gov>
Sent: Tuesday, July 8, 2025 2:08 PM
To: McClellan, Malie
Cc: Fujikawa, Eric I; Urasaki, Randall; Silva Jr, Dennis
Subject: Re: Conservation District Use Application Request for Determination - Kuhio Highway Intersection Improvements Project, Kauai

Good afternoon,

If a project is not in the Conservation District it would not require a Conservation District Use Permit.

Sincerely,
Michael Cain

Michael Cain, Administrator
Office of Conservation and Coastal Lands
1151 Punchbowl St. #131
Honolulu HI 96813
808.587.0377





Please note that emails to and from state employees in Hawai‘i are generally considered public records under the Hawai‘i Uniform Information Practices Act (UIPA), which is codified in Chapter 92F of the Hawai‘i Revised Statutes (HRS).

Please refer to our website at https://dlnr.hawaii.gov/occl/ for instructions on submitting applications.

From: McClellan, Malie <Malie.McClellan@wsp.com>
Sent: Wednesday, July 2, 2025 4:03 PM
To: Cain, Michael <michael.cain@hawaii.gov>
Cc: Fujikawa, Eric I <eric.i.fujikawa@hawaii.gov>; Urasaki, Randall M. <randall.urasaki@wsp.com>; Silva Jr, Dennis <Dennis.SilvaJr@wsp.com>
Subject: [EXTERNAL] Conservation District Use Application Request for Determination - Kuhio Highway Intersection Improvements Project, Kauai

Aloha Mr. Cain,
On behalf of the State of Hawaii Department of Transportation (HDOT), please find attached for a Conservation District Use Application (CDUA) Request for Determination for the subject Kuhio Highway Intersection Improvements Project on the Island of Kauai. Please let us know if there is anything additional we can provide to assist your review. Mahalo,

Mālie McClellan
Lead Planner

T +1 808-599-3438
M +1 808-561-1324

WSP USA Inc.
1001 Bishop Street, Suite 2400
Honolulu, HI 96813



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Appendix B Alternatives Analysis Report

KUHIO HIGHWAY AND KAPAA BYPASS ROAD ALTERNATIVES ANALYSIS

WAILUA, KAUAI, HAWAII

FINAL

July 18, 2024

Prepared for:

Mr. Eric I. Fujikawa
State of Hawaii Department of Transportation – Kauai District
1720 Haleukana Street
Lihue, Hawaii 96766

Austin, Tsutsumi & Associates, Inc.
Civil Engineers • Surveyors
501 Sumner Street, Suite 521
Honolulu, Hawaii 96817-5031
Telephone: (808) 533-3646
Facsimile: (808) 526-1267
E-mail: atahnl@atahawaii.com
Honolulu • Wailuku, Hawaii

KUHIO HIGHWAY AND KAPAA BYPASS ROAD ALTERNATIVES ANALYSIS

Wailua, Kauai, Hawaii

FINAL

Prepared for

State of Hawaii Department of Transportation – Kauai District
1720 Haleukana Street
Lihue, Hawaii 96766

Prepared by
Austin, Tsutsumi & Associates, Inc.
Civil Engineers • Surveyors
Honolulu • Wailuku, Hawaii

July 18, 2024

TABLE OF CONTENTS

			Page
1.	INTRODUCTION		1-4
	1.1	Project Description	1
	1.2	Study Methodology	3
	1.3	Analysis Methodology	3
2.	EXISTING TRAFFIC CONDITIONS		5-10
	2.1	Roadway Network	5
	2.2	Existing Traffic Volumes	6
	2.3	Existing Field Observations	6
	2.3.1	AM Peak Hour	6
	2.3.2	PM Peak Hour	7
	2.4	Existing Intersection Analysis	7
3.	ALTERNATIVES ANALYSIS		11-40
	3.1	Alternative 0: No Action	11
	3.1.1	Design Considerations	11
	3.1.2	Operational Impacts	11
	3.1.3	Simulation Results	12
	3.1.4	ROM Cost	12
	3.1.5	Discussion	12
	3.2	Alternative 1: Double-Lane Roundabout	14
	3.2.1	Design Considerations	14
	3.2.2	Operational Impacts	15
	3.2.3	Simulation Results	15
	3.2.4	ROM Cost	17

TABLE OF CONTENTS
Cont'd

3.2.5 Discussion 17

3.3 Alternative 2: Turbo Roundabout 20

3.3.1 Design Considerations 20

3.3.2 Operational Impacts 20

3.3.3 Simulation Results 21

3.3.4 ROM Cost 22

3.3.5 Discussion 22

3.4 Alternative 3: Traffic Signal 25

3.4.1 Design Considerations 25

3.4.2 Operational Impacts 25

3.4.3 Simulation Results 26

3.4.4 ROM Cost 27

3.4.5 Discussion 28

3.5 Alternative 4: Traffic Signal with Dual Northbound Left-Turns 30

3.5.1 Design Considerations 30

3.5.2 Operational Impacts 30

3.5.3 Simulation Results 31

3.5.4 ROM Cost 32

3.5.5 Discussion 32

3.6 Alternatives Comparison 34

3.7 Recommendations 34

4. CONCLUSIONS 41-42

4.1 Existing Conditions 41

4.2 Alternatives Analysis 41

TABLE OF CONTENTS
Cont'd

5. RECOMMENDATIONS 43

6. REFERENCES 44

TABLES

2.1 EXISTING CONDITIONS LEVEL OF SERVICE SUMMARY 8

3.1 FUTURE YEAR 2043 ALTERNATIVE 0 – NO ACTION LEVEL OF SERVICE SUMMARY 12

3.2 FUTURE YEAR 2043 ALTERNATIVE 1 – DOUBLE-LANE ROUNDABOUT LEVEL OF SERVICE SUMMARY 15

3.3 FUTURE YEAR 2043 ALTERNATIVE 2 – TURBO ROUNDABOUT LEVEL OF SERVICE SUMMARY 21

3.4 FUTURE YEAR 2043 ALTERNATIVE 3 – TRAFFIC SIGNAL LEVEL OF SERVICE SUMMARY 26

3.5 LEFT-TURN LANE STORAGE LENGTHS 27

3.6 FUTURE YEAR 2043 ALTERNATIVE 4 – TRAFFIC SIGNAL WITH DUAL NORTHBOUND LEFT-TURNS LEVEL OF SERVICE SUMMARY 31

3.7 ALTERNATIVES COMPARISON SUMMARY 36

FIGURES

1.1 PROJECT LOCATION 2

2.1 EXISTING LANE CONFIGURATION AND VOLUMES 9

2.2 KUHIO HIGHWAY/KAPAA BYPASS ROAD AND KUHIO HIGHWAY/PAPALOA ROAD (NORTH) EXISTING CONDITIONS 10

3.1 FUTURE YEAR 2043 LANE CONFIGURATION AND VOLUMES 13

3.2 ALTERNATIVE 1: DOUBLE-LANE ROUNDABOUT 19

3.3 ALTERNATIVE 2: TURBO ROUNDABOUT 24

3.4 ALTERNATIVE 3: TRAFFIC SIGNAL 29

TABLE OF CONTENTS
Cont'd

3.5	ALTERNATIVE 4: TRAFFIC SIGNAL WITH DUAL NORTHBOUND LEFT-TURN	33
3.6	ALTERNATIVES VOLUME AND LEVEL OF SERVICE COMPARISON.....	37-38
3.7	KUHIO HIGHWAY/KAPAA BYPASS ROAD/PAPALOA ROAD (NORTH) MAXIMUM QUEUE COMPARISON	39
3.8	KUHIO HIGHWAY/KAPAA BYPASS ROAD/PAPALOA ROAD (NORTH) AVERAGE QUEUE COMPARISON	40

APPENDICES

A. TRAFFIC COUNT DATA

B. VISSIM SIMULATION RESULTS

C. LEVEL OF SERVICE ANALYSIS

D. 2-1 ROUNDABOUT CONCEPT

E. MERGING ROUNDABOUT CONCEPT

AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

TERRANCE S. ARASHIRO, P.E.
ADRIENNE W.L.H. WONG, P.E., LEED AP
DEANNA M.R. HAYASHI, P.E.
PAUL K. ARITA, P.E.
ERIK S. KANESHIRO, L.P.L.S., LEED AP
MATT K. NAKAMOTO, P.E.
GARRETT K. TOKUOKA, P.E.

DRAFT FINAL

Kuhio Highway and Kapaa Bypass Road Alternatives Analysis

Wailua, Kauai, Hawaii

1. INTRODUCTION

This report documents the findings of a traffic study conducted by Austin, Tsutsumi, and Associates, Inc. (ATA) to evaluate the traffic impacts resulting from the proposed Kuhio Highway and Kapaa Bypass Road Alternatives Analysis Project (hereinafter referred to as the "Project") located in Wailua, Kauai, Hawaii.

1.1 Project Description

The State of Hawaii Department of Transportation – Kauai District (HDOT-K) is currently evaluating realigning the southern terminus of Kapaa Bypass Road at Kuhio Highway to intersect the existing Kuhio Highway/Papaloa Road (North) intersection near Coconut Marketplace. The realignment will consolidate the two (2) existing T-intersections into a single full access intersection.

In addition to consolidating the intersections, the realignment will provide the opportunity to allow left-turns from Papaloa Road (North) onto Kuhio Highway. Due to sight distance limitations at the Kuhio Highway/Lanikai Street intersection, HDOT-K is exploring allowing left-turns at the realigned Kuhio Highway/Kapaa Bypass Road/Papaloa Road (North) intersection as an alternate route in order to restrict left-turns at the Kuhio Highway/Lanikai Street intersection.

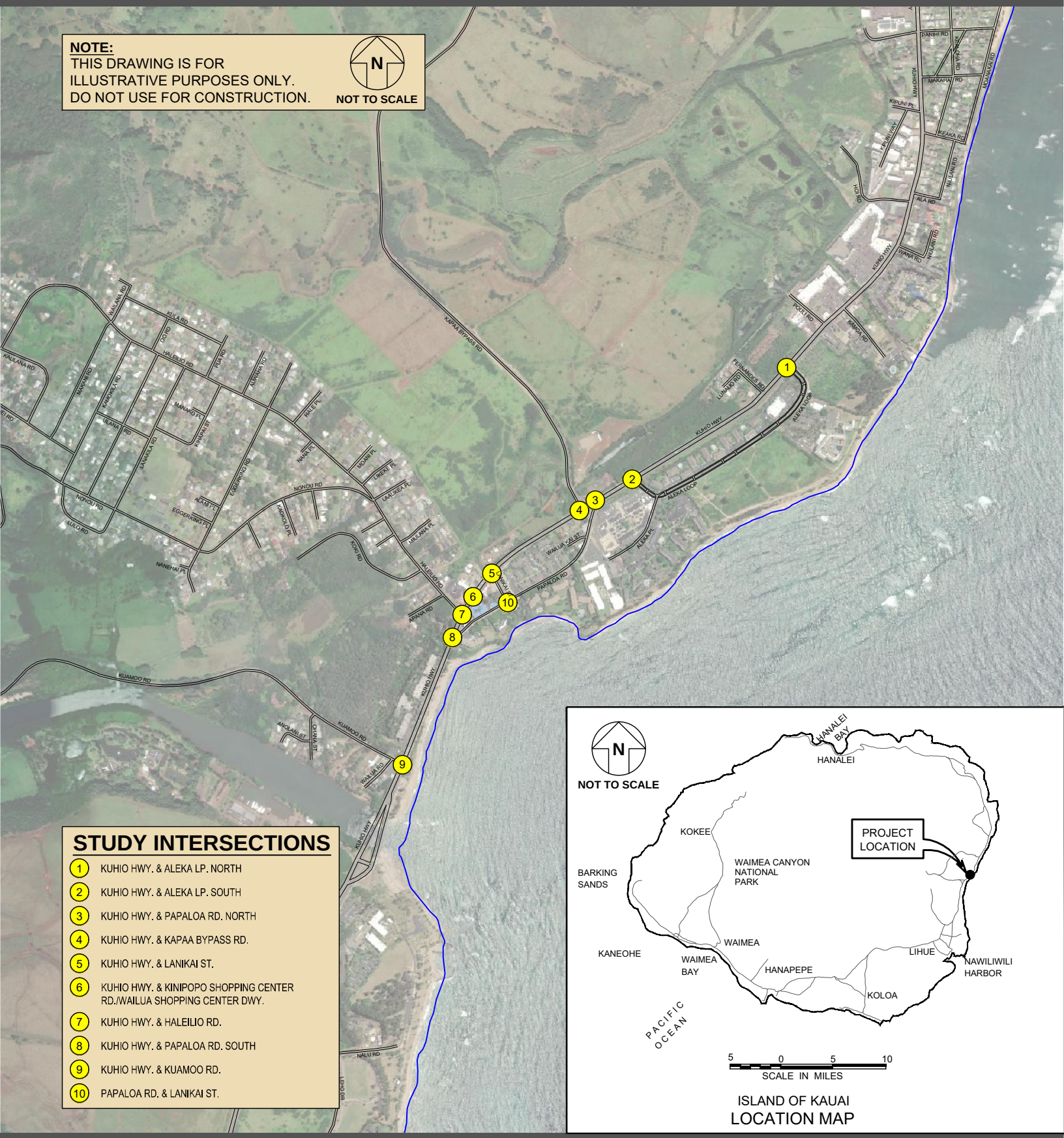
This study will detail existing traffic conditions in the vicinity of the Kuhio Highway/Kapaa Bypass Road and Kuhio Highway/Papaloa Road (North) intersections as well as consider the following future traffic control alternatives at the realigned full access intersection:

1. Alternative 1: Double-Lane Roundabout
2. Alternative 2: Turbo Roundabout
3. Alternative 3: Traffic Signal
4. Alternative 4: Traffic Signal with Dual Northbound Left-Turn Lanes

See Figure 1.1 for the Project Location.

KUHIO HIGHWAY AND KAPAA BYPASS ROAD ALTERNATIVES ANALYSIS

Austin Tsutsumi & Associates, Inc.
Engineers & Surveyors



STUDY INTERSECTIONS

1. KUHIO HWY. & ALEKA LP. NORTH
2. KUHIO HWY. & ALEKA LP. SOUTH
3. KUHIO HWY. & PAPALOA RD. NORTH
4. KUHIO HWY. & KAPAA BYPASS RD.
5. KUHIO HWY. & LANIKAI ST.
6. KUHIO HWY. & KINIPOPO SHOPPING CENTER RD./WAILUA SHOPPING CENTER DWY.
7. KUHIO HWY. & HALEILIO RD.
8. KUHIO HWY. & PAPALOA RD. SOUTH
9. KUHIO HWY. & KUAMOO RD.
10. PAPALOA RD. & LANIKAI ST.

ISLAND OF KAUAI
LOCATION MAP

FIGURE 1.1

PROJECT LOCATION

1.2 Study Methodology

This study will address the following:

- Assess existing traffic operating conditions during the weekday AM and PM peak hours of traffic at Kuhio Highway/Kapaa Bypass Road and Kuhio Highway/Papaloa Road (North) as well as within the study area.
- Identify and evaluate potential traffic control mitigation to improve operations at a future realigned Kuhio Highway/Kapaa Bypass Road/Papaloa Road (North) intersection.
- Provide recommendations, as necessary, to address existing and future operational deficiencies.

1.3 Analysis Methodology

The primary Measure of Effectiveness (MOE) used to evaluate the traffic control alternatives at the future realigned Kuhio Highway/Kapaa Bypass Road/Papaloa Road (North) intersection was delay and queuing along Kuhio Highway as based upon existing conditions field observations. Delay and queuing for each alternative were determined based on calibrated Vissim simulations to provide an "apples to apples" comparison between alternatives. Vissim was used for all simulations due to limitations with SimTraffic in modeling roundabout variations.

The Highway Capacity Manual (HCM) and Sidra analysis, which are primarily used to evaluate signalized/stop-controlled intersections and roundabouts, respectively, were utilized to determine a Level of Service (LOS) and initial viability for each of the studied alternatives. If HCM or Sidra analysis resulted in acceptable LOS levels for an alternative, simulations were further evaluated to determine anticipated delay and queuing. Because the calibration parameters between the HCM and Sidra are not consistent, the LOS was generally assumed to be a standalone criterion for each alternative and was not used to compare the effectiveness between alternatives.

The Vissim simulations were calibrated based on existing AM and PM peak hour conditions along Kuhio Highway between Kuamoo Road and Aleka Loop (North). All calibration parameters from existing conditions were held constant through the studied alternatives. The following calibration parameters were assumed:

- Simulations were generally calibrated using vehicle speeds and delays based on observed conditions during the AM and PM peak hours of traffic.
- Five (5) simulation runs were averaged to generate delay and queues for each studied alternative. Each run assumed a 15-minute seed (pre-record) time and 60-minute runtime.

Because only one (1) double-lane roundabout and no turbo roundabouts have been constructed in the State of Hawaii at the time of this study, driver behaviors at multi-lane roundabouts are still largely unknown. As a result, default driver behavior parameters such as headways and gap acceptance factors were assumed in Vissim simulations for the proposed roundabout alternatives.

Traffic count data was collected at the following intersections to further calibrate simulated conditions along Kuhio Highway in the vicinity of the Kapaa Bypass Road southern terminus:

1. Kuhio Highway/Aleka Loop [North] (Unsignalized)
2. Kuhio Highway/Aleka Loop [South] (Unsignalized)
3. Kuhio Highway/Papaloa Road [North] (Unsignalized)
4. Kuhio Highway/Kapaa Bypass (Unsignalized)
5. Kuhio Highway/Lanikai Street (Unsignalized)
6. Kuhio Highway/Kinipopo Shopping Village Road (Unsignalized)
7. Kuhio Highway/Haleilio Road (Signalized)
8. Kuhio Highway/Papaloa Road [South] (Unsignalized)
9. Papaloa Road/Lanikai Street (Unsignalized)
10. Kuhio Highway/Kuamoo Road (Signalized)

2. EXISTING TRAFFIC CONDITIONS

2.1 Roadway Network

The following are brief descriptions of the existing roadways studied within the vicinity of the Project. For the purposes of this study, Kuhio Highway is considered to run in the north-south direction. Directionality of remaining study roadways is based on each roadway's orientation in relation to Kuhio Highway.

Kuhio Highway is generally a two-way, three- to four-lane, north-south roadway within the study area. It begins to the south at its intersection with Kaumualii Highway and terminates to the north at the Kalalau Trail Trailhead. Kuhio Highway is a major roadway providing regional connectivity between the districts of Hanamaulu and Wainiha. Kuhio Highway was recently widened from three (3) to four (4) lanes between Kuamoo Road and the Kapaa Bypass Road southern terminus as part of the Kuhio Highway Short-Term Improvements project which was completed by HDOT-K in August 2023. In addition, with the Kuhio Highway Short-Term Improvements project, the weekday AM contraflow operations were modified to provide a southbound contraflow lane between Wailua Bridge and Kapule Highway. Kuhio Highway is no longer contraflowed in the vicinity of the Project with the completed widening. The posted speed limit along this roadway is 25 miles per hour (mph) in the vicinity of the Project.

Aleka Loop is a two-way, two-lane, north-south divided roadway that begins at its intersection with Kuhio Highway to the south and terminates to the north at its other intersection with Kuhio Highway. Aleka Loop serves various commercial and resort uses. The roadway has a posted speed limit of 15 mph in the vicinity of the Project.

Papaloa Road is a two-way, two-lane, north-south roadway that begins at its intersection with Kuhio Highway to the south and terminates to the north at its other intersection with Kuhio Highway. Papaloa Road serves various commercial, residential and resort uses. The roadway has a posted speed limit of 25 mph in the vicinity of the Project.

Kapaa Bypass Road is generally a two-way, two-lane, north-south roadway within the study area. Kapaa Bypass Road begins to the south at its intersection with Kuhio Highway in Wailua and terminates to the north at its intersection with Kuhio Highway in Kapaa. The northern terminus of the bypass road serves one-way traffic in the southbound direction only. Kapaa Bypass Road provides an alternative route to Kuhio Highway for drivers to avoid slowdowns through Kapaa Town caused by the numerous intersections as well as driveways and on-street parking serving commercial businesses. The roadway has a posted speed limit of 35 mph in the vicinity of the Project.

Lanikai Street is a two-way, two-lane, east-west roadway that begins at its intersection with Papaloa Road to the east and terminates to the west at its intersection with Kuhio Highway. Currently, Lanikai Street provides the only left turn exit onto Kuhio Highway for the commercial, residential and resort uses located makai of the highway between the Papaloa Road intersections. Although left turns at Kuhio Highway/Lanikai Street are currently allowed, sight distance is limited at the intersection. The roadway does not have a posted speed limit.

Haleilio Road is a two-way, two-lane, east-west roadway that begins at its intersection with Kuhio Highway to the east and terminates to the west at its intersection with Kaulana Road. Haleilio Road serves as the primary access for Wailua residents. The roadway has a posted speed limit of 25 mph.

Kuamoo Road is a two-way, two-lane, east-west roadway that begins to the east at its intersection with Kuhio Highway and terminates to the west near Keahua Stream. Kuamoo Road primarily serves the Wailua Homesteads residential area. During congested periods along Kuhio Highway and Kapaa Bypass Road, Kuamoo Road along with Kamalu Road and Olohena Road serves as a tertiary route between Kapaa and the Lihue area. The roadway has a posted speed limit of 35 mph in the vicinity of the Project.

2.2 Existing Traffic Volumes

Traffic volume data at the study intersections was collected on Tuesday, September 12, 2023. Based on the traffic count data, the weekday AM and PM peak hours of traffic within the study area generally occur between 7:00 AM to 8:00 AM and 4:00 PM to 5:00 PM, respectively. Traffic count data is provided in Appendix A.

At the time traffic volume data was collected, the HDOT-K Kuhio Highway Short-Term Improvements project had been completed, which widened Kuhio Highway to four (4) lanes between Kuamoo Road and the Kapaa Bypass Road southern terminus. The widening was fully completed in August 2023, but the widened section of the highway was opened to traffic earlier in June 2023. It was assumed that by the time data was collected in September 2023, drivers would be accustomed to the newly widened section of Kuhio Highway and would have rerouted between Kuhio Highway and Kapaa Bypass Road based on prevailing travel times. Therefore, no adjustments were made to existing traffic volumes to account for the Kuhio Highway Short-Term Improvements project.

2.3 Existing Field Observations

As a result of the Kuhio Highway Short-Term Improvements project, congestion along Kuhio Highway has significantly decreased during the AM and PM peak hours of traffic within the study area extending from Kuamoo Road to Aleka Loop (North). Congestion still persists north of the study area through Kapaa Town as a result of the numerous destinations along the corridor.

See Figure 2.1 for existing traffic volumes.

2.3.1 AM Peak Hour

During the AM peak hour, volumes are heaviest in the southbound direction along Kuhio Highway heading towards Lihue. With the Kuhio Highway Short-Term Improvements project, the right-turn movement from Kapaa Bypass Road onto Kuhio Highway was converted into a free movement allowing vehicles to turn directly into the newly added southbound lane without having to yield to vehicles already traveling on the highway. During the AM peak hour, volumes traveling southbound on Kuhio Highway and Kapaa Bypass Road are split evenly with approximately 660 vehicles per hour along each roadway.

In the study area, slowdowns and queuing along Kuhio Highway were primarily observed to occur during red signals at the signalized intersections at Haleilio Road and Kuamoo Road. However, queues were observed to clear within a single signal cycle.

Although congestion was not observed along Kuhio Highway, queuing was observed along the Kuamoo Road approach to Kuhio Highway during the AM peak hour. Since Kuamoo Road serves as the primary access for the Wailua Homesteads and other mauka residential areas in the Wailua/Kapaa area, right-turns exiting onto the highway were observed to be heavy during

the AM peak hour. Due to the Kuhio Highway/Kuamoo Road traffic signal primarily allocating green time to the heavy southbound highway approach, queues were observed to form along the Kuamoo Road approach, at times requiring multiple signal cycles to clear.

HDOT-K is currently evaluating and optimizing traffic signal operations at signals across the island. However, for the purposes of this study, modifications to the traffic signals at the studied intersections were not assumed to provide a direct comparison to observed existing conditions along the Kuhio Highway corridor.

Based on field conditions, travel times along Kuhio Highway in the northbound direction ranged from approximately 2.5 to 3 minutes in the northbound direction and 3 to 3.5 minutes in the southbound direction from just south of Kuamoo Road to just north of Aleka Loop (North). Simulations were calibrated to match observed queues and travel times. Resulting simulations account for average travel times of 2.8 minutes in the northbound direction and 3.0 minutes in the southbound direction during the AM peak hour of traffic along Kuhio Highway. Simulation results are included in Appendix B.

2.3.2 PM Peak Hour

Similar to the AM peak hour of traffic, minimal to no congestion was observed along Kuhio Highway during the PM peak hour within the study area. Given the heavier bidirectional volumes during the PM peak hour, left-turn movements were observed to have more difficulty finding gaps in traffic. The heavy left-turn from Kuhio Highway onto Kapaa Bypass Road was observed to occasionally queue beyond the left-turn pocket but did not block the adjacent through lane.

Based on field conditions, travel times along Kuhio Highway in the northbound direction ranged from approximately 2.5 to 3 minutes in the northbound direction and 3.5 to 4 minutes in the southbound direction from just south of Kuamoo Road to just north of Aleka Loop (North). Simulations were calibrated to match observed queues and travel times. Resulting simulations account for average travel times of 2.8 minutes in the northbound direction and 4.0 minutes in the southbound direction during the PM peak hour of traffic along Kuhio Highway. Simulation results are included in Appendix B.

2.4 Existing Intersection Analysis

As noted in Section 1.3, LOS analysis was performed at the Kuhio Highway/Kapaa Bypass Road and Kuhio Highway/Papaloa Road (North) intersections to evaluate capacity at the intersections based on the existing/proposed traffic control. Based on existing conditions analysis, all movements operate adequately with the exception of the eastbound left-turn at the Kuhio Highway/Kapaa Bypass Road intersection, which operates at LOS E(F) during the AM(PM) peak hours of traffic. This movement was observed to be a low volume movement since most vehicles likely choose to use Kuhio Highway instead of Kapaa Bypass Road if their destination is north of the bypass terminus due to the need to backtrack as well as the difficulty to find gaps in both northbound and southbound traffic to complete the turn.

Table 2.1 shows a summary of the existing delay, v/c ratio, and LOS. Figure 2.2 shows the existing traffic volumes, lane configuration and LOS at the study intersections. LOS worksheets are provided in Appendix C.

Table 2.1: Existing Conditions Level of Service Summary

Intersection	Existing Conditions					
	AM			PM		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
3. Kuhio Highway & Papaloa Road (North)						
WB RT	11.6	0.07	B	12.3	0.11	B
SB LT	9.6	0.04	A	10.1	0.06	B
Overall	0.5	-	-	0.8	-	-
4. Kuhio Highway & Kapaa Bypass Road						
NB LT	9.9	0.17	A	13.6	0.58	B
EB LT	39.1	0.07	E	480.4	0.98	F
EB RT	0.0	0.00	A	0.0	0.00	A
Overall	1.1	-	-	8.0	-	-

KUHIO HIGHWAY AND KAPAA BYPASS ROAD ALTERNATIVES ANALYSIS

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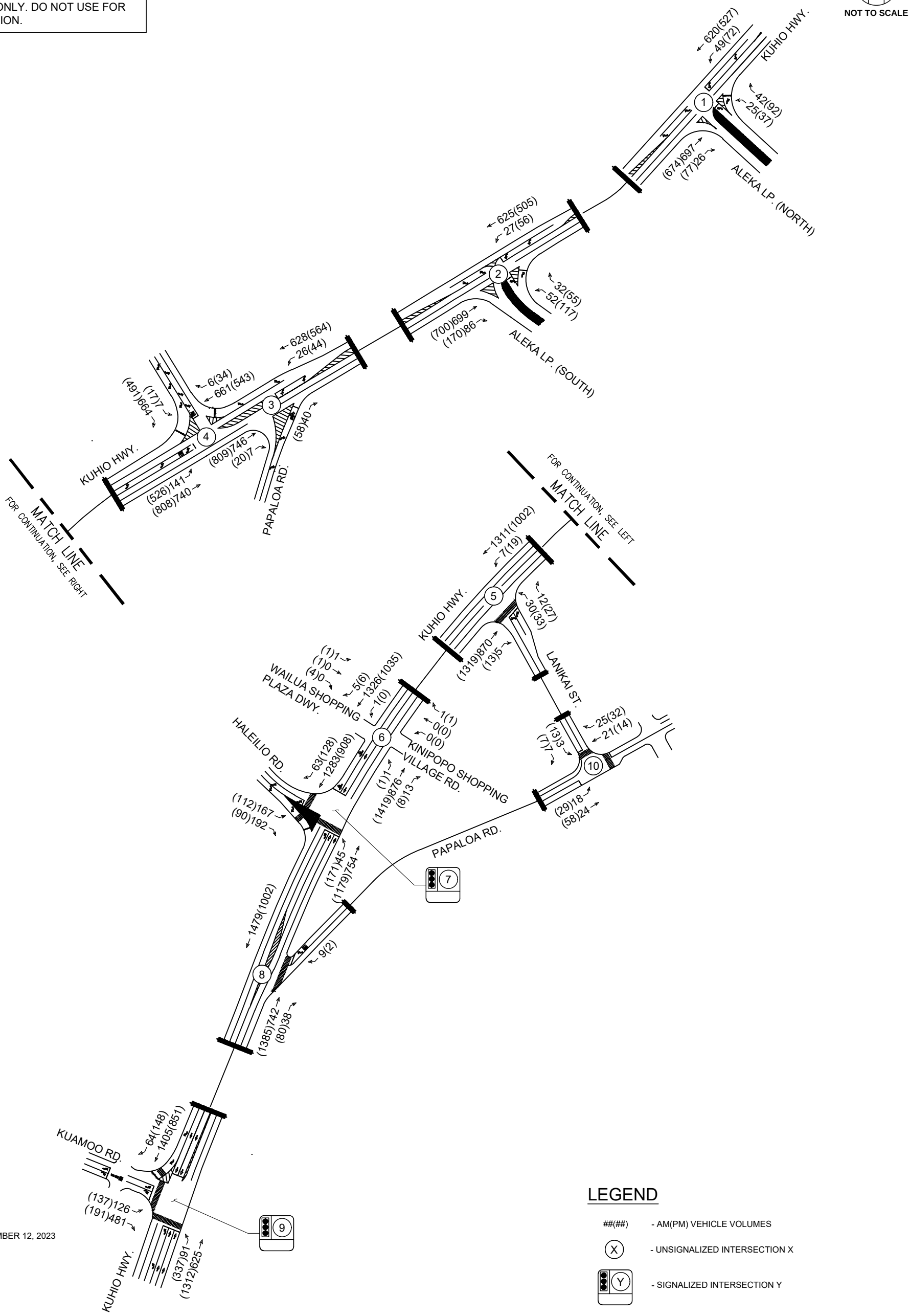

DATE OF COUNTS:
TUESDAY, SEPTEMBER 12, 2023

AM PEAK HOUR:
7:00 AM - 8:00 AM

PM PEAK HOUR:
4:00 PM - 5:00 PM

LEGEND

##(##)	- AM(PM) VEHICLE VOLUMES
(X)	- UNSIGNALIZED INTERSECTION X
(Y)	- SIGNALIZED INTERSECTION Y

FIGURE 2.1

EXISTING LANE CONFIGURATION AND VOLUMES

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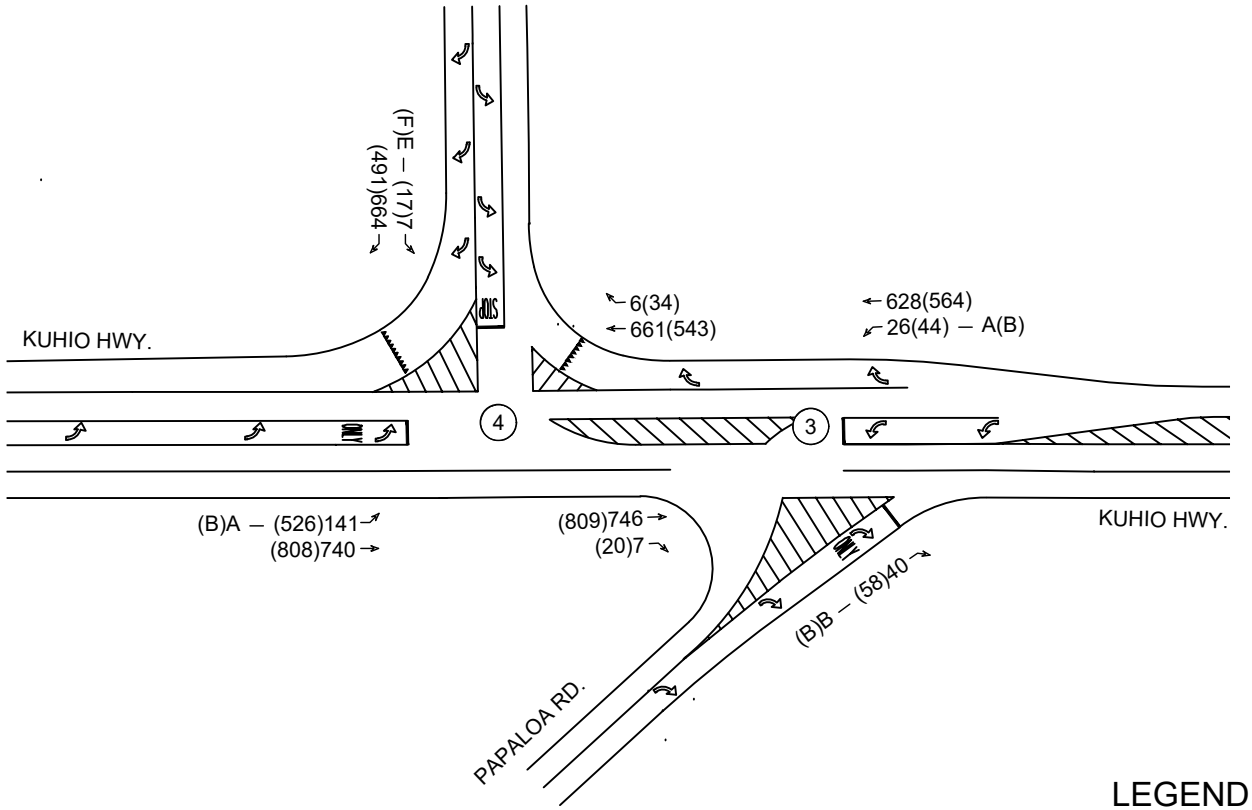

DATE OF COUNTS:
TUESDAY, SEPTEMBER 12, 2023

AM PEAK HOUR:
7:00 AM - 8:00 AM

PM PEAK HOUR:
4:00 PM - 5:00 PM

LEGEND

##(##)	AM(PM) VEHICLE VOLUMES
(X)	UNSIGNALIZED INTERSECTION X
X(X)	AM(PM) LOS

3. ALTERNATIVES ANALYSIS

The Year 2043 was selected to reflect a 20-year planning horizon for the proposed Project. Background traffic growth in the study area was estimated based on the HDOT island of Kauai 2035 Travel Demand Forecasting Model (TDFM). The forecasting model uses population forecasts from the Kauai General Plan to distribute households and vehicular trips across predetermined Traffic Analysis Zones (TAZs) based upon existing TAZ household distributions. Based on the TDFM, an approximate annual growth rate of 0.8% was applied along Kuhio Highway and Kapaa Bypass Road, which assumes both roadways will continue to operate under balanced equilibrium conditions. A 0.5% annual growth rate was applied to all remaining study roadways. See Figure 3.1 for Future Year 2043 traffic volumes.

As noted in Section 1.1, the realignment of Kapaa Bypass Road is proposed not only to consolidate the Kuhio Highway/Kapaa Bypass Road and Kuhio Highway/Papaloa Road (North) intersections, but to provide an alternate route for left-turn movements currently turning at the Kuhio Highway/Lanikai Street intersection. Currently, the Kuhio Highway/Lanikai Street intersection provides the only full access intersection allowing left-turns in and out of the commercial, residential and resort areas located makai of the highway along Papaloa Road. However, following the Kuhio Highway Short-Term Improvements project, sight distance at the Kuhio Highway/Lanikai Street intersection has become limited. Consolidating the Kapaa Bypass Road and Papaloa Road (North) intersections will provide an alternate location where left-turns can be made, allowing HDOT-K to restrict left-turns at the Kuhio Highway/Lanikai Street intersection. All studied alternatives consolidating the Kapaa Bypass Road and Papaloa Road (North) intersections assume the Lanikai Street left-turn restriction with all left-turns rerouted to Papaloa Road (North).

3.1 Alternative 0: No Action

The “No Action” alternative was evaluated to provide a baseline for comparison of Future Year 2043 traffic scenarios. The “No Action” alternative assumes no realignment of Kapaa Bypass Road and maintains the existing stop-control for the Kapaa Bypass Road and Papaloa Road (North) approaches to Kuhio Highway.

3.1.1 Design Considerations

Not applicable.

3.1.2 Operational Impacts

By Future Year 2043, the Kuhio Highway/Kapaa Bypass Road and Kuhio Highway/Papaloa Road (North) intersections are expected to experience increased vehicle demand, resulting in less gaps in traffic for left-turning traffic at both intersections. During the PM peak hour, the left-turn from Kapaa Bypass Road onto the highway is expected to operate overcapacity with lengthy delays.

Table 3.1 shows a summary of the Future Year 2043 delay, v/c ratio, and LOS under the no action alternative. LOS worksheets are provided in Appendix C.

Table 3.1: Future Year 2043 Alternative 0 – No Action Level of Service Summary

Intersection	Future Year 2043 Alternative 0 – No Action					
	AM			PM		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
3. Kuhio Highway & Papaloa Road (North)						
WB RT	12.4	0.09	B	13.4	0.14	B
SB LT	10.3	0.04	B	11.0	0.08	B
Overall	0.5	-	-	0.8	-	-
4. Kuhio Highway & Kapaa Bypass Road						
NB LT	10.8	0.21	B	17.8	0.70	C
EB LT	57.3	0.11	F	1478.9	2.40	F*
EB RT	0.0	0.00	A	0.0	0.00	A
Overall	1.2	-	-	17.3	-	-

* Indicates overcapacity conditions, v/c ≥ 1.

3.1.3 Simulation Results

With the increase in traffic in the study area expected by Future Year 2043, travel times are generally anticipated to remain similar to or slightly increase compared to existing conditions. Travel times of approximately 2.8(3.2) minutes are expected in the northbound direction during the AM(PM) peak hours and 3.1(4.1) minutes are expected in the southbound direction during the AM(PM) peak hours.

Queueing at the Kuhio Highway/Kapaa Bypass Road and Kuhio Highway/Papaloa Road (North) intersections is primarily expected to occur during the PM peak hour. The heavy northbound left-turn volume entering the bypass road during the PM peak hour is expected to experience increased delays with the reduction in gaps in southbound traffic as traffic increases. As a result, northbound left-turn queues are expected to spill back out of the turn pocket and into the adjacent through lane. Although average queues of approximately 300 feet are expected, at worse, queues may extend beyond the Haleilio Road and Papaloa Road (South) intersections.

No major queuing is expected for the remaining study intersection movements during the AM and PM peak hours of traffic.

3.1.4 ROM Cost

Not applicable.

3.1.5 Discussion

By Future Year 2043, left-turns from Kuhio Highway onto Kapaa Bypass Road are expected to have increased difficulty completing maneuvers, increasing the likelihood of queues extending beyond the left-turn pocket and blocking adjacent through traffic. Although delays along the highway will generally remain minimal by Future Year 2043 with stop-control operations at Kapaa Bypass Road and Papaloa Road (North), the no action alternative does not address the desired left-turn restriction at the Kuhio Highway/Lanikai Street intersection.

KUHIO HIGHWAY AND KAPAA BYPASS ROAD ALTERNATIVES ANALYSIS

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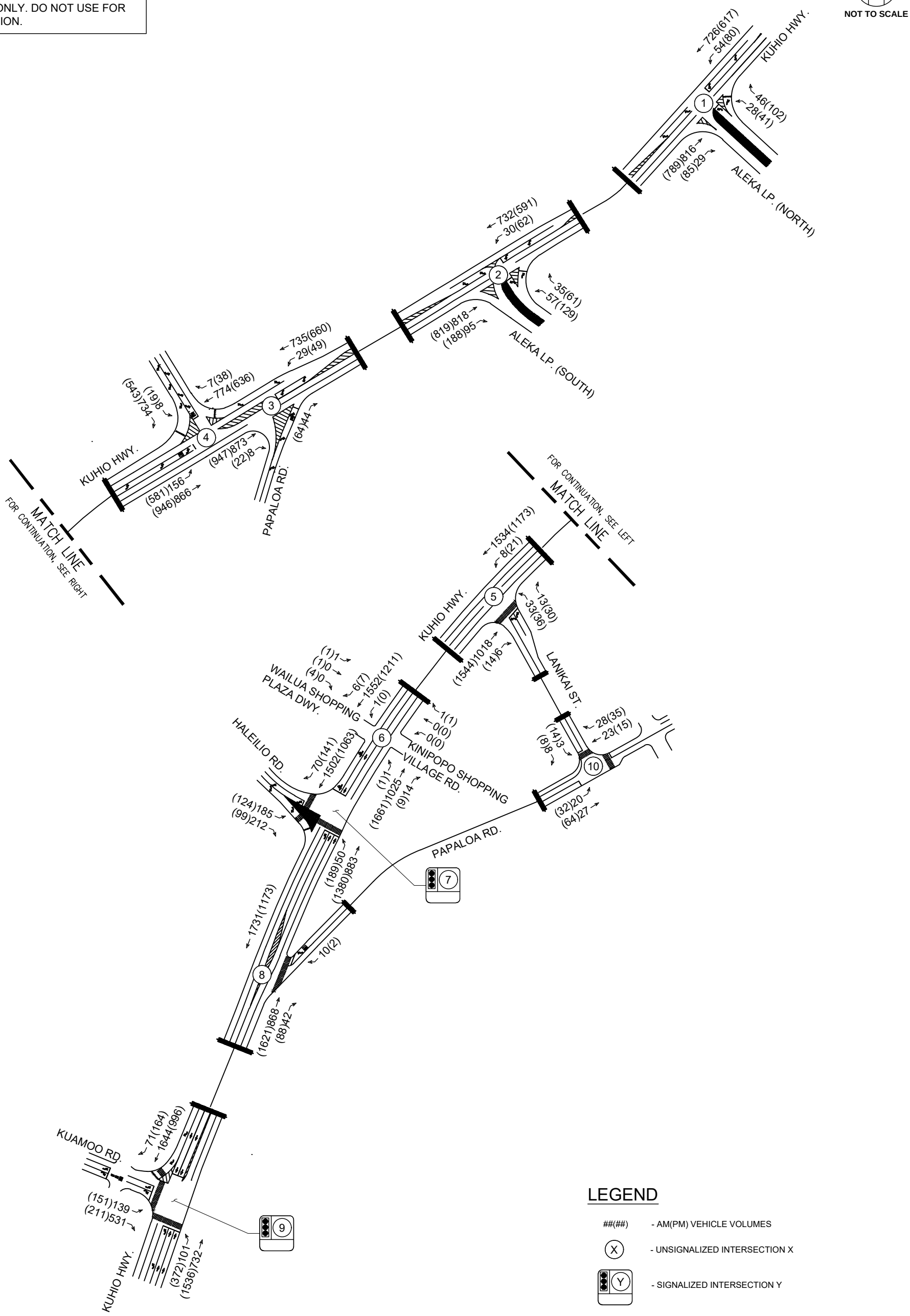

LEGEND

##(##)	- AM(PM) VEHICLE VOLUMES
(X)	- UNSIGNALIZED INTERSECTION X
(Y)	- SIGNALIZED INTERSECTION Y

FIGURE 3.1

FUTURE YEAR 2043 LANE CONFIGURATION AND VOLUMES

3.2 Alternative 1: Double-Lane Roundabout

3.2.1 Design Considerations

Various roundabout configurations were initially evaluated at the proposed realigned Kuhio Highway/Kapaa Bypass Road/Papaloa Road (North) intersection. In an effort to generally preserve the existing lane configuration, a roundabout concept with two (2) northbound lanes and one (1) southbound lane along Kuhio Highway, as well as a right-turn bypass lane for Kapaa Bypass Road, was assessed. However, based on LOS capacity analysis, this concept was expected to result in overcapacity conditions along the highway by Future Year 2043 during the PM peak hour of traffic. Therefore, the "2-1" roundabout concept was not explored further. The concept layout and LOS analysis are included in Appendix D.

To mitigate overcapacity conditions presented with the "2-1" roundabout concept, a concept with two (2) northbound and two (2) southbound lanes was evaluated. With an additional southbound through lane, the right-turn exiting from Kapaa Bypass Road would be required to either yield to circulating southbound traffic at the roundabout or continue as a free movement and merge into the southbound traffic further downstream. The merge option would require an additional southbound receiving lane to be constructed at the roundabout and extend southbound to provide drivers with an adequate merging distance. Based on discussions with HDOT-K, because the merging bypass lane could cause slowdowns on the Kuhio Highway mainline, which in turn could create queues that spill back into the roundabout, the merging bypass lane roundabout concept was also not explored further. The concept layout and LOS analysis are included in Appendix E.

Ultimately, the concept with two (2) northbound and southbound lanes along Kuhio Highway and a yielding right-turn along Kapaa Bypass Road was evaluated as the potential double-lane roundabout concept.

The following additional considerations were assumed for all roundabout designs:

- Inscribed circle diameter of 160 feet which is a typical size for a double-lane roundabout.
- Design vehicles of WB-67 for Kuhio Highway through movements and WB-50 for remaining movements.
- Property acquisition mauka of the highway to accommodate the roundabout footprint. Avoid impacting properties on the makai side of the highway.
- Restriction of left-turns at the Kuhio Highway/Lanikai Street intersection with all left-turns rerouted to the Kuhio Highway/Kapaa Bypass Road/Papaloa Road (North) intersection.

The double-lane roundabout concept is shown in Figure 3.2.

Based on the double-lane roundabout concept layout, both stopping sight distance and intersection sight distance are expected to be met for all approaches. Required easements for stopping sight distance and intersection sight distance are shown in Figure 3.2 in pink and orange, respectively.

3.2.2 Operational Impacts

By Future Year 2043, the double-lane roundabout at the realigned Kuhio Highway/Kapaa Bypass Road/Papaloa Road (North) intersection is expected to operate adequately based on capacity analysis with all movements operating at LOS B or better during both the AM and PM peak hours of traffic.

Table 3.2 shows a summary of the Future Year 2043 delay, v/c ratio, and LOS under the double-lane roundabout alternative. LOS worksheets are provided in Appendix C.

Table 3.2: Future Year 2043 Alternative 1 – Double-Lane Roundabout Level of Service Summary

Intersection	Future Year 2043 Alternative 1 – Double-Lane Roundabout					
	AM			PM		
	SIDRA Delay	v/c Ratio	LOS	SIDRA Delay	v/c Ratio	LOS
3. Kuhio Highway & Kapaa Bypass Road & Papaloa Road (North)						
NB LT/TH	5.2	0.41	A	8.8	0.65	A
NB TH/RT	3.3	0.41	A	4.0	0.65	A
EB LT/TH/RT	12.2	0.67	B	10.1	0.56	B
EB RT	11.5	0.67	B	9.3	0.56	A
WB LT/TH/RT	7.5	0.15	A	10.4	0.29	B
SB LT/TH	5.1	0.35	A	14.9	0.60	B
SB TH/RT	4.4	0.35	A	11.9	0.60	B
Overall	6.7	-	A	8.8	-	A

3.2.3 Simulation Results

Although the capacity analysis in Section 3.2.2 indicates adequate capacity for the double-lane roundabout alternative for both peak hours of traffic, based on simulations, increased delays are expected to result, primarily during the PM peak hour.

With the double-lane roundabout, travel times are anticipated to generally remain the same at 2.8(3.0) minutes in the northbound direction during the AM(PM) peak hours, but travel times are expected to increase to 3.2(9.2) minutes in the southbound direction during the AM(PM) peak hours.

During the AM peak hour, queues are anticipated to form along the Kapaa Bypass Road eastbound approach since vehicles along the bypass road are required to yield to heavy southbound vehicle volumes circulating through the roundabout. Queues are generally expected to move steadily; however, maximum queues of approximately 970 feet are projected to form. Minimal queuing and delay are anticipated for the other approaches to the roundabout.

During the PM peak hour, heavy northbound left-turn volumes are expected to conflict with the equally heavy southbound volumes, limiting the number of gaps in which southbound vehicles are able to enter the roundabout. As a result, long queues are expected to form along the southbound approach of Kuhio Highway. Although the arrival of northbound left-turning vehicles

are metered by the upstream traffic signal at the Kuhio Highway/Haleilio Road intersection, the gaps in northbound traffic are generally limited since Kuhio Highway receives the majority of the green time at the Haleilio Road traffic signal. Although queues are expected to form along the northbound and eastbound approaches as vehicles entering the roundabout are required to yield to circulating traffic, queues are expected to be minimal compared to the southbound approach.

For the purposes of the simulations, the additional southbound lane along Kuhio Highway was modeled at a maximum length of approximately 1,700 feet, which assumes the widening may extend as far as the residential properties in the vicinity of Fernandes Road. Based on simulations during the PM peak hour, maximum southbound queues are expected to extend beyond the widened portion of the highway and into the single lane portion for a total queue length of approximately 1,900 feet. However, average queues are expected to be roughly half as long at approximately 900 feet. It should be noted that if the additional southbound lane extends for a shorter distance, a longer queue would be expected.

Based on the PM peak hour simulations, the double-lane roundabout alternative would benefit from larger gaps in circulating northbound left-turn traffic to allow greater southbound entry into the roundabout. Gaps in northbound left-turn traffic may be achieved by the following:

- Providing an additional northbound left-turn lane – An additional northbound left-turn lane would spread left-turn volumes over two (2) lanes, allowing left-turn volumes to clear the roundabout in less time and provide additional gaps for southbound traffic. However, an additional northbound left-turn lane would preclude providing two (2) northbound through lanes at the roundabout. Since northbound through volumes are higher than left-turning volumes, this would not be a desired configuration. In addition, since northbound through volumes are higher than left-turning volumes, in a dual left-turn lane configuration, most left-turners would likely continue to use the inner turn lane since volumes would be lower than in the shared outer lane.
- Metering the northbound entry – Based on the Transportation Research Board NCHRP Research Report 1043: Guide for Roundabouts, hereinafter referred to as the "Roundabout Guide," entry metering signals can be used to improve roundabout operations during peak periods. Roundabout metering includes a queue detector on the impacted approach and a metering signal/signal controller on the upstream approach. When long queues are detected on the subject approach, the signal controller activates the metering signal to halt roundabout entry from conflicting traffic volumes. Metering is typically done by approach, which would create additional delays for the metered approach. In this case, northbound through volumes would be stopped periodically although they do not contribute to conflicting circulating flows for the southbound approach. According to the Roundabout Guide, roundabout metering in the United States is limited with only six (6) permanent or temporary installations currently in place. Based on guidance from the Federal Highway Administration's Roundabouts: An Informational Guide, published in 2000, metering through signalization can be implemented when necessary, but roundabouts should not be planned/designed with an intent for metering. As an alternative, the Roundabout Guide notes that metering can also be done by an upstream signalized intersection, although generally not as effective due to vehicles entering at intermediate locations.

Given the above considerations, roundabout metering during the PM peak hour may be considered through an adjustment of signal timing at the Kuhio Highway/Haleilio Road intersection as a potential mitigation for southbound queues at the roundabout. However, the

metering will result in added delays at the Kuhio Highway/Haleilio Road intersection and may be less effective at creating gaps due to driveways and intersections contributing to traffic between Haleilio Road and Kapaa Bypass Road.

3.2.4 ROM Cost

This high-level cost estimate is based on the best available information at the time of this report.

A ROM cost of $25 Million is projected for the double-lane roundabout alternative and proposed Kapaa Bypass Road realignment.

3.2.5 Discussion

Although the double-lane roundabout alternative may result in long, slow moving southbound queues along Kuhio Highway during the PM peak hour, some variability in operations may exist due to driver behaviors that are largely unknown at this time given the limited number of existing local double-lane roundabouts for comparison. Reroutes in traffic between Kuhio Highway and Kapaa Bypass Road are also likely to occur as traffic rebalances to adjust to differences in travel times.

Pros:

- Results in slower speeds along the Kuhio Highway and Kapaa Bypass Road approaches.
- Aligns with Complete Streets policy to provide accessible conditions for all users.
- Less conflict points for vehicles, pedestrians, and bicyclists.
- Roundabouts result in an 82% reduction in fatal and injury crashes compared to two-way stop-controlled intersections and a 78% reduction in fatal and injury crashes compared to signalized intersections[1].
- Reduces queuing and delays for left-turn movements.
- Lower maintenance cost.
- Lower environmental impact.
- Longer lifespan at approximately 25 years.
- Sight distance can be met without impacting existing development.

Cons:

- Removes priority for the mainline which is expected to result in queuing and delays primarily along the southbound highway approach.
- Removes the free right-turn movement from Kapaa Bypass Road to Kuhio Highway.
- Driver confusion may exist when first travelling through the roundabout since double-lane roundabouts have not yet been constructed in Kauai. However, this is expected to reduce with time.

[1] Based on statistics published by the Federal Highway Administration (https://highways.dot.gov/safety/proven-safety-countermeasures/roundabouts). Date Accessed: April 5, 2024.

- Long-term driver behaviors that may impact roundabout operations are unknown at this time since no double-lane roundabouts have been constructed on Kauai. These driver behaviors may include, but are not limited to, changing lanes within the roundabout, traveling on the truck apron to maintain higher speeds, or driving more cautiously at slower speeds.
- High construction cost anticipated.

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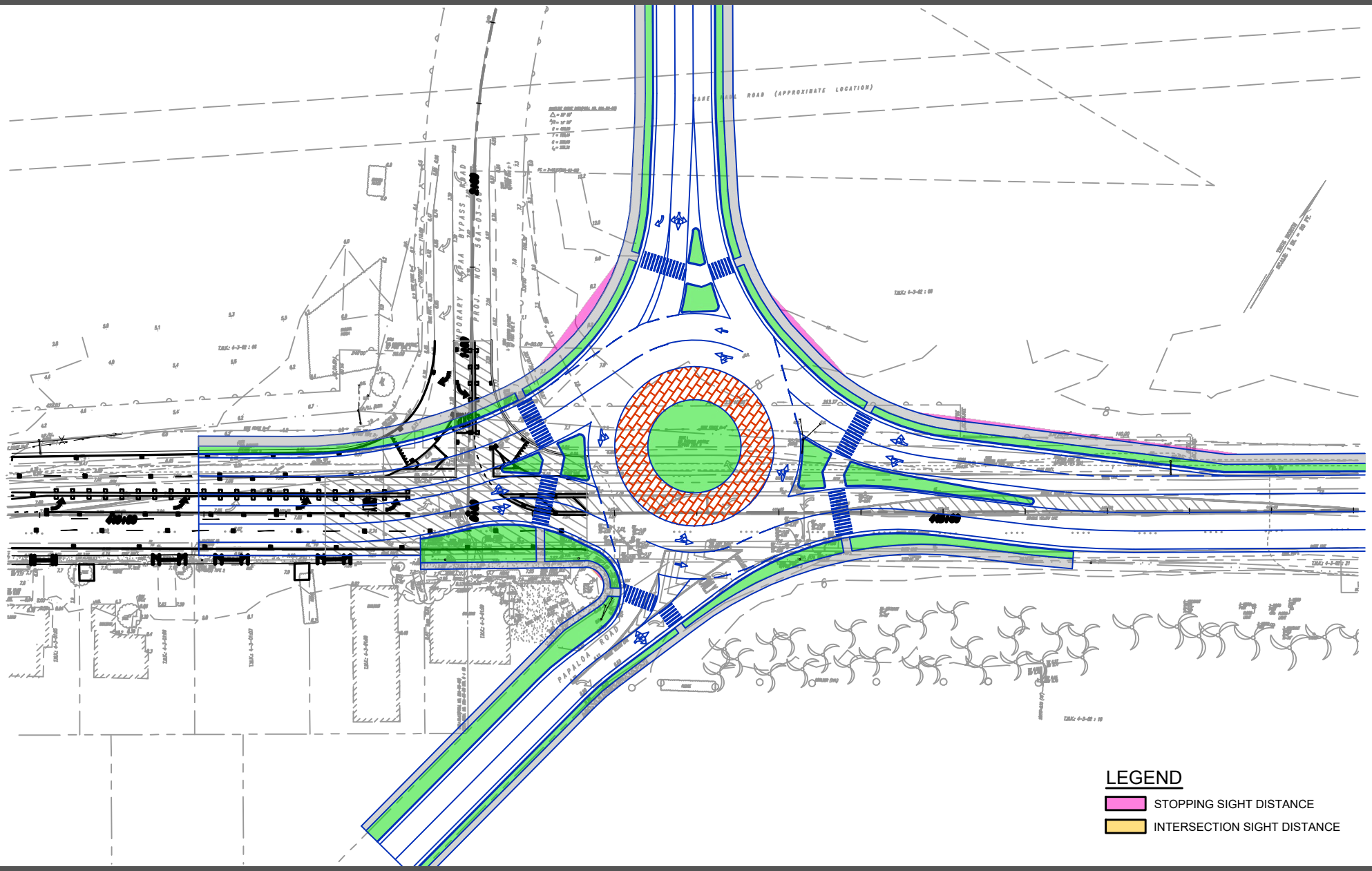

FIGURE 3.2

ALTERNATIVE 1:
DOUBLE-LANE ROUNDABOUT

3.3 Alternative 2: Turbo Roundabout

3.3.1 Design Considerations

A turbo roundabout is a variation of a multi-lane roundabout that was originally developed in the Netherlands and has primarily been constructed in European countries. Turbo roundabouts are generally characterized by the following features:

- "Spiral" geometry which inserts a second circulatory lane that can only be accessed by entering roundabout traffic and not by circulating traffic.
- Lane dividers to discourage lane changing within the roundabout. Dividers may be raised or mountable.
- Approach legs are typically at right angles to the roundabout. Speed reduction generally occurs as a result of tighter turning movements caused by lane dividers, and therefore, deflection on approach legs is not required to achieve desired speeds through the roundabout.
- At least two (2) legs must have two (2) exit lanes.

Based on the above characteristics, a similar lane configuration to the double-lane roundabout was assumed with an additional southbound through lane provided north of the roundabout. As with the double-lane roundabout, the following parameters were assumed for the turbo roundabout design:

- Inscribed circle diameter of 162 feet which is based on the typical size for a double-lane roundabout (160 feet) plus one-foot lane dividers between the northbound and southbound circulating lanes.
- Design vehicles of WB-67 for Kuhio Highway through movements and WB-50 for remaining movements. All lane dividers were assumed to be mountable to accommodate design vehicles.
- Property acquisition mauka of the highway to accommodate the roundabout footprint. Avoid impacting properties on the makai side of the highway.
- Restriction of left-turns at the Kuhio Highway/Lanikai Street intersection with all left-turns rerouted to the Kuhio Highway/Kapaa Bypass Road/Papaloa Road (North) intersection.

The turbo roundabout concept layout is shown in Figure 3.3.

Based on the turbo roundabout concept layout, both stopping sight distance and intersection sight distance are expected to be met for all approaches. However, an existing sign at the southwest corner of the intersection may present a sight obstruction depending on the height of the driver/vehicle sightline. This sign may need to be removed/relocated to meet sight distance requirements if the issue cannot be mitigated in final design if this alternative is pursued. Required easements for stopping sight distance and intersection sight distance are shown in Figure 3.2 in pink and orange, respectively.

3.3.2 Operational Impacts

By Future Year 2043, the turbo roundabout at the realigned Kuhio Highway/Kapaa Bypass Road/Papaloa Road (North) intersection is expected to operate adequately based on capacity

analysis with all movements operating at LOS B or better during both the AM and PM peak hours of traffic.

Table 3.3 shows a summary of the Future Year 2043 delay, v/c ratio, and LOS under the turbo roundabout alternative. LOS worksheets are provided in Appendix C.

Table 3.3: Future Year 2043 Alternative 2 – Turbo Roundabout Level of Service Summary

Intersection	Future Year 2043 Alternative 2 – Turbo Roundabout					
	AM			PM		
	SIDRA Delay	v/c Ratio	LOS	SIDRA Delay	v/c Ratio	LOS
3. Kuhio Highway & Kapaa Bypass Road & Papaloa Road (North)						
NB LT/TH	5.2	0.41	A	8.8	0.65	A
NB TH/RT	3.3	0.41	A	4.0	0.65	A
EB LT/TH/RT	11.1	0.63	B	9.7	0.52	A
EB RT	8.9	0.63	B	7.1	0.52	A
WB LT/TH/RT	6.9	0.13	A	9.9	0.26	A
SB LT/TH	5.1	0.35	A	14.9	0.60	B
SB TH/RT	4.4	0.35	A	11.9	0.60	B
Overall	6.1	-	A	8.5	-	A

3.3.3 Simulation Results

Similar to the double-lane roundabout, although capacity analysis indicates minimal anticipated delay through the turbo roundabout, based on simulations, increased delays are expected to occur, primarily during the PM peak hour.

With the turbo roundabout, travel times are anticipated to increase to 3.0(3.5) minutes in the northbound direction during the AM(PM) peak hours and to 3.2(6.5) minutes in the southbound direction during the AM(PM) peak hours.

During the AM peak hour, turbo roundabout operations are expected to be similar to the double-lane roundabout alternative with queues expected to form along Kapaa Bypass Road as vehicles exiting the bypass are required to yield to the southbound circulating vehicles. Maximum queues are expected to extend approximately 1,150 feet; however, average queues are expected to be much shorter at approximately 200 feet since queues are generally expected to clear steadily.

Based on simulations, delays during the PM peak hour in the southbound direction are projected to be less than the double-lane roundabout alternative. Due to the tight turn required upon entering the inner lane of the roundabout from the Kuhio Highway approaches, vehicles making the northbound left-turn onto Kapaa Bypass Road are expected to experience longer delays entering the roundabout, resulting in more gaps for southbound traffic to enter. As a result, shorter queues are expected in the southbound direction; however, longer queues are expected in the northbound direction due to the slower entering speeds. It should be noted that because no turbo roundabouts have been constructed in the State, actual driver behaviors at the roundabout may vary with entering speeds slower or faster than modeled in simulations. If

speeds entering the roundabout are slower than modeled and/or drivers exhibit more cautious behavior entering the roundabout due to the presence of delineation, queues may extend longer in both the northbound and southbound directions. Unlike the double-lane roundabout, roundabout metering would not present a viable option for mitigation in this situation.

Similar to the double-lane roundabout alternative, for the purposes of the simulations, the additional southbound lane along Kuhio Highway was modeled at a maximum length of approximately 1,700 feet. For the turbo roundabout alternative, southbound queues are expected to extend a maximum length of approximately 1,000 feet. It is recommended that the southbound widening extend this far at a minimum to accommodate potential queues.

3.3.4 ROM Cost

This high-level cost estimate is based on the best available information at the time of this report.

A ROM cost of $25 Million is projected for the turbo roundabout alternative and proposed Kapaa Bypass Road realignment.

3.3.5 Discussion

Because turbo roundabouts have not yet been constructed in the State, actual operations due to differences in driver behavior are not known at this time. As a result, variations in actual operations compared to simulations may occur. Compared to the double-lane roundabout, operations are generally expected to be similar with the turbo roundabout. However, due to lower entering speeds for the northbound and southbound approaches of Kuhio Highway, the turbo roundabout is expected to have longer northbound queues but shorter southbound queues during the PM peak hour.

Pros:

- Results in slower speeds along the Kuhio Highway and Kapaa Bypass Road approaches.
- Aligns with Complete Streets policy to provide accessible conditions for all users.
- Less conflict points for vehicles, pedestrians, and bicyclists.
- Roundabouts result in an 82% reduction in fatal and injury crashes compared to two-way stop-controlled intersections and a 78% reduction in fatal and injury crashes compared to signalized intersections[2].
- Reduces queuing and delays for left-turn movements.
- Delineation between lanes discourages lane changes within the roundabout reducing potential conflicts.
- Lower maintenance cost.
- Lower environmental impact.
- Longer lifespan at approximately 25 years.

[2] Based on statistics published by the Federal Highway Administration (https://highways.dot.gov/safety/proven-safety-countermeasures/roundabouts). Date Accessed: April 5, 2024.

Cons:

- Removes priority for the mainline which may result in queuing and delays along the highway.
- Removes the free right-turn movement from Kapaa Bypass Road to Kuhio Highway.
- Tight entry turn into the inner roundabout lane may require significant reductions in speed leading to lower lane utilization and/or additional backups along the highway.
- Driver confusion may exist when first travelling through the roundabout since turbo roundabouts have not yet been constructed in Hawaii. However, this is expected to reduce with time.
- Long-term driver behaviors that may impact roundabout operations are unknown at this time since no turbo roundabouts have been constructed on Kauai. These driver behaviors may include, but are not limited to, changing lanes within the roundabout, traveling on the truck apron to maintain higher speeds, or driving more cautiously at slower speeds.
- High construction cost anticipated.
- Existing sign on southwest corner of the intersection may need to be removed/relocated to provide adequate sight distance.

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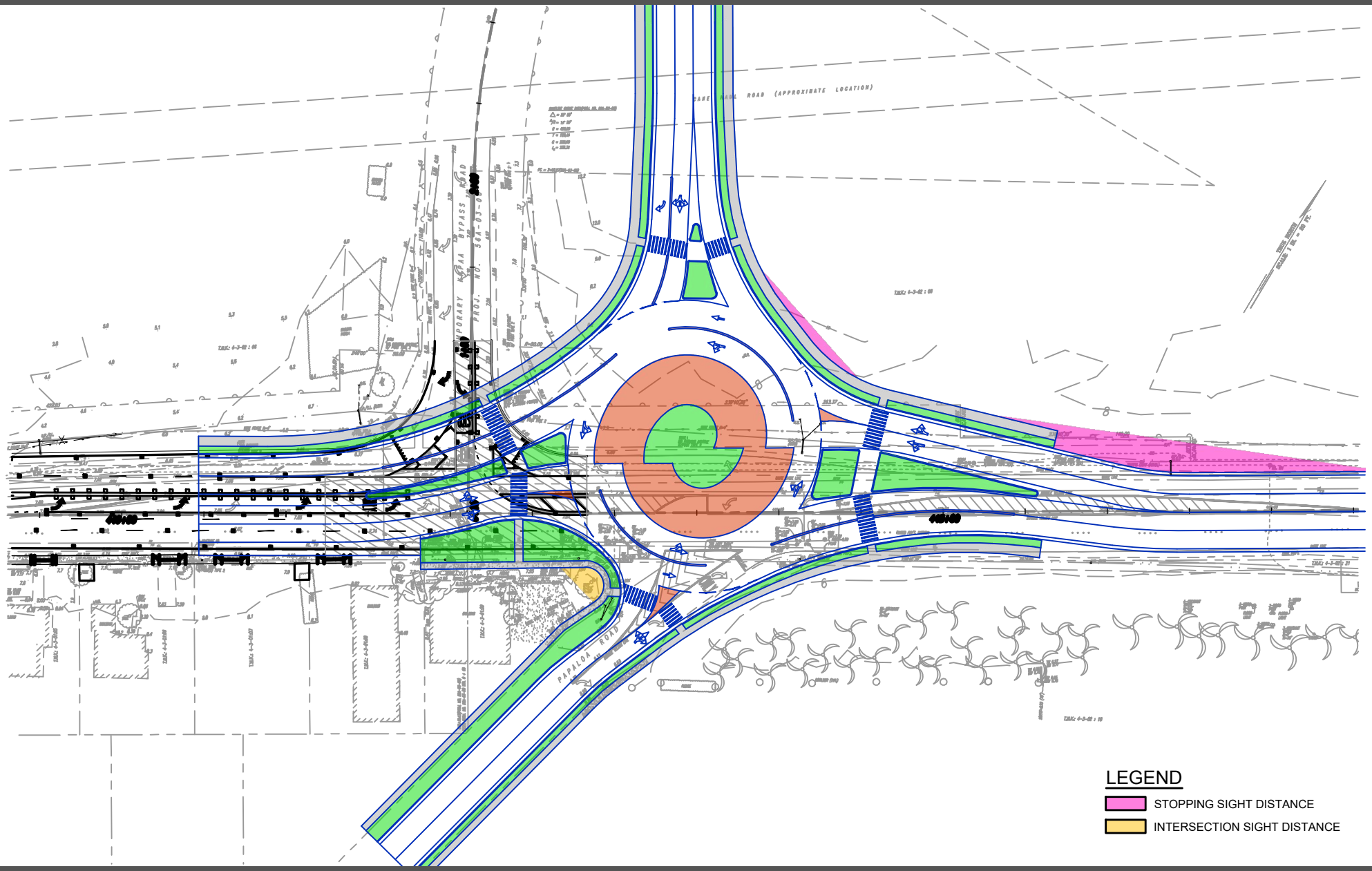

FIGURE 3.3

ALTERNATIVE 2:
TURBO ROUNDABOUT

3.4 Alternative 3: Traffic Signal

3.4.1 Design Considerations

In an effort to generally preserve the existing lane configuration at both the Kapaa Bypass Road and Papaloa Road (North) intersections, a traffic signal concept with the following lane configuration was initially assessed:

- Northbound: One (1) left-turn lane, one (1) through lane and one (1) shared through/right-turn lane
- Southbound: One (1) left-turn lane, one (1) through lane and one (1) right-turn lane
- Eastbound: One (1) shared left-turn/through lane and one (1) free right-turn lane
- Westbound: One (1) shared left-turn/through/right-turn lane

However, based on LOS capacity analysis, this concept was expected to result in near or overcapacity conditions along the highway by Future Year 2043 during the PM peak hour of traffic. The overcapacity conditions are the result of heavy northbound left-turn volumes conflicting with a similar southbound through volume.

Based on the northbound left-turn and southbound through conflict, additional capacity at the intersection may be provided by either widening the northbound approach to provide an additional left-turn lane or widening the southbound approach to provide an additional through lane. Alternative 3 includes widening the southbound approach similar to the roundabout alternatives, while Alternative 4 includes the dual northbound left-turn lane option. With the second southbound through lane, the free right-turn movement from Kapaa Bypass Road onto Kuhio Highway was relegated to a signalized movement with right-turn on red allowed.

With the Alternative 3 traffic signal, protected only and protected-permissive phasing, similar to the Kuhio Highway/Haleilio Road and Kuhio Highway/Kuamoo Road intersections, was evaluated for left-turns from the highway. Hereinafter, the protected only scenario will be referred to as Alternative 3A and the protected-permissive scenario will be referred to as Alternative 3B.

The traffic signal concept layout is shown in Figure 3.4.

3.4.2 Operational Impacts

By Future Year 2043, a traffic signal at the realigned Kuhio Highway/Kapaa Bypass Road/Papaloa Road intersection is expected to operate adequately with all movements operating at LOS D or better during both the AM and PM peak hours of traffic with either protected only or protected-permissive phasing. Although projected to operate at LOS D with protected only phasing and LOS B with protected-permissive phasing, the northbound left-turn is projected to operate near capacity during the PM peak hour of traffic.

Table 3.4 shows a summary of the Future Year 2043 delay, v/c ratio, and LOS under the traffic signal alternative. LOS worksheets are provided in Appendix C.

Table 3.4: Future Year 2043 Alternative 3 – Traffic Signal Level of Service Summary

Intersection	Future Year 2043 Alternative 3A – Traffic Signal Protected Only Left-Turn Phasing						Future Year 2043 Alternative 3B – Traffic Signal Protected-Permissive Left-Turn Phasing					
	AM			PM			AM			PM		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
3. Kuhio Highway & Kapaa Bypass Road & Papaloa Road (North)												
NB LT	34.3	0.78	C	44.1	0.95	D	14.2	0.48	B	16.8	0.90	B
NB TH/RT	17.1	0.64	B	8.8	0.47	A	17.7	0.68	B	9.4	0.52	A
EB LT/TH	15.2	0.02	B	30.5	0.09	C	13.8	0.02	B	23.3	0.08	C
EB RT	41.1	0.92	D	40.9	0.82	D	36.8	0.91	D	31.4	0.78	C
WB LT/TH/RT	15.7	0.12	B	31.5	0.23	C	14.3	0.12	B	24.0	0.21	C
SB LT	39.6	0.56	D	51.2	0.77	D	14.4	0.13	B	13.5	0.19	B
SB TH	21.4	0.71	C	28.5	0.74	C	19.6	0.70	B	19.6	0.65	B
SB RT	16.0	0.01	B	22.0	0.02	C	14.7	0.01	B	15.2	0.02	B
Overall	24.6	-	C	26.4	-	C	21.6	-	C	15.9	-	B

3.4.3 Simulation Results

With the protected only left-turn phasing under Alternative 3A, travel times are anticipated to increase to 3.3(3.8) minutes in the northbound direction during the AM(PM) peak hours and to 3.7(5.0) minutes in the southbound direction during the AM(PM) peak hours. With the traffic signal with protected-permissive left-turn phasing under Alternative 3B, travel times are anticipated to increase slightly to 3.2(3.2) minutes in the northbound direction during the AM(PM) peak hours and to 3.7(4.8) minutes in the southbound direction during the AM(PM) peak hours.

The protected only left-turn phasing along the highway is expected to have a larger increase in travel times during the PM peak hour of traffic compared to the protected-permissive left-turn phasing. Because southbound through volumes along Kuhio Highway are lighter than northbound through volumes during the PM peak hour, northbound left-turning vehicles are expected to be able to occasionally turn during gaps in southbound traffic if permissive left-turns are allowed. If protected only left-turn phasing is provided and northbound left-turns are not allowed to turn during gaps in southbound traffic, a longer green phase is expected to be required for the northbound left-turn movement, shortening the green phase for the southbound through movement and increasing delays along the highway. In addition, the likelihood of northbound left-turns spilling out of the left-turn pocket is expected to increase with the protected only phasing, which could impact the northbound through movement.

Unlike the roundabout alternatives, the traffic signal allows more control over prioritizing the mainline Kuhio Highway through movements. During the AM peak hour, priority of the mainline is expected to come at the expense of the eastbound Kapaa Bypass Road approach, with lengthy maximum queues possible similar to the roundabout alternatives. During the PM peak hour, the priority is expected to come at the expense of the northbound left-turn. Queues are still expected to form along the mainline approaches as well since the traffic signal requires vehicles to come to a complete stop whereas a roundabout typically allows a slow, steady flow of traffic.

As noted in Section 3.4.1, although northbound left-turn volumes are expected to be over 600 vehicles during the PM peak hour, only a single northbound left-turn lane was assumed with Alternative 3. As a result, long northbound left-turn queues are anticipated to form during the movement's red and/or permissive green phases. Based on simulations, during the PM peak hour, northbound left-turn queues are expected to on average extend 240 feet with protected-permissive phasing. However, at a maximum, left-turn queues may extend 1,115 feet with protected-permissive phasing. If protected only phasing is provided at the intersection, average queues are expected to extend 600 feet with the possibility of maximum queues extending through multiple intersections up to 2,660 feet. Realistically, as the left-turn queue and associated delays increase, vehicles will likely continue northbound on Kuhio Highway instead of turning onto Kapaa Bypass Road, limiting the amount of queueing that will ultimately occur. Based on the American Association of State Highway and Transportation Officials A Policy on Geometric Design of Highways and Streets, 7th Edition, dated 2018 (hereinafter referred to as the AASHTO Green Book), 775 feet of storage is recommended for the northbound left-turn lane as shown in Table 3.5 below. With the recommended storage length from the AASHTO Green Book, vehicle queues may temporarily block the adjacent through lane if surges in traffic occur and maximum queues are observed.

Table 3.5: Left-Turn Lane Storage Lengths

Movement	Peak Hour	Design Volume per lane (veh)	Cycle Length (sec)	Cycles per Hour	Avg. Veh. per Cycle	Minimum Storage Length (1.5 factor) [1, 2]		Recommended storage length [3]
						Veh	Ft	
Kuhio Highway/Kapaa Bypass Road/Papaloa Road (North)								
NB Kuhio Highway Left-turn lane	AM	165	120	30	6	9	225	775 ft.
	PM	616	120	30	21	31	775	
SB Kuhio Highway Left-turn lane	AM	33	120	30	2	2	60	100 ft.
	PM	66	120	30	3	4	100	

Notes:
1. Minimum storage length is 1.5 times the average number of vehicles per cycle based on the AASHTO Green Book 2018.
2. Assume 1 vehicle length = 25 ft.
3. Recommended storage length is exclusive of taper length and deceleration length. To be verified upon design.

Similar to the roundabout alternatives, for the purposes of the simulations, the additional southbound lane along Kuhio Highway was modeled at a maximum length of approximately 1,700 feet. For the traffic signal alternative, southbound queues are expected to extend a maximum length of approximately 500 feet for both protected-permissive and protected only left-turn phasing. It is recommended that the southbound widening extend this far at a minimum to accommodate potential queues.

3.4.4 ROM Cost

This high-level cost estimate is based on the best available information at the time of this report.

A ROM construction cost of $10 Million is projected for the traffic signal alternative and the proposed realignment of Kapaa Bypass Road.

In addition to initial construction costs, traffic signals have greater operational and maintenance costs compared to roundabouts due to greater electricity usage and the need to replace various traffic signal parts. Based on the City and County of Honolulu Department of Transportation Services Transportation Technology Division Fiscal Year 2024 operating budget[3], each of the approximately 850 traffic signals maintained by the department costs roughly $8,000 per year to operate and maintain. This cost includes, but is not limited to, employee salaries, electricity costs, and traffic signal supplies and parts. Assuming a similar $8,000 per year cost for a traffic signal on Kauai, the additional operation and maintenance cost for the traffic signal alternative over the 20-year study period is projected to be approximately $160,000.

Based on the typical lifespan of a traffic signal of 10-20 years, it is assumed that replacement of major traffic signal infrastructure will need to occur within the 20-year study period for an added cost of approximately $1 Million.

A total ROM cost of $11.2 Million is projected for the traffic signal alternative and proposed realignment of Kapaa Bypass Road.

3.4.5 Discussion

Compared to the roundabout alternatives, a traffic signal will allow greater control over which movements have priority at the intersection by allocating more or less green time to specific movements. However, a traffic signal does require vehicles to come to a complete stop during red phases, which will contribute to queuing along all approaches.

Pros:

- Provides dedicated phase for highway left-turn movements.
- Allows control over movement priority through signal timing adjustments.
- Shorter distance recommended for additional southbound through lane.
- Lower construction cost than roundabout.

Cons:

- No geometry-based speed mitigation.
- Greater number of conflict points.
- Removes the free right-turn movement from Kapaa Bypass Road to Kuhio Highway.
- Potential for northbound left-turn volumes to spill out of pocket and into adjacent through lane.
- Higher maintenance cost.
- Higher environmental impact.
- Shorter lifespan at approximately 10-20 years.

[3] City and County of Honolulu, The Executive Program and Budget Fiscal Year 2024 Volume 1 – Operating Program & Budget, 2023.

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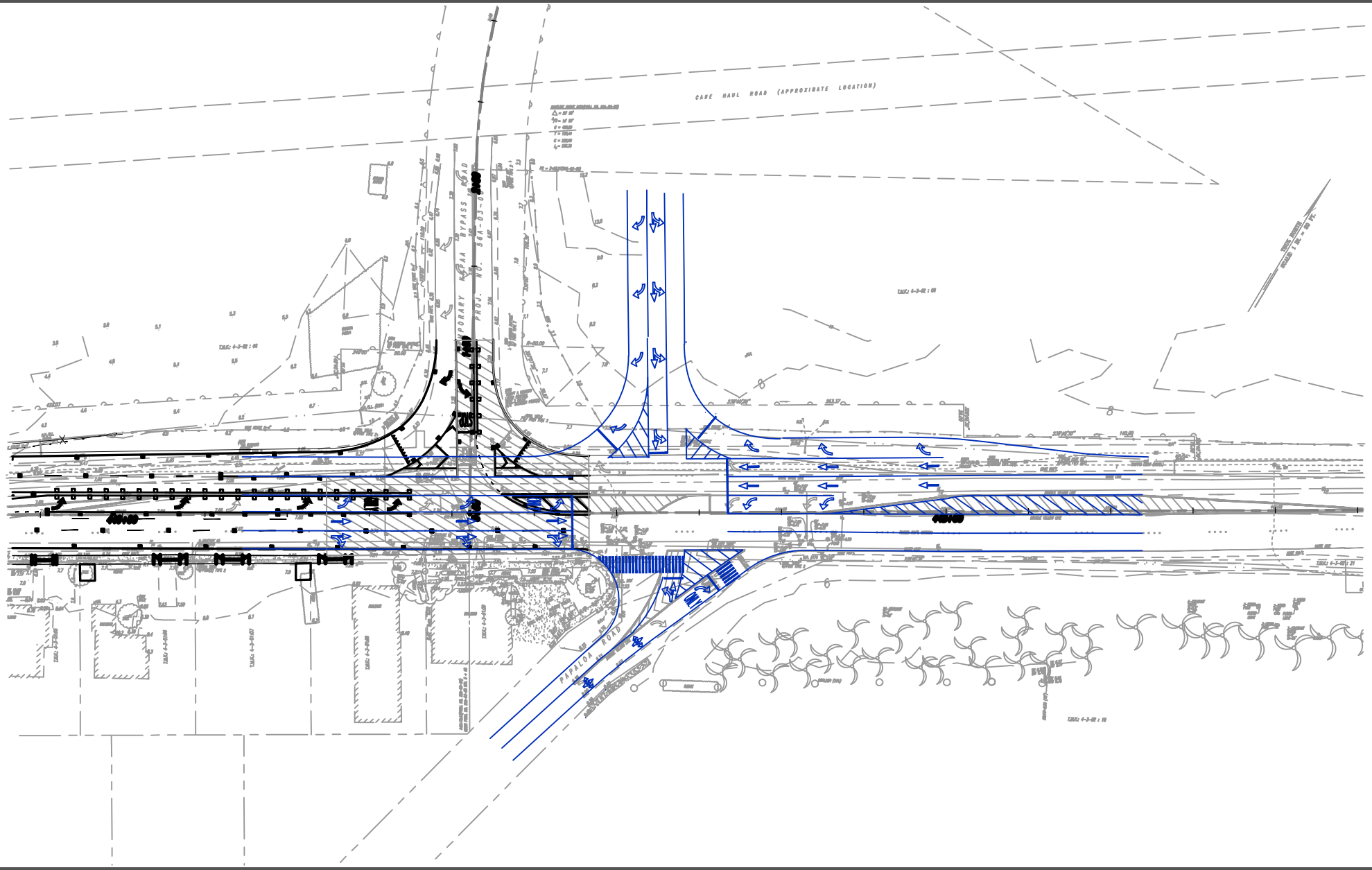

FIGURE 3.4

ALTERNATIVE 3:
TRAFFIC SIGNAL

3.5 Alternative 4: Traffic Signal with Dual Northbound Left-Turns

3.5.1 Design Considerations

As noted in Section 3.4.1, two (2) different lane configurations were evaluated for the traffic signal alternative. Given the heavy PM peak hour northbound left-turn volume of approximately 600 vehicles per hour, dual northbound left-turn lanes are warranted at this intersection. In addition to widening Kuhio Highway to provide the additional left-turn lane, Kapaa Bypass Road would also need to be widened to provide two (2) receiving lanes. The two (2) receiving lanes would eventually merge back to a single lane along the bypass road.

Since left-turn volumes from the highway onto the bypass road will be limited based on the number of vehicles arriving per cycle, difficulties with the downstream merge are not expected to occur as long as an adequate merging distance is provided. Based on left-turn storage lane length calculations shown in Section 3.4.3 Table 3.5, during the PM peak hour, 31 vehicles may be expected to turn per cycle. As a worst-case scenario, the merge lane should accommodate all 31 vehicles in a single lane (775 feet minimum) to prevent queues from backing up into the Kuhio Highway/Kapaa Bypass Road/Papaloa Road (North) intersection.

Protected only left-turn signal phasing was evaluated for both approaches of the highway since permitted left-turns would not be allowed with the dual northbound left-turn lanes.

The additional southbound through lane included in the previous alternatives was not included in Alternative 4 since the additional northbound left-turn lane is expected to increase capacity of the southbound approach of the highway as well by reducing the required green time for conflicting movements. Based on AM peak hour congestion that occurred prior to the Kuhio Highway Short-Term Improvements project, it was assumed that two (2) southbound lanes would be necessary south of the bypass road connection. Therefore, without the additional southbound through lane north of the intersection, it was assumed that the free right-turn movement from Kapaa Bypass Road onto Kuhio Highway would remain. This would require widening the south leg of the highway to accommodate the wider cross-section with the dual northbound left-turn lanes.

The traffic signal concept layout with dual northbound left-turn lanes is shown in Figure 3.5.

3.5.2 Operational Impacts

By Future Year 2043, a traffic signal with dual northbound left-turns at the realigned Kuhio Highway/Kapaa Bypass Road/Papaloa Road intersection is expected to operate adequately with all movements operating at LOS D or better during both the AM and PM peak hours of traffic. Compared to Alternative 3, Alternative 4 benefits from greater capacity for the northbound left-turn as well as for the free eastbound right-turn movement. The increased capacity for the eastbound right-turn is most notable during the AM peak hour when volumes along both the highway and bypass road are heavy headed towards Lihue.

Table 3.6 shows a summary of the Future Year 2043 delay, v/c ratio, and LOS under the traffic signal with dual northbound left-turn lanes alternative. LOS worksheets are provided in Appendix C.

Table 3.6: Future Year 2043 Alternative 4 – Traffic Signal with Dual Northbound Left-Turns Level of Service Summary

Intersection	Future Year 2043 Alternative 4 – Traffic Signal with Dual Northbound Left-Turns					
	AM			PM		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
3. Kuhio Highway & Kapaa Bypass Road & Papaloa Road (North)						
NB LT	21.4	0.54	C	23.1	0.77	C
NB TH/RT	5.7	0.45	A	5.7	0.45	A
EB LT/TH	21.2	0.06	C	28.6	0.14	C
EB RT	0.0	0.00	A	0.0	0.00	A
WB LT/TH/RT	22.2	0.25	C	30.2	0.36	C
SB LT	27.4	0.51	C	37.5	0.71	D
SB TH	10.6	0.81	B	18.0	0.85	B
SB RT	5.2	0.00	A	9.4	0.02	A
Overall	9.9	-	A	15.3	-	B

3.5.3 Simulation Results

With the traffic signal and dual northbound left-turn lanes, travel times are anticipated to generally remain the same at 2.9(3.0) minutes in the northbound direction during the AM(PM) peak hours and 3.1(4.2) minutes in the southbound direction during the AM(PM) peak hours.

As noted previously, the primary benefit of the traffic signal is that it allows more control over prioritizing the mainline Kuhio Highway through movements. Compared to Alternative 3, which includes a single northbound left-turn lane and two (2) southbound through lanes, Alternative 4 maintains only one (1) southbound through lane, allowing the free eastbound right-turn movement to remain. As a result, minimal queuing is anticipated for Kapaa Bypass Road during the AM peak hour. The dual northbound left-turn lanes are anticipated to significantly reduce PM peak hour queuing in the northbound direction since the likelihood of queues extending beyond the left-turn pocket is expected to be minimized with the additional turn lane. Similar to Alternative 3, queues are still expected to form along all approaches to the intersection since the traffic signal requires vehicles to come to a complete stop whereas a roundabout typically allows a slow, steady flow of traffic.

As shown in Table 3.5 in Section 3.4.3, a total northbound left-turn storage length of 775 feet is recommended based on the AASHTO Green Book. For Alternative 4, this total storage length would be split over the two (2) left-turn lanes. Based on PM peak hour simulations, which reflect the highest northbound left-turn volumes of the studied peak hours, northbound left-turn queues are expected to on average extend approximately 60 feet up to a maximum 330 feet. Therefore, the recommended storage length from the AASHTO Green Book is generally expected to accommodate maximum queues. However, it should be noted that because the left-turn lanes will eventually merge back to a single lane along Kapaa Bypass Road, if adequate merging distance is not provided, uneven lane utilization could occur, reducing the efficiency of the dual left-turn lanes.

3.5.4 ROM Cost

This high-level cost estimate is based on the best available information at the time of this report.

A ROM construction cost of $12 Million is projected for the traffic signal alternative with dual northbound left-turn lanes and proposed realignment of Kapaa Bypass Road.

With the additional operating and maintenance costs as well as traffic signal replacement costs noted in Section 3.4.4, a total ROM cost of $13.2 Million is projected for the traffic signal alternative with dual northbound left-turn lanes and proposed realignment of Kapaa Bypass Road.

3.5.5 Discussion

Compared to the roundabout alternatives, a traffic signal will allow greater control over which movements have priority at the intersection by allocating more or less green time to specific movements. However, a traffic signal does require vehicles to come to a complete stop during red phases, which will contribute to queuing along all approaches. The dual northbound left-turn lanes are expected to reduce the frequency of vehicles spilling out of the left-turn pocket compared to the single northbound left-turn lane alternative.

Pros:

- Provides dedicated phase for highway left-turn movements.
- Allows control over movement priority through signal timing adjustments.
- Maintains single southbound through lane and the free eastbound right-turn movement.
- Lower construction cost than roundabout.
- Turning movement queues at the intersection are expected to be contained within turn pockets.

Cons:

- No geometry-based speed mitigation.
- Greater number of conflict points.
- Potential for uneven northbound left-turn lane utilization.
- Higher cost than Alternative 3: Traffic Signal option since requires widening both Kuhio Highway and Kapaa Bypass Road.
- Higher maintenance cost.
- Higher environmental impact.
- Shorter lifespan at approximately 10-20 years.

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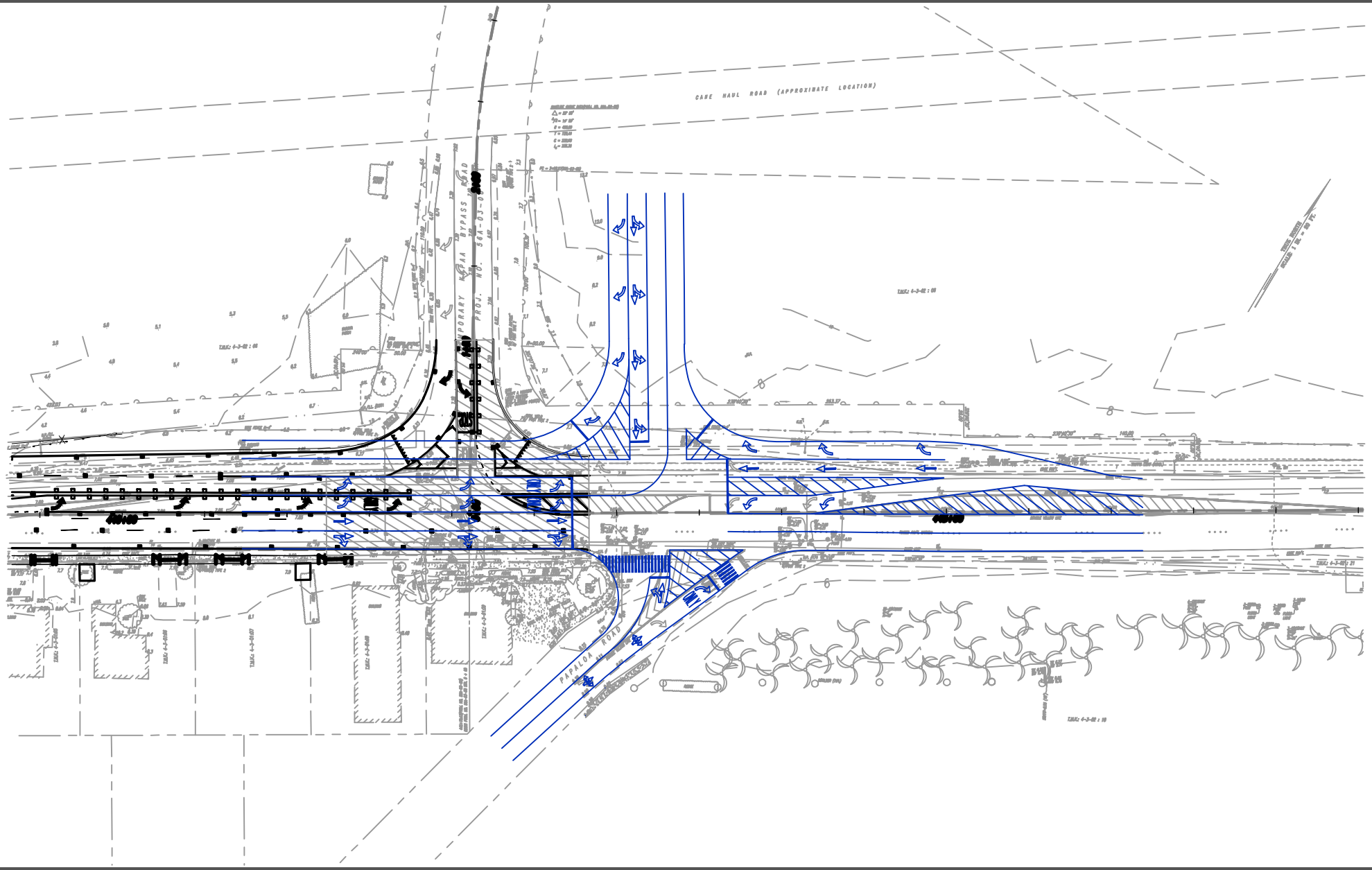

FIGURE 3.5

ALTERNATIVE 4: TRAFFIC SIGNAL WITH DUAL NORTHBOUND LEFT-TURN

3.6 Alternatives Comparison

Figure 3.6 shows the Future Year 2043 traffic volumes, lane configuration and LOS at the study intersection for each of the studied alternatives. Figures 3.7 and 3.8 show the Future Year 2043 maximum queue lengths and average queue lengths, respectively, anticipated during the AM and PM peak hours of traffic for the studied alternatives. Table 3.7 provides an overall summary comparison of the alternatives.

3.7 Recommendations

All studied alternatives are expected to have trade-offs in traffic operations due to the heavy conflicting volumes projected at this intersection of the highway and the bypass road. Several factors should be considered in evaluating the four (4) studied alternatives:

- As traffic operations decline along Kuhio Highway or Kapaa Bypass Road, vehicles will likely reroute to the other less congested route, resulting in more balanced queuing and delays. For example:
    - Under Alternative 1: Double-Lane Roundabout, as southbound delays increase along Kuhio Highway, a percentage of vehicles projected along the highway may reroute to Kapaa Bypass Road and enter the roundabout as an eastbound right-turn rather than a southbound through movement.
    - Under Alternative 3: Traffic Signal, as northbound left-turn delays increase, a percentage of vehicles may stay on Kuhio Highway instead of trying to access Kapaa Bypass Road if delays through Kapaa Town are less than delays at the Kuhio Highway/Kapaa Bypass Road/Papaloa Road (North) traffic signal.

  The number of vehicles that are able to reroute will ultimately depend on each vehicle's origin/destination since vehicles headed to/from Kapaa Town would likely not benefit from using a less direct route via the bypass road.
- Due to the limited number of double-lane roundabouts and lack of turbo roundabouts constructed in the State, driver behavior at these types of roundabouts is largely unknown at this time, and actual operations of the roundabouts could vary based on how aggressive drivers are.
- Planning efforts for the Coconut Marketplace Mobility Hub (CMMH) are ongoing. Initial plans propose an airport shuttle, a suite of transportation options, and an information center[4] located within the existing Coconut Marketplace site. With the proposed CMMH, multimodal transportation activity in the vicinity of the hub is anticipated to increase, furthering the need to consider the needs of all transportation users at the Kuhio Highway/Kapaa Bypass Road/Papaloa Road (North) intersection.

Based on the above factors and the pros and cons discussed in the previous sections, either a roundabout or traffic signal may be considered at the Kuhio Highway/Kapaa Bypass Road/Papaloa Road (North) intersection. Of the studied traffic signal alternatives, Alternative 4: Traffic Signal with Dual Northbound Left-Turn Lanes is expected to provide the greatest capacity for high-volume movements and will allow control over priority movements at the intersection through signal timing adjustments. However, the traffic signal alternative is not expected to provide as many benefits to multimodal users at the intersection. Although a traffic

[4] County of Kauai Office of Economic Development Coconut Marketplace Mobility Hub Plan (https://kauaiforward.com/coconut-marketplace-mobility-hub-plan/). Date Accessed: April 8, 2024.

signal would provide designated crossing times for pedestrians compared to an unsignalized condition, compared to a roundabout, a traffic signal would not address high speeds through the intersection and would maintain a high number of conflict points between vehicles, pedestrians, and bicyclists.

Both Alternative 1: Double-Lane Roundabout and Alternative 2: Turbo Roundabout are expected to address multimodal transportation concerns that are not addressed with a traffic signal. The roundabout alternatives are anticipated to reduce vehicle speeds, conflict points, and the number of fatal and injury crashes at the intersection compared to the traffic signal alternatives. However, as a trade-off, the roundabout alternatives are expected to result in longer delays for vehicles, with the potential for lengthy queues to form along Kuhio Highway. While the turbo roundabout is expected to have less major queuing concerns compared to the double-lane roundabout, the turbo roundabout does have more uncertainties regarding operations since there are a limited number of turbo roundabouts currently constructed and operational within the United States.

Ultimately, either a traffic signal or roundabout alternative may be considered at the Kuhio Highway/Kapaa Bypass Road/Papaloa Road (North) intersection depending on HDOT-K's priorities at the intersection and threshold for acceptable vehicle operations. As noted previously, as traffic operations decline along Kuhio Highway or Kapaa Bypass Road, either as the result of a roundabout or a traffic signal, reroutes will likely occur between the highway and the bypass, reducing congestion and resulting in more balanced queuing and delays at the intersection. Therefore, although a traffic signal is expected to result in shorter delays for both Kuhio Highway and Kapaa Bypass Road, longer delays resulting from a double-lane roundabout or turbo roundabout may be acceptable, especially if reroutes occur, given the benefits to multimodal users and lower anticipated fatal and injury crashes.

Table 3.7: Alternatives Comparison Summary

	Alternative 0: No Action	**Alternative 1: Double-Lane Roundabout**	**Alternative 2: Turbo Roundabout**	**Alternative 3A: Traffic Signal (Protected Only Left-Turn Phasing)**	**Alternative 3B: Traffic Signal (Protected-Permissive Left-Turn Phasing)**	**Alternative 4: Traffic Signal with Dual Northbound Left-Turn Lanes**
Corridor Travel Times (minutes)	Northbound AM: 2.8 Southbound AM: 3.1 Northbound PM: 3.2 Southbound PM: 4.1	Northbound AM: 2.8 Southbound AM: 3.2 Northbound PM: 3.0 Southbound PM: 9.2	Northbound AM: 3.0 Southbound AM: 3.2 Northbound PM: 3.5 Southbound PM: 6.5	Northbound AM: 3.3 Southbound AM: 3.7 Northbound PM: 3.8 Southbound PM: 5.0	Northbound AM: 3.2 Southbound AM: 3.7 Northbound PM: 3.2 Southbound PM: 4.8	Northbound AM: 3.2 Southbound AM: 3.7 Northbound PM: 3.2 Southbound PM: 4.8
Increase in Corridor Delay Compared to No Action (minutes)	N/A	Northbound AM: +0.1 Southbound AM: +0.1 Northbound PM: -0.2 Southbound PM: +5.1	Northbound AM: +0.2 Southbound AM: +0.1 Northbound PM: +0.2 Southbound PM: +2.3	Northbound AM: +0.5 Southbound AM: +0.6 Northbound PM: +0.6 Southbound PM: +0.8	Northbound AM: +0.4 Southbound AM: +0.6 Northbound PM: +0.0 Southbound PM: +0.7	Northbound AM: +0.4 Southbound AM: +0.6 Northbound PM: +0.0 Southbound PM: +0.7
Priority Movement(s)	Kuhio Highway northbound/southbound through movements	Roundabout circulating traffic	Roundabout circulating traffic	Kuhio Highway northbound/southbound through movements	Kuhio Highway northbound/southbound through movements	Kuhio Highway northbound/southbound through movements
Critical Movement(s)	Northbound left-turn during PM peak	Eastbound approach during AM peak Southbound approach during PM peak	Eastbound approach during AM peak Northbound/southbound approach during PM peak	Eastbound right-turn during AM peak Northbound left-turn during PM peak	Eastbound right-turn during AM peak Northbound left-turn during PM peak	N/A
Additional Mitigation	N/A	Entry metering or upstream traffic signal metering may be considered to mitigate southbound queues	N/A	N/A	N/A	N/A
Primary Benefits	No additional costs	Increased pedestrian and bicyclist accessibility due to lower vehicle speeds and less conflict points, ultimately anticipated to result in fewer fatal and injury related crashes	Increased pedestrian and bicyclist accessibility due to lower vehicle speeds and less conflict points, ultimately anticipated to result in fewer fatal and injury related crashes	Lower cost alternative that provides adequate vehicle operations with the ability to control priority for movements at the intersection	Lower cost alternative that provides adequate vehicle operations with the ability to control priority for movements at the intersection	Provides greatest vehicle operations with the ability to control priority for movements at the intersection
ROM Cost	N/A	$25 Million	$25 Million	$11.2 Million	$11.2 Million	$13.2 Million

KUHIO HIGHWAY AND KAPAA BYPASS ROAD ALTERNATIVES ANALYSIS

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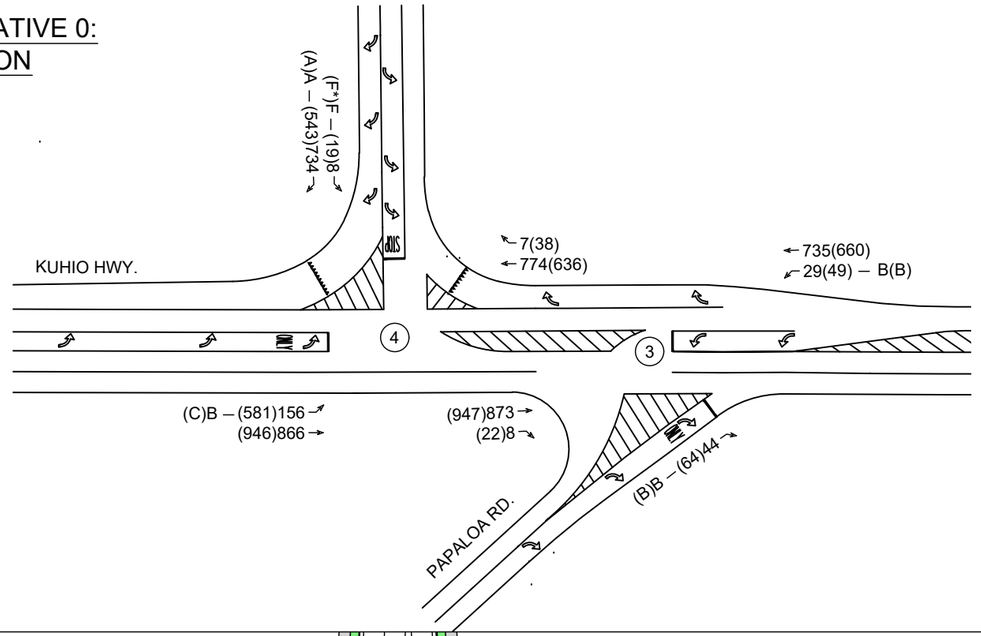
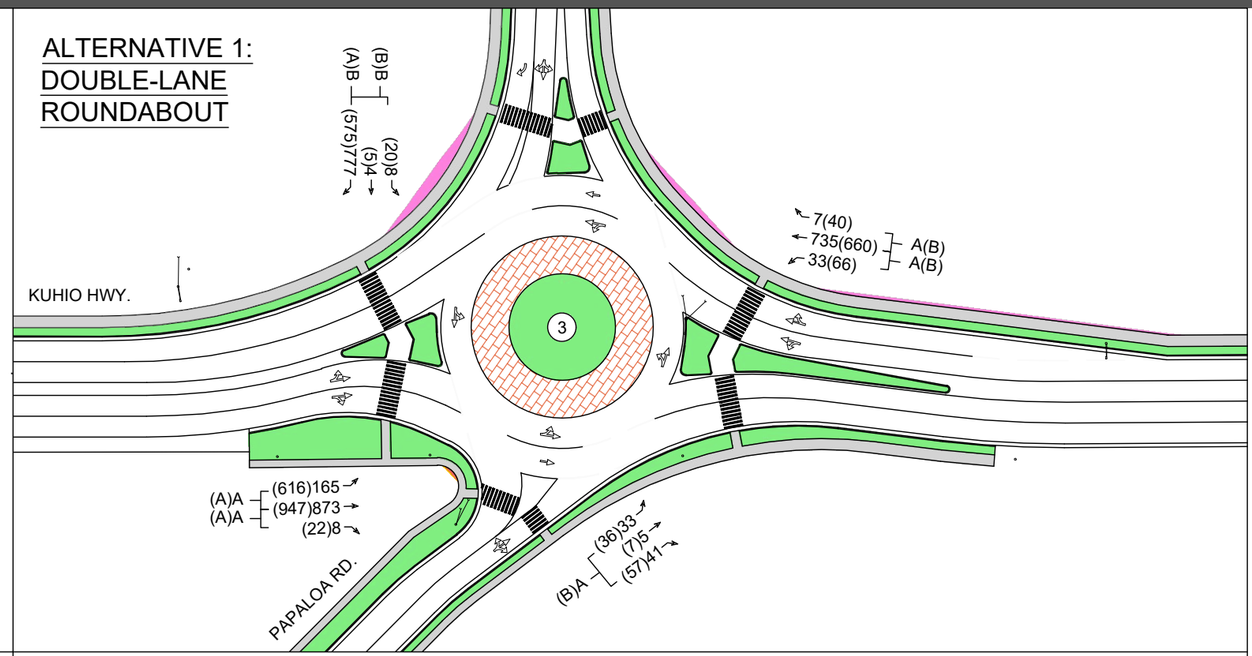
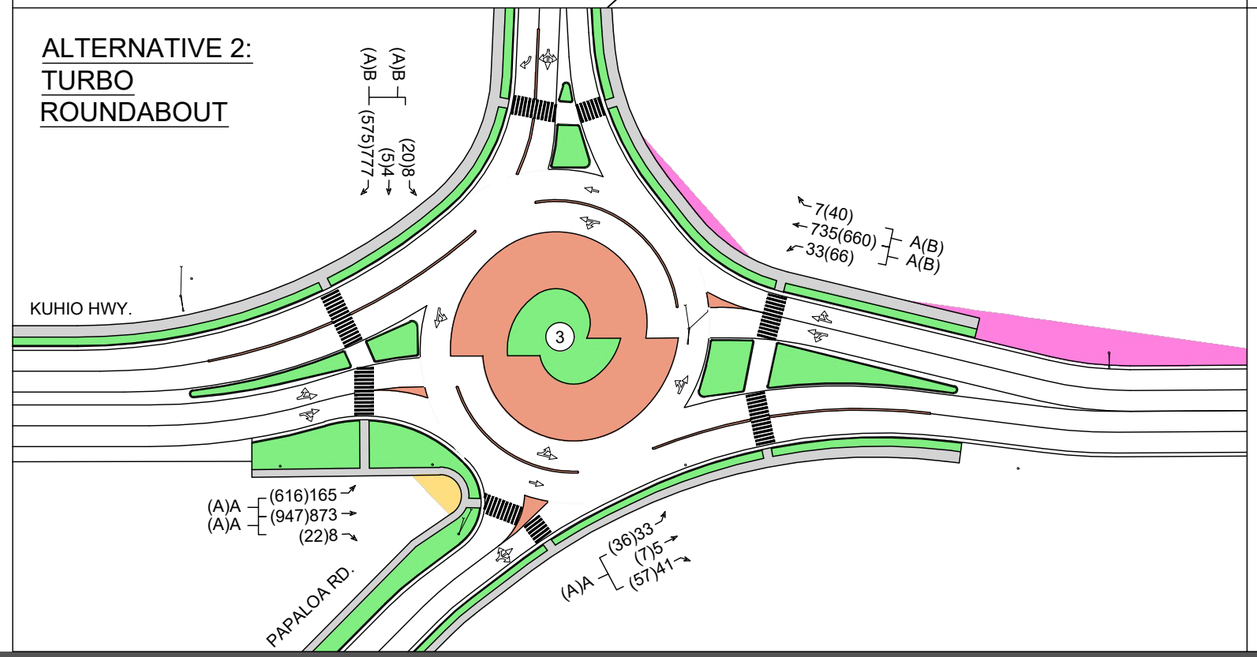
ALTERNATIVE 0: NO ACTION



ALTERNATIVE 1: DOUBLE-LANE ROUNDABOUT



ALTERNATIVE 2: TURBO ROUNDABOUT



LEGEND

##(##)	- AM(PM) VEHICLE VOLUMES
X(X)	- AM(PM) LOS
(X)	- UNSIGNALIZED INTERSECTION X
(Y) / X/X	- SIGNALIZED INTERSECTION Y, OVERALL AM/PM LOS

NOTES:
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FIGURE 3.6A

ALTERNATIVES VOLUME AND LEVEL OF SERVICE COMPARISON

KUHIO HIGHWAY AND KAPAA BYPASS ROAD ALTERNATIVES ANALYSIS

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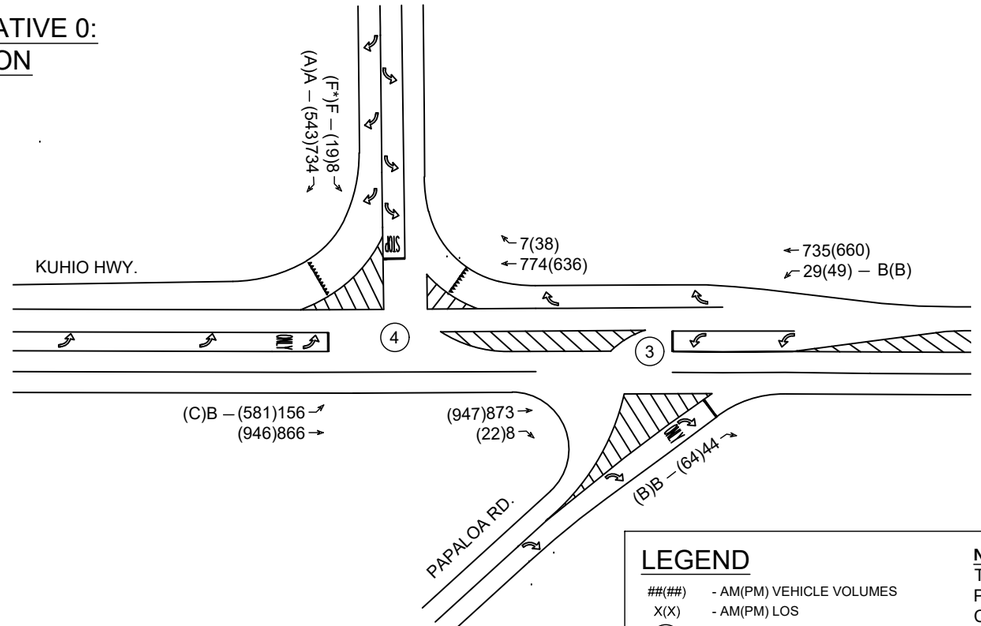
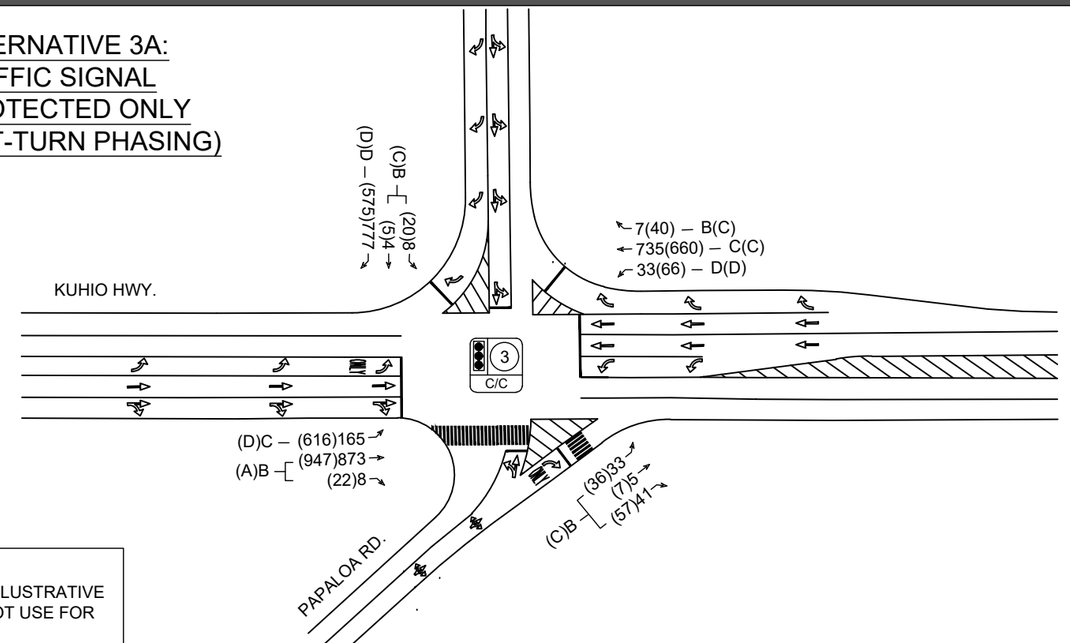
ALTERNATIVE 0: NO ACTION



ALTERNATIVE 3A: TRAFFIC SIGNAL (PROTECTED ONLY LEFT-TURN PHASING)



LEGEND

##(##)	- AM(PM) VEHICLE VOLUMES
X(X)	- AM(PM) LOS
(X)	- UNSIGNALIZED INTERSECTION X
(Y) X/X	- SIGNALIZED INTERSECTION Y, OVERALL AM/PM LOS

NOTES:
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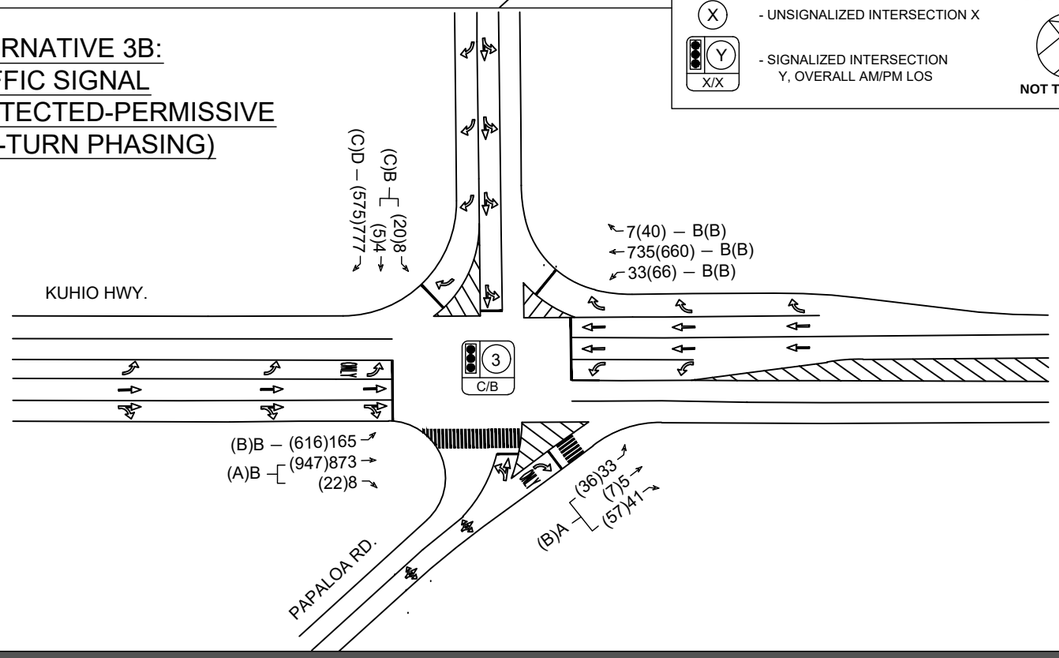
NOT TO SCALE

ALTERNATIVE 3B: TRAFFIC SIGNAL (PROTECTED-PERMISSIVE LEFT-TURN PHASING)



ALTERNATIVE 4: TRAFFIC SIGNAL WITH DUAL NORTHBOUND LEFT-TURNS

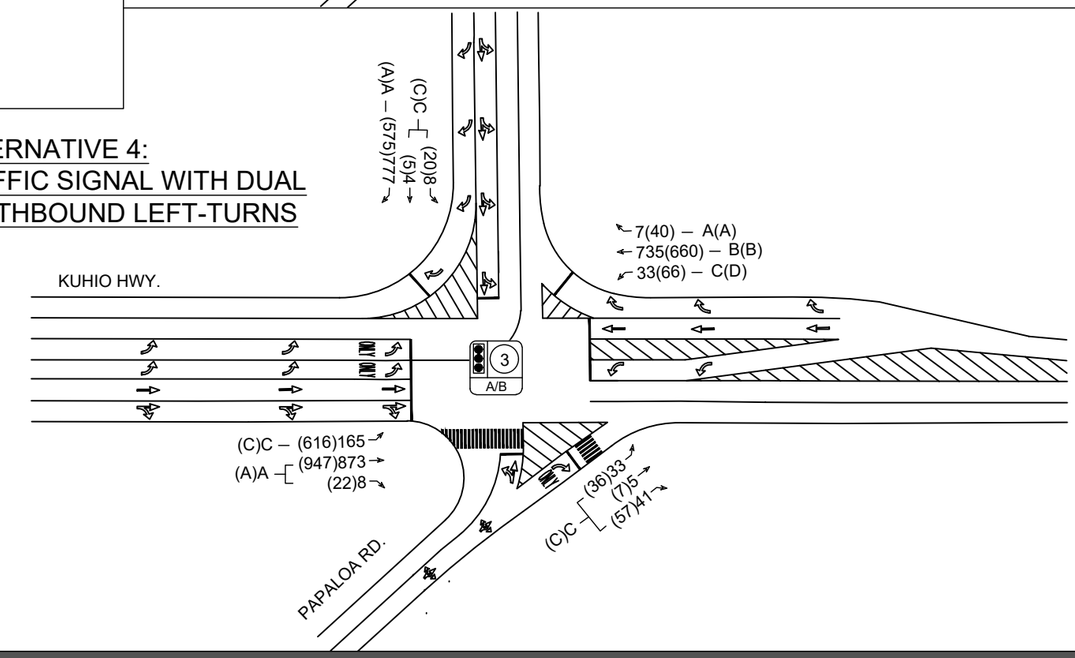


FIGURE 3.6B

ALTERNATIVES VOLUME AND LEVEL OF SERVICE COMPARISON

KUHIO HIGHWAY AND KAPAA BYPASS ROAD ALTERNATIVES ANALYSIS

AustinTsutsumi & ASSOCIATES, INC.
Engineers & Surveyors

AM PEAK HOUR

KAPAA BYPASS RD. EASTBOUND:
ALT 0 (NO ACTION): 45 FT
ALT 1 (DOUBLE-LANE RAB): 972 FT
ALT 2 (TURBO RAB): 1143 FT
ALT 3A (SIGNAL - PT): 1509 FT
ALT 3B (SIGNAL - PM+PT): 1376 FT
ALT 4 (SIGNAL - NB DLT): 258 FT

KUHIO HWY. SOUTHBOUND:
ALT 0 (NO ACTION): 26 FT
ALT 1 (DOUBLE-LANE RAB): 143 FT
ALT 2 (TURBO RAB): 203 FT
ALT 3A (SIGNAL - PT): 431 FT
ALT 3B (SIGNAL - PM+PT): 437 FT
ALT 4 (SIGNAL - NB DLT): 83 FT

KUHIO HWY. NORTHBOUND:
ALT 0 (NO ACTION): 74 FT
ALT 1 (DOUBLE-LANE RAB): 63 FT
ALT 2 (TURBO RAB): 291 FT
ALT 3A (SIGNAL - PT): 438 FT
ALT 3B (SIGNAL - PM+PT): 355 FT
ALT 4 (SIGNAL - NB DLT): 176 FT

PAPALOA RD. WESTBOUND:
ALT 0 (NO ACTION): 48 FT
ALT 1 (DOUBLE-LANE RAB): 41 FT
ALT 2 (TURBO RAB): 40 FT
ALT 3A (SIGNAL - PT): 100 FT
ALT 3B (SIGNAL - PM+PT): 82 FT
ALT 4 (SIGNAL - NB DLT): 93 FT

PM PEAK HOUR

KAPAA BYPASS RD. EASTBOUND:
ALT 0 (NO ACTION): 57 FT
ALT 1 (DOUBLE-LANE RAB): 324 FT
ALT 2 (TURBO RAB): 323 FT
ALT 3A (SIGNAL - PT): 958 FT
ALT 3B (SIGNAL - PM+PT): 793 FT
ALT 4 (SIGNAL - DLT): 121 FT

KUHIO HWY. SOUTHBOUND:
ALT 0 (NO ACTION): 49 FT
ALT 1 (DOUBLE-LANE RAB): 1936 FT
ALT 2 (TURBO RAB): 990 FT
ALT 3A (SIGNAL - PT): 519 FT
ALT 3B (SIGNAL - PM+PT): 512 FT
ALT 4 (SIGNAL - DLT): 122 FT

KUHIO HWY. NORTHBOUND:
ALT 0 (NO ACTION): 1595 FT
ALT 1 (DOUBLE-LANE RAB): 535 FT
ALT 2 (TURBO RAB): 980 FT
ALT 3A (SIGNAL - PT): 1336 FT
ALT 3B (SIGNAL - PM+PT): 1115 FT
ALT 4 (SIGNAL - NB DLT): 333 FT

PAPALOA RD. WESTBOUND:
ALT 0 (NO ACTION): 58 FT
ALT 1 (DOUBLE-LANE RAB): 96 FT
ALT 2 (TURBO RAB): 183 FT
ALT 3A (SIGNAL - PT): 169 FT
ALT 3B (SIGNAL - PM+PT): 142 FT
ALT 4 (SIGNAL - DLT): 141 FT

LEGEND

- ALTERNATIVE 0: NO ACTION MAXIMUM QUEUE
- ALTERNATIVE 1: DOUBLE-LANE ROUNDABOUT MAXIMUM QUEUE
- ALTERNATIVE 2: TURBO ROUNDABOUT MAXIMUM QUEUE
- ALTERNATIVE 3A: TRAFFIC SIGNAL (PROTECTED ONLY LEFT-TURNS) MAXIMUM QUEUE
- ALTERNATIVE 3B: TRAFFIC SIGNAL (PROTECTED-PERMISSIVE LEFT-TURNS) MAXIMUM QUEUE
- ALTERNATIVE 4: TRAFFIC SIGNAL (DUAL NORTHBOUND LEFT-TURN LANES) MAXIMUM QUEUE

NOTES:
1. THIS DRAWING IS FOR ILLUSTRATIVE PURPOSES ONLY. DO NOT USE FOR CONSTRUCTION.
2. QUEUE REPRESENTS THE AVERAGE MAXIMUM QUEUE OVER FIVE (5) SIMULATION RUNS.
3. FOR APPROACHES WITH MULTIPLE LANES, QUEUE REPRESENTS THE LONGEST QUEUE ACROSS ALL LANES/MOVEMENTS.
4. FOR ALTERNATIVE 0: NO ACTION, QUEUES SHOWN AT CONSOLIDATED KUHIO HIGHWAY/KAPAA BYPASS ROAD/PAPALOA ROAD (NORTH) INTERSECTION FOR COMPARISON PURPOSES; ALTERNATIVE DOES NOT ACTUALLY COMBINE THE STUDY INTERSECTIONS.

N
NOT TO SCALE

FIGURE 3.7

KUHIO HIGHWAY/KAPAA BYPASS ROAD/PAPALOA ROAD (NORTH) MAXIMUM QUEUE COMPARISON

KUHIO HIGHWAY AND KAPAA BYPASS ROAD ALTERNATIVES ANALYSIS

AustinTsutsumi & ASSOCIATES, INC.
Engineers & Surveyors

AM PEAK HOUR

KAPAA BYPASS RD. EASTBOUND:
ALT 0 (NO ACTION): 0 FT
ALT 1 (DOUBLE-LANE RAB): 107 FT
ALT 2 (TURBO RAB): 195 FT
ALT 3A (SIGNAL - PT): 624 FT
ALT 3B (SIGNAL - PM+PT): 333 FT
ALT 4 (SIGNAL - NB DLT): 2 FT

KUHIO HWY. SOUTHBOUND:
ALT 0 (NO ACTION): 0 FT
ALT 1 (DOUBLE-LANE RAB): 4 FT
ALT 2 (TURBO RAB): 8 FT
ALT 3A (SIGNAL - PT): 105 FT
ALT 3B (SIGNAL - PM+PT): 98 FT
ALT 4 (SIGNAL - NB DLT): 4 FT

KUHIO HWY. NORTHBOUND:
ALT 0 (NO ACTION): 1 FT
ALT 1 (DOUBLE-LANE RAB): 0 FT
ALT 2 (TURBO RAB): 10 FT
ALT 3A (SIGNAL - PT): 75 FT
ALT 3B (SIGNAL - PM+PT): 61 FT
ALT 4 (SIGNAL - NB DLT): 15 FT

PAPALOA RD. WESTBOUND:
ALT 0 (NO ACTION): 0 FT
ALT 1 (DOUBLE-LANE RAB): 0 FT
ALT 2 (TURBO RAB): 0 FT
ALT 3A (SIGNAL - PT): 3 FT
ALT 3B (SIGNAL - PM+PT): 3 FT
ALT 4 (SIGNAL - NB DLT): 3 FT

PM PEAK HOUR

KAPAA BYPASS RD. EASTBOUND:
ALT 0 (NO ACTION): 0 FT
ALT 1 (DOUBLE-LANE RAB): 11 FT
ALT 2 (TURBO RAB): 12 FT
ALT 3A (SIGNAL - PT): 197 FT
ALT 3B (SIGNAL - PM+PT): 129 FT
ALT 4 (SIGNAL - NB DLT): 7 FT

KUHIO HWY. SOUTHBOUND:
ALT 0 (NO ACTION): 1 FT
ALT 1 (DOUBLE-LANE RAB): 419 FT
ALT 2 (TURBO RAB): 333 FT
ALT 3A (SIGNAL - PT): 164 FT
ALT 3B (SIGNAL - PM+PT): 124 FT
ALT 4 (SIGNAL - NB DLT): 11 FT

KUHIO HWY. NORTHBOUND:
ALT 0 (NO ACTION): 301 FT
ALT 1 (DOUBLE-LANE RAB): 26 FT
ALT 2 (TURBO RAB): 201 FT
ALT 3A (SIGNAL - PT): 603 FT
ALT 3B (SIGNAL - PM+PT): 241 FT
ALT 4 (SIGNAL - NB DLT): 59 FT

PAPALOA RD. WESTBOUND:
ALT 0 (NO ACTION): 0 FT
ALT 1 (DOUBLE-LANE RAB): 4 FT
ALT 2 (TURBO RAB): 14 FT
ALT 3A (SIGNAL - PT): 15 FT
ALT 3B (SIGNAL - PM+PT): 11 FT
ALT 4 (SIGNAL - NB DLT): 8 FT

LEGEND

- ALTERNATIVE 0: NO ACTION AVERAGE QUEUE
- ALTERNATIVE 1: DOUBLE-LANE ROUNDABOUT AVERAGE QUEUE
- ALTERNATIVE 2: TURBO ROUNDABOUT AVERAGE QUEUE
- ALTERNATIVE 3A: TRAFFIC SIGNAL (PROTECTED ONLY LEFT-TURNS) AVERAGE QUEUE
- ALTERNATIVE 3B: TRAFFIC SIGNAL (PROTECTED-PERMISSIVE LEFT-TURNS) AVERAGE QUEUE
- ALTERNATIVE 4: TRAFFIC SIGNAL (NORTHBOUND DUAL LEFT-TURN LANES) AVERAGE QUEUE

NOTES:
1. THIS DRAWING IS FOR ILLUSTRATIVE PURPOSES ONLY. DO NOT USE FOR CONSTRUCTION.
2. QUEUE REPRESENTS THE AVERAGE QUEUE AVERAGED OVER FIVE (5) SIMULATION RUNS.
3. FOR APPROACHES WITH MULTIPLE LANES, QUEUE REPRESENTS THE LONGEST QUEUE ACROSS ALL LANES/MOVEMENTS.
4. FOR ALTERNATIVE 0: NO ACTION, QUEUES SHOWN AT CONSOLIDATED KUHIO HIGHWAY/KAPAA BYPASS ROAD/PAPALOA ROAD (NORTH) INTERSECTION FOR COMPARISON PURPOSES; ALTERNATIVE DOES NOT ACTUALLY COMBINE THE STUDY INTERSECTIONS.
5. QUEUES NOT DEPICTED FOR AVERAGE QUEUES LESS THAN 20 FEET.

N
NOT TO SCALE

FIGURE 3.8

KUHIO HIGHWAY/KAPAA BYPASS ROAD/PAPALOA ROAD (NORTH) AVERAGE QUEUE COMPARISON

4. CONCLUSIONS

The State of Hawaii Department of Transportation – Kauai District (HDOT-K) is currently evaluating realigning the southern terminus of Kapaa Bypass Road at Kuhio Highway to intersect the existing Kuhio Highway/Papaloa Road (North) intersection near Coconut Marketplace. The realignment will consolidate the two (2) existing T-intersections into a single full access intersection. The following future traffic control alternatives at the realigned full access intersection were evaluated:

1. Alternative 1: Double-Lane Roundabout
2. Alternative 2: Turbo Roundabout
3. Alternative 3: Traffic Signal
4. Alternative 4: Traffic Signal with Dual Northbound Left-Turn Lanes

4.1 Existing Conditions

Following the completion of the Kuhio Highway Short-Term Improvements project, minimal to no congestion was observed along the Kuhio Highway corridor between Kuamoo Road and Aleka Loop (North). Congestion persists north of the study area through Kapaa Town as a result of the numerous destinations along the highway, but congestion was not observed to impact operations through the study area.

During the AM peak hour, volumes are heaviest in the southbound direction along Kuhio Highway heading towards Lihue. With the Kuhio Highway Short-Term Improvements project, the right-turn movement from Kapaa Bypass Road onto Kuhio Highway was converted into a free movement allowing vehicles to turn directly into the newly added southbound lane without having to yield to vehicles already traveling on the highway. During the AM peak hour, volumes traveling southbound on Kuhio Highway and Kapaa Bypass Road are split evenly with approximately 660 vehicles per hour along each roadway.

During the PM peak hour, volumes are heavier in the northbound direction along Kuhio Highway heading towards Kapaa. Volumes using Kapaa Bypass Road are lighter than Kuhio Highway during the PM peak. However, the northbound left-turn from the highway onto the bypass road is still heavy at 526 vehicles per hour. Vehicles making the northbound left-turn were observed to occasionally queue beyond the left-turn pocket due to limited gaps in southbound traffic since northbound and southbound volumes along the highway are more balanced during the PM peak hour.

4.2 Alternatives Analysis

The Year 2043 was evaluated to reflect a 20-year planning horizon for the proposed Project. An approximate annual growth rate of 0.8% was applied to Kuhio Highway and Kapaa Bypass Road to reflect anticipated growth in the region by Year 2043. A 0.5% annual growth rate was applied to remaining study roadways.

The following alternatives were evaluated for Year 2043:

1. **Alternative 0: No Action** – The “No Action” alternative was evaluated to provide a baseline for comparison for the study alternatives. Based on the “No Action” alternative, delays for yielding movements, primarily for the northbound left-turn onto

Kapaa Bypass Road during the PM peak hour, are expected to have increased difficulty finding acceptable gaps in traffic to complete turns.

2. **Alternative 1: Double-Lane Roundabout** – A double-lane roundabout is expected to result in increased delay and queuing for the eastbound approach of Kapaa Bypass Road during the AM peak hour and for the southbound approach of Kuhio Highway during the PM peak hour. The double-lane roundabout is expected to result in the longest PM peak hour southbound queues of all studied alternatives as southbound vehicles are expected to have limited gaps to enter the roundabout due to heavy northbound left-turn circulating volumes. Metering of northbound volumes via the Kuhio Highway/Haleilio Road traffic signal may be considered to help mitigate southbound queues. A double-lane roundabout is also expected to provide increased multimodal accessibility and reduce the number of fatal and injury crashes at the intersection.
3. **Alternative 2: Turbo Roundabout** – A turbo roundabout is expected to operate similar to a double-lane roundabout. However, due to the turbo roundabout geometry, speeds entering the roundabout from Kuhio Highway are anticipated to be lower than for the double-lane roundabout. The slower entering speeds are expected to result in longer northbound queues. However, the slower speeds are expected to result in more gaps for southbound traffic to enter the roundabout during the PM peak hour, leading to shorter southbound queues. A turbo roundabout is also expected to provide increased multimodal accessibility and reduce the number of fatal and injury crashes at the intersection.
4. **Alternative 3: Traffic Signal** – A traffic signal is expected to prioritize the Kuhio Highway mainline through movements, which, as a trade-off, is anticipated to result in longer queues for the minor movements. Although dependent on the ultimate traffic signal timing, the traffic signal is expected to result in the longest eastbound queues during the AM peak hour and the longest northbound left-turn queues during the PM peak hour of the studied action alternatives.
5. **Alternative 4: Traffic Signal with Dual Northbound Left-Turn Lanes** – Similar to Alternative 3, Alternative 4 is expected to prioritize the Kuhio Highway mainline through movements. However, with the provision of dual northbound left-turn lanes and maintaining the free eastbound right-turn movement, the minor movements at the intersection are expected to operate adequately, resulting in the shortest overall vehicle queues during both the AM an PM peak hours.

Although simulation results provide a general picture of anticipated operations of future year conditions with the study alternatives, it should be noted that for the roundabout alternatives, actual operations may vary based on driver behaviors entering and circulating the roundabout. Because double-lane and turbo roundabouts have not yet been constructed on Kauai, driver behaviors may vary from assumed conditions. In addition, operations may also be impacted by reroutes occurring between Kuhio Highway and Kapaa Bypass Road as drivers navigate to the route with the least amount of anticipated delay. However, due to the numerous destinations within Kapaa Town accessible via Kuhio Highway, the number of vehicles able to conveniently reroute to the bypass road may be limited.

5. RECOMMENDATIONS

Either a traffic signal or roundabout may be considered at the Kuhio Highway/Kapaa Bypass Road/Papaloa Road (North) intersection. Alternative 4: Traffic Signal with Dual Northbound Left-Turn Lanes would be the preferred traffic signal alternative since it provides adequate capacity for all heavy volume movements along the highway and along the bypass road. Either Alternative 1: Double-Lane Roundabout or Alternative 2: Turbo Roundabout may be considered as the roundabout alternative depending on the level of operations that may be acceptable to HDOT-K compared to the benefits of installing a roundabout, which include but are not limited to increased multimodal accessibility, less conflict points, and reduced fatal and injury crashes. While analysis of the turbo roundabout alternative results in less significant queuing compared to the double-lane roundabout, the risk of unknown driver behaviors is expected to be higher with the turbo roundabout, increasing the potential for operations to differ from the modeled scenario.

6. REFERENCES

1. American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets, 2018.

2. Federal Highway Administration, Roundabouts: An Informational Guide, 2000.

3. Federal Highway Administration, Turbo Roundabouts: Informational Primer, 2022.

4. Transportation Research Board, Highway Capacity Manual, 7th Edition.

5. Transportation Research Board, NCHRP Research Report 1043: Guide for Roundabouts, 2023.

APPENDICES

APPENDIX A

TRAFFIC COUNT DATA

Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Aleka Lp North
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

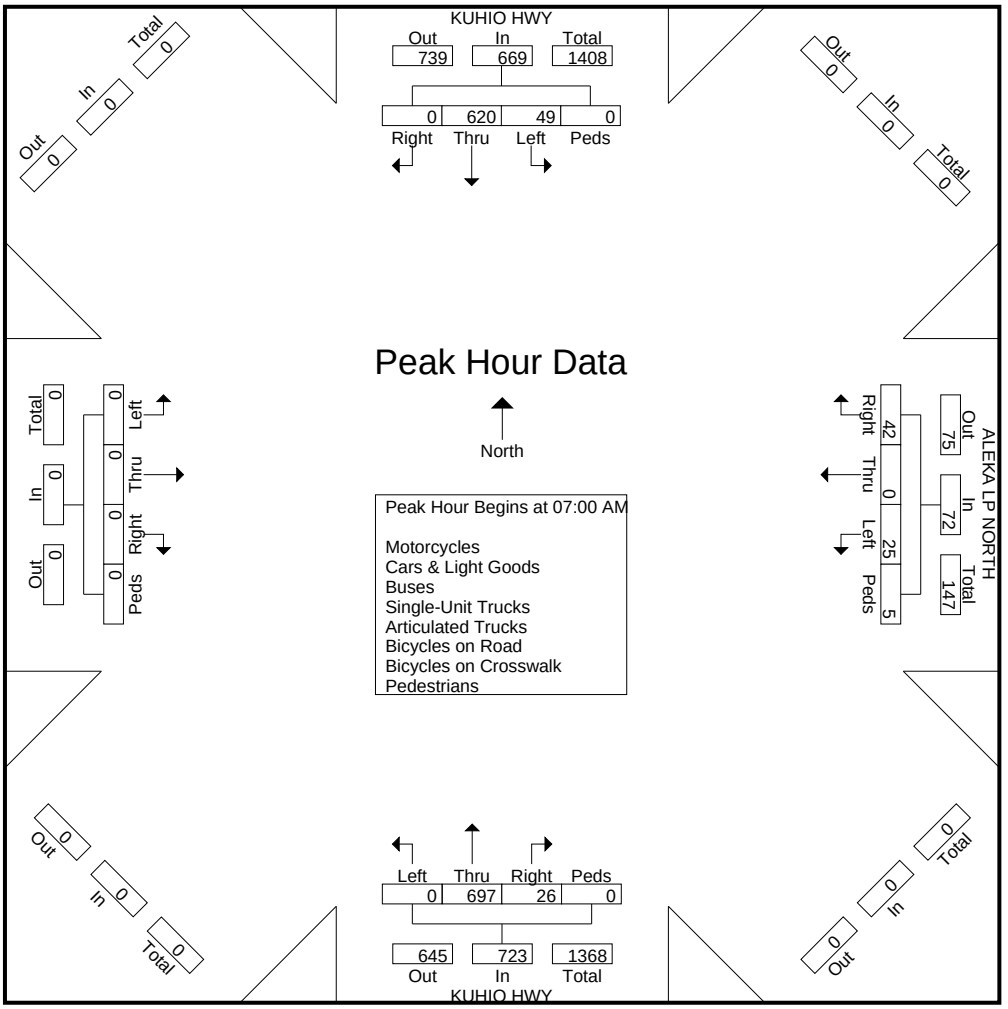
	KUHIO HWY Southbound				ALEKA LP NORTH Westbound				KUHIO HWY Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:45 AM	9	148	0	0	7	0	3	0	0	185	7	0	0	0	0	0	359
Total	9	148	0	0	7	0	3	0	0	185	7	0	0	0	0	0	359
07:00 AM	8	166	0	0	7	0	5	0	0	146	2	0	0	0	0	0	334
07:15 AM	6	184	0	0	4	0	13	4	0	178	5	0	0	0	0	0	394
07:30 AM	20	152	0	0	5	0	15	1	0	189	8	0	0	0	0	0	390
07:45 AM	15	118	0	0	9	0	9	0	0	184	11	0	0	0	0	0	346
Total	49	620	0	0	25	0	42	5	0	697	26	0	0	0	0	0	1464
08:00 AM	7	127	0	0	11	0	9	0	0	162	9	0	0	0	0	0	325
08:15 AM	16	152	0	0	9	0	19	0	0	172	11	0	0	0	0	0	379
08:30 AM	8	147	0	0	7	0	11	0	0	160	8	0	0	0	0	0	341
Grand Total	89	1194	0	0	59	0	84	5	0	1376	61	0	0	0	0	0	2868
Apprch %	6.9	93.1	0	0	39.9	0	56.8	3.4	0	95.8	4.2	0	0	0	0	0	
Total %	3.1	41.6	0	0	2.1	0	2.9	0.2	0	48	2.1	0	0	0	0	0	
Motorcycles	0	2	0	0	0	0	0	0	0	3	0	0	0	0	0	0	5
% Motorcycles	0	0.2	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0.2
Cars & Light Goods	84	1157	0	0	57	0	81	0	0	1314	58	0	0	0	0	0	2751
% Cars & Light Goods	94.4	96.9	0	0	96.6	0	96.4	0	0	95.5	95.1	0	0	0	0	0	95.9
Buses	0	8	0	0	1	0	0	0	0	8	1	0	0	0	0	0	18
% Buses	0	0.7	0	0	1.7	0	0	0	0	0.6	1.6	0	0	0	0	0	0.6
Single-Unit Trucks	3	23	0	0	1	0	2	0	0	45	2	0	0	0	0	0	76
% Single-Unit Trucks	3.4	1.9	0	0	1.7	0	2.4	0	0	3.3	3.3	0	0	0	0	0	2.6
Articulated Trucks	0	3	0	0	0	0	0	0	0	6	0	0	0	0	0	0	9
% Articulated Trucks	0	0.3	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0.3
Bicycles on Road	2	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	4
% Bicycles on Road	2.2	0.1	0	0	0	0	1.2	0	0	0	0	0	0	0	0	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
% Bicycles on Crosswalk	0	0	0	0	0	0	0	60	0	0	0	0	0	0	0	0	0.1
Pedestrians	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
% Pedestrians	0	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	0.1

Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Aleka Lp North
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	KUHIO HWY Southbound					ALEKA LP NORTH Westbound					KUHIO HWY Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	8	166	0	0	174	7	0	5	0	12	0	146	2	0	148	0	0	0	0	0	334
07:15 AM	6	184	0	0	190	4	0	13	4	21	0	178	5	0	183	0	0	0	0	0	394
07:30 AM	20	152	0	0	172	5	0	15	1	21	0	189	8	0	197	0	0	0	0	0	390
07:45 AM	15	118	0	0	133	9	0	9	0	18	0	184	11	0	195	0	0	0	0	0	346
Total Volume	49	620	0	0	669	25	0	42	5	72	0	697	26	0	723	0	0	0	0	0	1464
% App. Total	7.3	92.7	0	0		34.7	0	58.3	6.9		0	96.4	3.6	0		0	0	0	0		
PHF	.613	.842	.000	.000	.880	.694	.000	.700	.313	.857	.000	.922	.591	.000	.918	.000	.000	.000	.000	.000	.929



Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Aleka Lp South
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

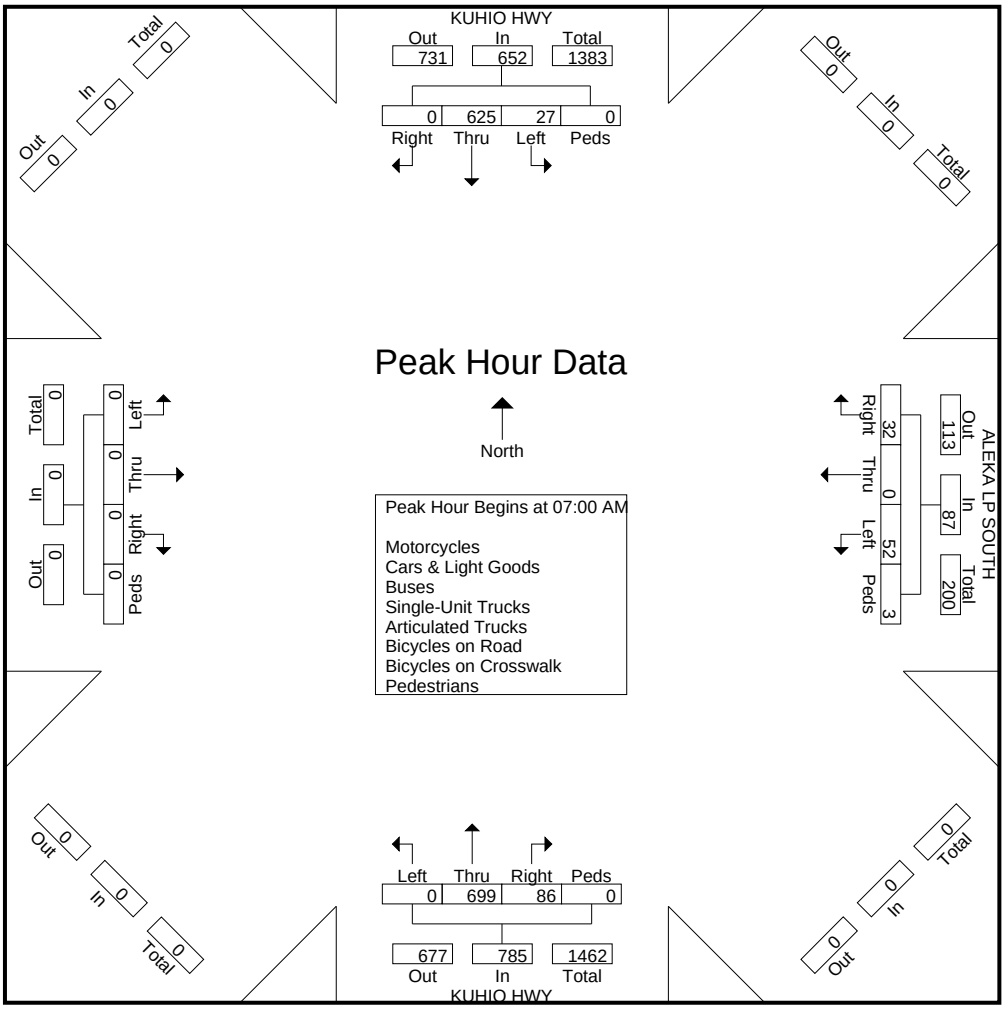
	KUHIO HWY Southbound				ALEKA LP SOUTH Westbound				KUHIO HWY Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:45 AM	6	154	0	0	9	0	3	0	0	180	18	0	0	0	0	0	370
Total	6	154	0	0	9	0	3	0	0	180	18	0	0	0	0	0	370
07:00 AM	5	171	0	0	16	0	6	2	0	146	19	0	0	0	0	0	365
07:15 AM	4	184	0	0	10	0	8	0	0	183	18	0	0	0	0	0	407
07:30 AM	7	152	0	0	17	0	14	1	0	179	28	0	0	0	0	0	398
07:45 AM	11	118	0	0	9	0	4	0	0	191	21	0	0	0	0	0	354
Total	27	625	0	0	52	0	32	3	0	699	86	0	0	0	0	0	1524
08:00 AM	12	122	0	0	18	0	16	0	0	151	16	0	0	0	0	0	335
08:15 AM	11	145	0	0	14	0	15	0	0	173	39	0	0	0	0	0	397
08:30 AM	14	146	0	0	19	0	14	0	0	161	28	0	0	0	0	0	382
Grand Total	70	1192	0	0	112	0	80	3	0	1364	187	0	0	0	0	0	3008
Apprch %	5.5	94.5	0	0	57.4	0	41	1.5	0	87.9	12.1	0	0	0	0	0	
Total %	2.3	39.6	0	0	3.7	0	2.7	0.1	0	45.3	6.2	0	0	0	0	0	
Motorcycles	0	1	0	0	0	0	0	0	0	4	0	0	0	0	0	0	5
% Motorcycles	0	0.1	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0.2
Cars & Light Goods	67	1155	0	0	111	0	77	0	0	1303	185	0	0	0	0	0	2898
% Cars & Light Goods	95.7	96.9	0	0	99.1	0	96.2	0	0	95.5	98.9	0	0	0	0	0	96.3
Buses	0	9	0	0	0	0	0	0	0	8	0	0	0	0	0	0	17
% Buses	0	0.8	0	0	0	0	0	0	0	0.6	0	0	0	0	0	0	0.6
Single-Unit Trucks	3	22	0	0	1	0	3	0	0	41	2	0	0	0	0	0	72
% Single-Unit Trucks	4.3	1.8	0	0	0.9	0	3.8	0	0	3	1.1	0	0	0	0	0	2.4
Articulated Trucks	0	3	0	0	0	0	0	0	0	8	0	0	0	0	0	0	11
% Articulated Trucks	0	0.3	0	0	0	0	0	0	0	0.6	0	0	0	0	0	0	0.4
Bicycles on Road	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
% Bicycles on Road	0	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
% Bicycles on Crosswalk	0	0	0	0	0	0	0	66.7	0	0	0	0	0	0	0	0	0.1
Pedestrians	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
% Pedestrians	0	0	0	0	0	0	0	33.3	0	0	0	0	0	0	0	0	0

Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Aleka Lp South
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	KUHIO HWY Southbound					ALEKA LP SOUTH Westbound					KUHIO HWY Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	5	171	0	0	176	16	0	6	2	24	0	146	19	0	165	0	0	0	0	0	365
07:15 AM	4	184	0	0	188	10	0	8	0	18	0	183	18	0	201	0	0	0	0	0	407
07:30 AM	7	152	0	0	159	17	0	14	1	32	0	179	28	0	207	0	0	0	0	0	398
07:45 AM	11	118	0	0	129	9	0	4	0	13	0	191	21	0	212	0	0	0	0	0	354
Total Volume	27	625	0	0	652	52	0	32	3	87	0	699	86	0	785	0	0	0	0	0	1524
% App. Total	4.1	95.9	0	0		59.8	0	36.8	3.4		0	89	11	0		0	0	0	0		
PHF	.614	.849	.000	.000	.867	.765	.000	.571	.375	.680	.000	.915	.768	.000	.926	.000	.000	.000	.000	.000	.936



Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Papaloa Rd North
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

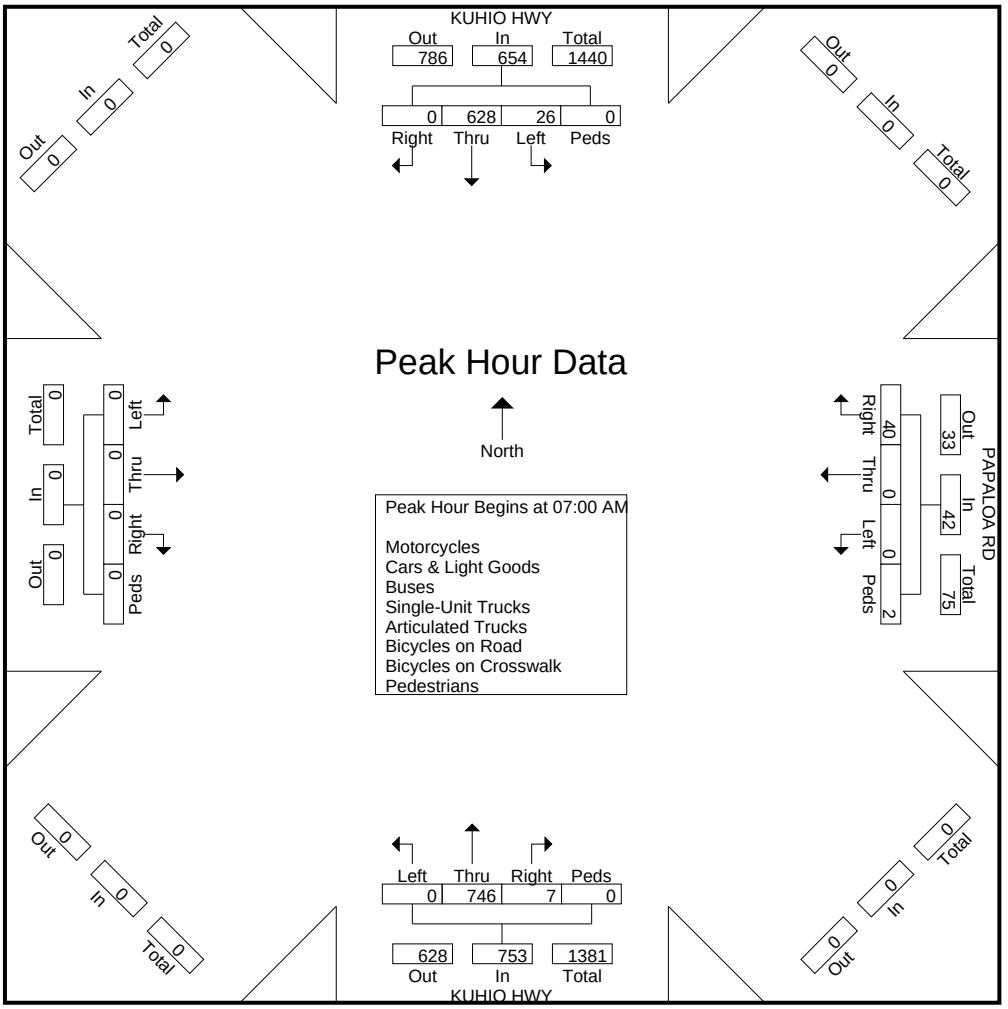
	KUHIO HWY Southbound				PAPALOA RD Westbound				KUHIO HWY Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:45 AM	4	150	0	0	1	0	13	0	0	188	2	0	0	0	0	0	358
Total	4	150	0	0	1	0	13	0	0	188	2	0	0	0	0	0	358
07:00 AM	6	178	0	0	0	0	7	2	0	158	3	0	0	0	0	0	354
07:15 AM	7	170	0	0	0	0	10	0	0	192	1	0	0	0	0	0	380
07:30 AM	4	160	0	0	0	0	11	0	0	194	0	0	0	0	0	0	369
07:45 AM	9	120	0	0	0	0	12	0	0	202	3	0	0	0	0	0	346
Total	26	628	0	0	0	0	40	2	0	746	7	0	0	0	0	0	1449
08:00 AM	5	134	0	0	0	0	10	0	0	151	1	0	0	0	0	0	301
08:15 AM	6	154	0	0	0	0	13	0	0	192	3	0	0	0	0	0	368
08:30 AM	11	154	0	0	0	0	11	0	0	173	4	0	0	0	0	0	353
Grand Total	52	1220	0	0	1	0	87	2	0	1450	17	0	0	0	0	0	2829
Apprch %	4.1	95.9	0	0	1.1	0	96.7	2.2	0	98.8	1.2	0	0	0	0	0	
Total %	1.8	43.1	0	0	0	0	3.1	0.1	0	51.3	0.6	0	0	0	0	0	
Motorcycles	0	2	0	0	0	0	0	0	0	4	0	0	0	0	0	0	6
% Motorcycles	0	0.2	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0.2
Cars & Light Goods	52	1186	0	0	1	0	84	0	0	1393	13	0	0	0	0	0	2729
% Cars & Light Goods	100	97.2	0	0	100	0	96.6	0	0	96.1	76.5	0	0	0	0	0	96.5
Buses	0	11	0	0	0	0	1	0	0	7	0	0	0	0	0	0	19
% Buses	0	0.9	0	0	0	0	1.1	0	0	0.5	0	0	0	0	0	0	0.7
Single-Unit Trucks	0	17	0	0	0	0	2	0	0	39	1	0	0	0	0	0	59
% Single-Unit Trucks	0	1.4	0	0	0	0	2.3	0	0	2.7	5.9	0	0	0	0	0	2.1
Articulated Trucks	0	4	0	0	0	0	0	0	0	7	0	0	0	0	0	0	11
% Articulated Trucks	0	0.3	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0.4
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	17.6	0	0	0	0	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
% Bicycles on Crosswalk	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0.1
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Papaloa Rd North
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	KUHIO HWY Southbound					PAPALOA RD Westbound					KUHIO HWY Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	6	178	0	0	184	0	0	7	2	9	0	158	3	0	161	0	0	0	0	0	354
07:15 AM	7	170	0	0	177	0	0	10	0	10	0	192	1	0	193	0	0	0	0	0	380
07:30 AM	4	160	0	0	164	0	0	11	0	11	0	194	0	0	194	0	0	0	0	0	369
07:45 AM	9	120	0	0	129	0	0	12	0	12	0	202	3	0	205	0	0	0	0	0	346
Total Volume	26	628	0	0	654	0	0	40	2	42	0	746	7	0	753	0	0	0	0	0	1449
% App. Total	4	96	0	0		0	0	95.2	4.8		0	99.1	0.9	0		0	0	0	0		
PHF	.722	.882	.000	.000	.889	.000	.000	.833	.250	.875	.000	.923	.583	.000	.918	.000	.000	.000	.000	.000	.953



Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Kapaa Bypass Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

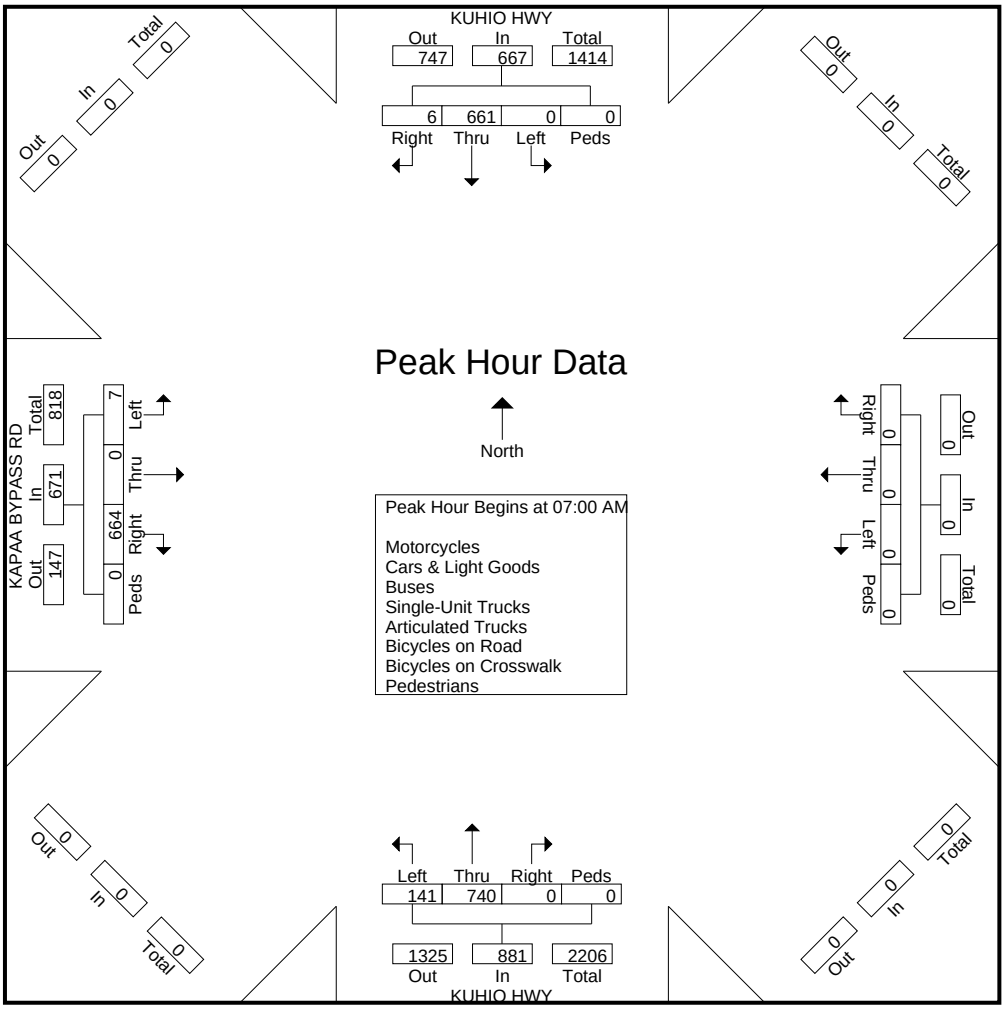
	KUHIO HWY Southbound				Westbound				KUHIO HWY Northbound				KAPAA BYPASS RD Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:45 AM	0	155	3	0	0	0	0	0	14	197	0	0	1	0	124	0	494
Total	0	155	3	0	0	0	0	0	14	197	0	0	1	0	124	0	494
07:00 AM	0	191	0	0	0	0	0	0	24	157	0	0	4	0	161	0	537
07:15 AM	0	189	1	0	0	0	0	0	43	178	0	0	1	0	184	0	596
07:30 AM	0	156	5	0	0	0	0	0	40	205	0	0	1	0	171	0	578
07:45 AM	0	125	0	0	0	0	0	0	34	200	0	0	1	0	148	0	508
Total	0	661	6	0	0	0	0	0	141	740	0	0	7	0	664	0	2219
08:00 AM	0	127	1	0	0	0	0	0	28	161	0	0	3	0	171	0	491
08:15 AM	0	157	1	0	0	0	0	0	24	197	0	0	3	0	139	0	521
08:30 AM	0	153	2	0	0	0	0	0	24	180	0	0	5	0	124	0	488
Grand Total	0	1253	13	0	0	0	0	0	231	1475	0	0	19	0	1222	0	4213
Apprch %	0	99	1	0	0	0	0	0	13.5	86.5	0	0	1.5	0	98.5	0	
Total %	0	29.7	0.3	0	0	0	0	0	5.5	35	0	0	0.5	0	29	0	
Motorcycles	0	3	0	0	0	0	0	0	1	4	0	0	0	0	0	0	8
% Motorcycles	0	0.2	0	0	0	0	0	0	0.4	0.3	0	0	0	0	0	0	0.2
Cars & Light Goods	0	1216	13	0	0	0	0	0	225	1415	0	0	18	0	1208	0	4095
% Cars & Light Goods	0	97	100	0	0	0	0	0	97.4	95.9	0	0	94.7	0	98.9	0	97.2
Buses	0	9	0	0	0	0	0	0	1	7	0	0	0	0	6	0	23
% Buses	0	0.7	0	0	0	0	0	0	0.4	0.5	0	0	0	0	0.5	0	0.5
Single-Unit Trucks	0	22	0	0	0	0	0	0	4	40	0	0	1	0	4	0	71
% Single-Unit Trucks	0	1.8	0	0	0	0	0	0	1.7	2.7	0	0	5.3	0	0.3	0	1.7
Articulated Trucks	0	3	0	0	0	0	0	0	0	6	0	0	0	0	4	0	13
% Articulated Trucks	0	0.2	0	0	0	0	0	0	0	0.4	0	0	0	0	0.3	0	0.3
Bicycles on Road	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Kapaa Bypass Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	KUHIO HWY Southbound					Westbound					KUHIO HWY Northbound					KAPAA BYPASS RD Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:45 AM to 08:30 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	191	0	0	191	0	0	0	0	0	24	157	0	0	181	4	0	161	0	165	537
07:15 AM	0	189	1	0	190	0	0	0	0	0	43	178	0	0	221	1	0	184	0	185	596
07:30 AM	0	156	5	0	161	0	0	0	0	0	40	205	0	0	245	1	0	171	0	172	578
07:45 AM	0	125	0	0	125	0	0	0	0	0	34	200	0	0	234	1	0	148	0	149	508
Total Volume	0	661	6	0	667	0	0	0	0	0	141	740	0	0	881	7	0	664	0	671	2219
% App. Total	0	99.1	0.9	0		0	0	0	0		16	84	0	0		1	0	99	0		
PHF	.000	.865	.300	.000	.873	.000	.000	.000	.000	.000	.820	.902	.000	.000	.899	.438	.000	.902	.000	.907	.931



Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Lanikai St
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

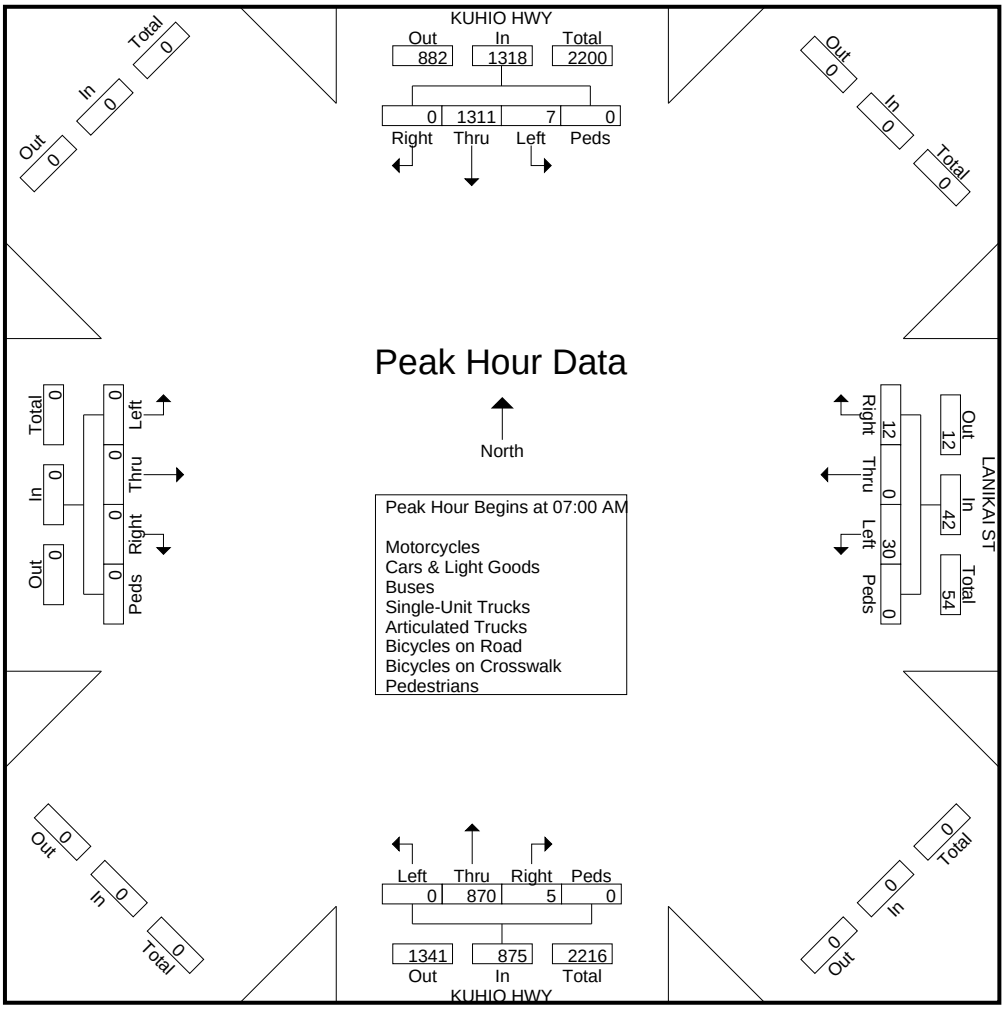
	KUHIO HWY Southbound				LANIKAI ST Westbound				KUHIO HWY Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:45 AM	1	276	0	0	9	0	3	2	0	194	2	0	0	0	0	0	487
Total	1	276	0	0	9	0	3	2	0	194	2	0	0	0	0	0	487
07:00 AM	1	347	0	0	7	0	0	0	0	192	0	0	0	0	0	0	547
07:15 AM	3	366	0	0	8	0	5	0	0	219	1	0	0	0	0	0	602
07:30 AM	1	326	0	0	10	0	1	0	0	226	3	0	0	0	0	0	567
07:45 AM	2	272	0	0	5	0	6	0	0	233	1	0	0	0	0	0	519
Total	7	1311	0	0	30	0	12	0	0	870	5	0	0	0	0	0	2235
08:00 AM	3	293	0	0	12	0	5	0	0	168	1	0	0	0	0	0	482
08:15 AM	0	295	0	0	7	0	7	0	0	221	4	0	0	0	0	0	534
08:30 AM	1	275	0	0	6	0	3	2	0	184	1	0	0	0	0	0	472
Grand Total	12	2450	0	0	64	0	30	4	0	1637	13	0	0	0	0	0	4210
Apprch %	0.5	99.5	0	0	65.3	0	30.6	4.1	0	99.2	0.8	0	0	0	0	0	
Total %	0.3	58.2	0	0	1.5	0	0.7	0.1	0	38.9	0.3	0	0	0	0	0	
Motorcycles	0	3	0	0	0	0	0	0	0	5	0	0	0	0	0	0	8
% Motorcycles	0	0.1	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0.2
Cars & Light Goods	12	2393	0	0	63	0	29	0	0	1576	13	0	0	0	0	0	4086
% Cars & Light Goods	100	97.7	0	0	98.4	0	96.7	0	0	96.3	100	0	0	0	0	0	97.1
Buses	0	16	0	0	0	0	0	0	0	8	0	0	0	0	0	0	24
% Buses	0	0.7	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0.6
Single-Unit Trucks	0	30	0	0	1	0	0	0	0	41	0	0	0	0	0	0	72
% Single-Unit Trucks	0	1.2	0	0	1.6	0	0	0	0	2.5	0	0	0	0	0	0	1.7
Articulated Trucks	0	8	0	0	0	0	0	0	0	7	0	0	0	0	0	0	15
% Articulated Trucks	0	0.3	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0.4
Bicycles on Road	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
% Bicycles on Road	0	0	0	0	0	0	3.3	0	0	0	0	0	0	0	0	0	0
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	4
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0.1

Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Lanikai St
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	KUHIO HWY Southbound					LANIKAI ST Westbound					KUHIO HWY Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:45 AM to 08:30 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	1	347	0	0	348	7	0	0	0	7	0	192	0	0	192	0	0	0	0	0	547
07:15 AM	3	366	0	0	369	8	0	5	0	13	0	219	1	0	220	0	0	0	0	0	602
07:30 AM	1	326	0	0	327	10	0	1	0	11	0	226	3	0	229	0	0	0	0	0	567
07:45 AM	2	272	0	0	274	5	0	6	0	11	0	233	1	0	234	0	0	0	0	0	519
Total Volume	7	1311	0	0	1318	30	0	12	0	42	0	870	5	0	875	0	0	0	0	0	2235
% App. Total	0.5	99.5	0	0		71.4	0	28.6	0		0	99.4	0.6	0		0	0	0	0		
PHF	.583	.895	.000	.000	.893	.750	.000	.500	.000	.808	.000	.933	.417	.000	.935	.000	.000	.000	.000	.000	.928



Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Kinipoo Shopping Village Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KUHIO HWY Southbound				KINIPOO SHOPPING VILLAGE Westbound				KUHIO HWY Northbound				PRIVATE DWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:45 AM	0	270	1	0	0	0	0	1	0	199	1	0	0	0	0	2	474
Total	0	270	1	0	0	0	0	1	0	199	1	0	0	0	0	2	474
07:00 AM	0	340	2	0	0	0	0	2	1	194	5	0	1	0	0	0	545
07:15 AM	0	394	1	1	0	0	1	2	0	223	5	0	0	0	0	0	627
07:30 AM	0	315	2	0	0	0	0	1	0	226	1	0	0	0	0	0	545
07:45 AM	1	277	0	0	0	0	0	4	0	233	2	0	0	0	0	0	517
Total	1	1326	5	1	0	0	1	9	1	876	13	0	1	0	0	0	2234
08:00 AM	0	288	6	0	0	0	2	0	0	167	0	0	1	0	0	0	464
08:15 AM	1	299	1	0	0	0	3	1	0	218	3	1	0	0	0	1	528
08:30 AM	0	276	0	0	0	0	0	4	0	189	5	0	1	0	0	4	479
Grand Total	2	2459	13	1	0	0	6	15	1	1649	22	1	3	0	0	7	4179
Apprch %	0.1	99.4	0.5	0	0	0	28.6	71.4	0.1	98.6	1.3	0.1	30	0	0	70	
Total %	0	58.8	0.3	0	0	0	0.1	0.4	0	39.5	0.5	0	0.1	0	0	0.2	
Motorcycles	0	2	0	0	0	0	0	0	0	4	0	0	0	0	0	0	6
% Motorcycles	0	0.1	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0.1
Cars & Light Goods	2	2403	11	0	0	0	6	0	1	1592	19	0	3	0	0	0	4037
% Cars & Light Goods	100	97.7	84.6	0	0	0	100	0	100	96.5	86.4	0	100	0	0	0	96.6
Buses	0	18	0	0	0	0	0	0	0	6	0	0	0	0	0	0	24
% Buses	0	0.7	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0.6
Single-Unit Trucks	0	27	2	0	0	0	0	0	0	41	1	0	0	0	0	0	71
% Single-Unit Trucks	0	1.1	15.4	0	0	0	0	0	0	2.5	4.5	0	0	0	0	0	1.7
Articulated Trucks	0	8	0	0	0	0	0	0	0	6	0	0	0	0	0	0	14
% Articulated Trucks	0	0.3	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0.3
Bicycles on Road	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	3
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	9.1	0	0	0	0	0	0.1
Bicycles on Crosswalk	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0	4
% Bicycles on Crosswalk	0	0	0	0	0	0	0	20	0	0	0	100	0	0	0	0	0.1
Pedestrians	0	0	0	1	0	0	0	12	0	0	0	0	0	0	0	7	20
% Pedestrians	0	0	0	100	0	0	0	80	0	0	0	0	0	0	0	100	0.5

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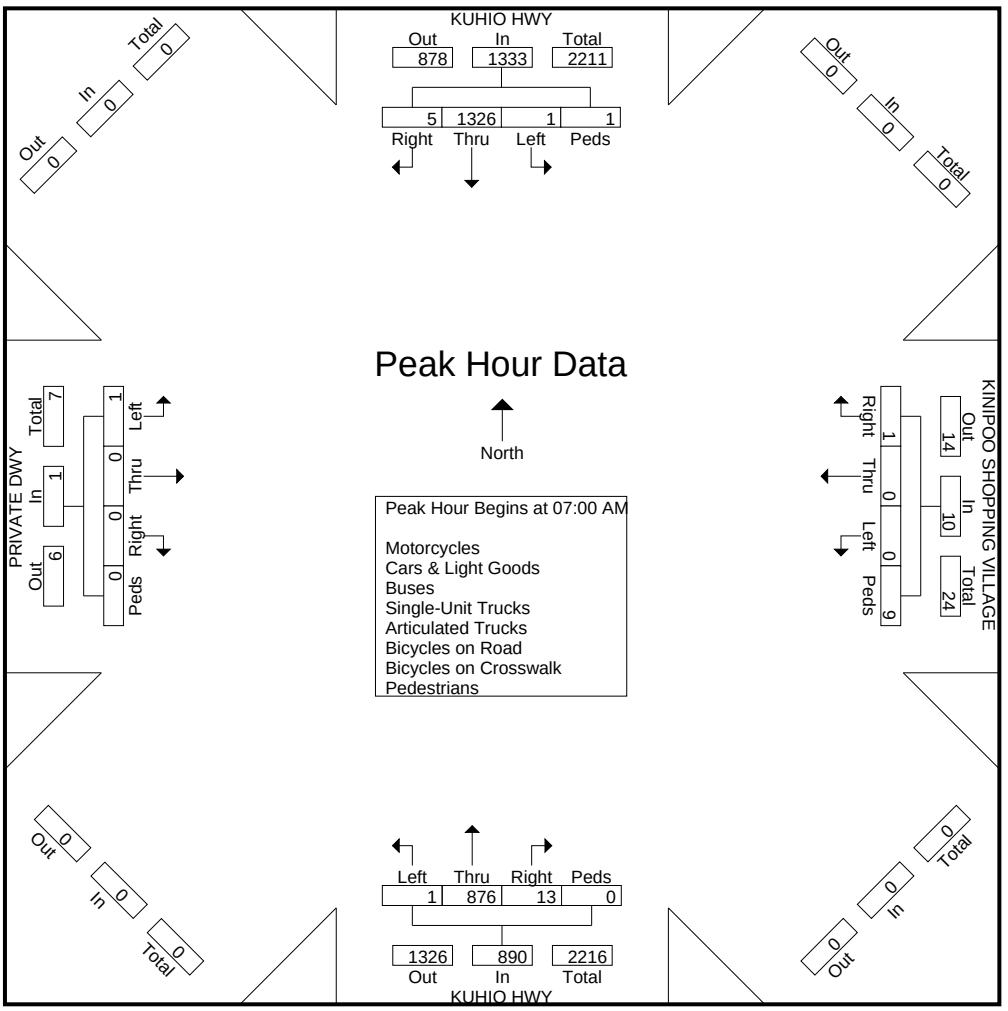
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Kinipoo Shopping Village Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	KUHIO HWY Southbound					KINIPOO SHOPPING VILLAGE Westbound					KUHIO HWY Northbound					PRIVATE DWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:45 AM to 08:30 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	340	2	0	342	0	0	0	2	2	1	194	5	0	200	1	0	0	0	1	545
07:15 AM	0	394	1	1	396	0	0	1	2	3	0	223	5	0	228	0	0	0	0	0	627
07:30 AM	0	315	2	0	317	0	0	0	1	1	0	226	1	0	227	0	0	0	0	0	545
07:45 AM	1	277	0	0	278	0	0	0	4	4	0	233	2	0	235	0	0	0	0	0	517
Total Volume	1	1326	5	1	1333	0	0	1	9	10	1	876	13	0	890	1	0	0	0	1	2234
% App. Total	0.1	99.5	0.4	0.1		0	0	10	90		0.1	98.4	1.5	0		100	0	0	0		
PHF	.250	.841	.625	.250	.842	.000	.000	.250	.563	.625	.250	.940	.650	.000	.947	.250	.000	.000	.000	.250	.891



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501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Haleilio Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KUHIO HWY Southbound				Westbound				KUHIO HWY Northbound				HALEILIO RD Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:45 AM	0	273	6	0	0	0	0	0	10	163	0	0	34	0	38	0	524
Total	0	273	6	0	0	0	0	0	10	163	0	0	34	0	38	0	524
07:00 AM	0	333	13	0	0	0	0	0	9	163	0	5	39	0	73	3	638
07:15 AM	0	385	13	0	0	0	0	0	8	186	0	2	53	0	67	0	714
07:30 AM	0	299	17	0	0	0	0	0	13	194	0	1	48	0	24	1	597
07:45 AM	0	266	20	0	0	0	0	0	15	211	0	2	27	0	28	2	571
Total	0	1283	63	0	0	0	0	0	45	754	0	10	167	0	192	6	2520
08:00 AM	0	268	24	0	0	0	0	0	29	147	0	17	27	0	20	17	549
08:15 AM	0	271	29	0	0	0	0	0	11	196	0	5	27	0	29	4	572
08:30 AM	0	263	14	0	0	0	0	0	14	170	0	5	23	0	23	5	517
Grand Total	0	2358	136	0	0	0	0	0	109	1430	0	37	278	0	302	32	4682
Apprch %	0	94.5	5.5	0	0	0	0	0	6.9	90.7	0	2.3	45.4	0	49.3	5.2	
Total %	0	50.4	2.9	0	0	0	0	0	2.3	30.5	0	0.8	5.9	0	6.5	0.7	
Motorcycles	0	1	0	0	0	0	0	0	0	3	0	0	1	0	1	0	6
% Motorcycles	0	0	0	0	0	0	0	0	0	0.2	0	0	0.4	0	0.3	0	0.1
Cars & Light Goods	0	2310	132	0	0	0	0	0	107	1374	0	0	274	0	294	0	4491
% Cars & Light Goods	0	98	97.1	0	0	0	0	0	98.2	96.1	0	0	98.6	0	97.4	0	95.9
Buses	0	13	2	0	0	0	0	0	1	4	0	0	1	0	3	0	24
% Buses	0	0.6	1.5	0	0	0	0	0	0.9	0.3	0	0	0.4	0	1	0	0.5
Single-Unit Trucks	0	27	1	0	0	0	0	0	1	44	0	0	1	0	4	0	78
% Single-Unit Trucks	0	1.1	0.7	0	0	0	0	0	0.9	3.1	0	0	0.4	0	1.3	0	1.7
Articulated Trucks	0	7	0	0	0	0	0	0	0	5	0	0	0	0	0	0	12
% Articulated Trucks	0	0.3	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0.3
Bicycles on Road	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	2
% Bicycles on Road	0	0	0.7	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	5.4	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	35	0	0	0	32	67
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	94.6	0	0	0	100	1.4

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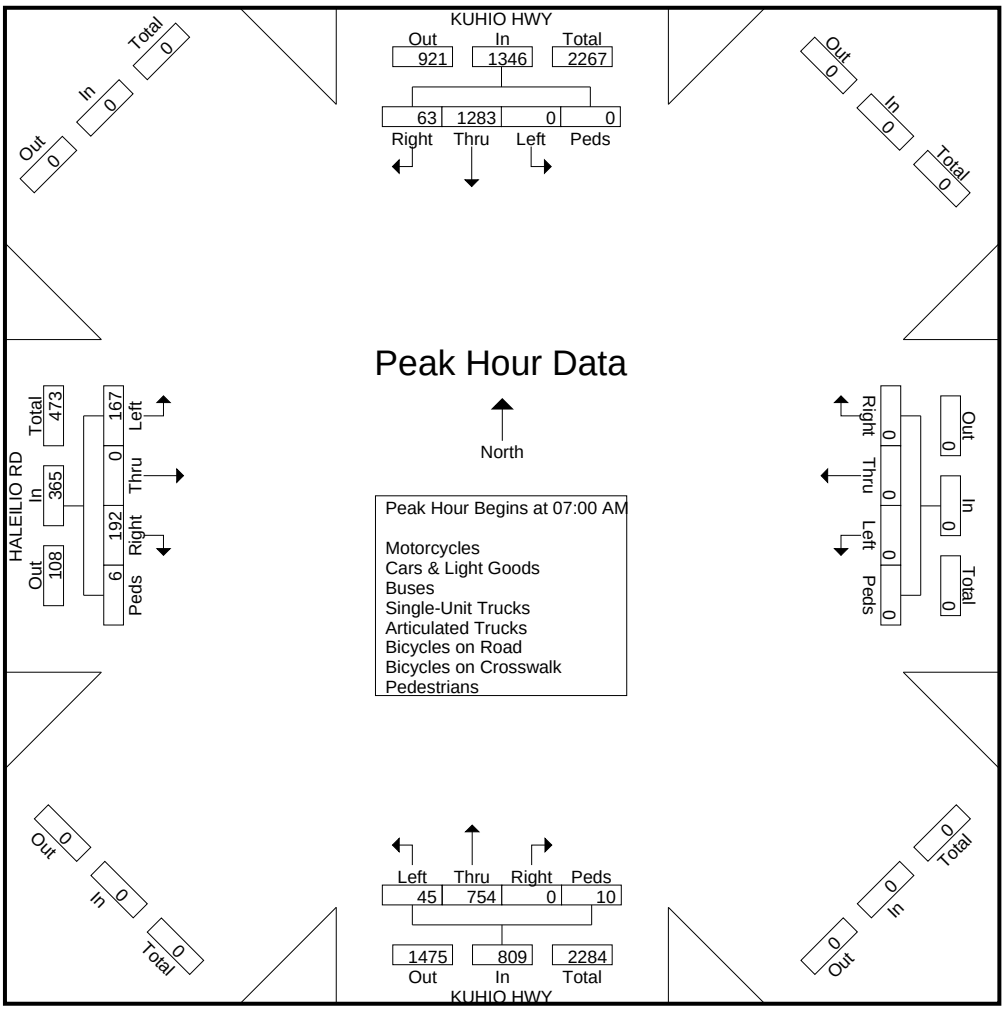
501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Haleilio Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	KUHIO HWY Southbound					Westbound					KUHIO HWY Northbound					HALEILIO RD Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:45 AM to 08:30 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	333	13	0	346	0	0	0	0	0	9	163	0	5	177	39	0	73	3	115	638
07:15 AM	0	385	13	0	398	0	0	0	0	0	8	186	0	2	196	53	0	67	0	120	714
07:30 AM	0	299	17	0	316	0	0	0	0	0	13	194	0	1	208	48	0	24	1	73	597
07:45 AM	0	266	20	0	286	0	0	0	0	0	15	211	0	2	228	27	0	28	2	57	571
Total Volume	0	1283	63	0	1346	0	0	0	0	0	45	754	0	10	809	167	0	192	6	365	2520
% App. Total	0	95.3	4.7	0		0	0	0	0		5.6	93.2	0	1.2		45.8	0	52.6	1.6		
PHF	.000	.833	.788	.000	.845	.000	.000	.000	.000	.000	.750	.893	.000	.500	.887	.788	.000	.658	.500	.760	.882



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501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Papaloa Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

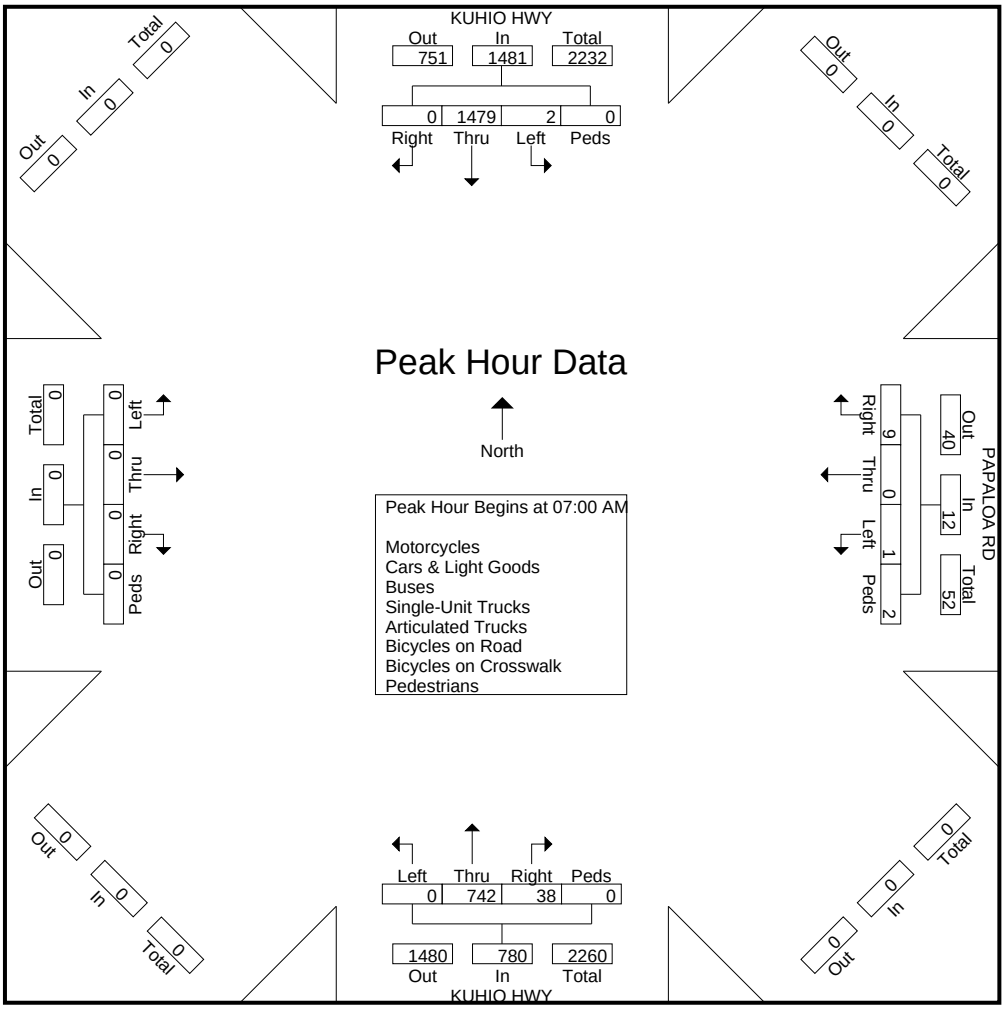
	KUHIO HWY Southbound				PAPALOA RD Westbound				KUHIO HWY Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:45 AM	0	303	0	0	1	0	0	0	0	170	9	0	0	0	0	0	483
Total	0	303	0	0	1	0	0	0	0	170	9	0	0	0	0	0	483
07:00 AM	1	404	0	0	0	0	1	2	0	159	9	0	0	0	0	0	576
07:15 AM	0	458	0	0	0	0	5	0	0	175	11	0	0	0	0	0	649
07:30 AM	1	325	0	0	0	0	2	0	0	191	10	0	0	0	0	0	529
07:45 AM	0	292	0	0	1	0	1	0	0	217	8	0	0	0	0	0	519
Total	2	1479	0	0	1	0	9	2	0	742	38	0	0	0	0	0	2273
08:00 AM	0	289	0	0	0	0	0	1	0	180	11	0	0	0	0	0	481
08:15 AM	1	296	0	0	0	0	2	0	0	195	12	0	0	0	0	0	506
08:30 AM	1	284	0	0	2	0	2	2	0	178	14	0	0	0	0	0	483
Grand Total	4	2651	0	0	4	0	13	5	0	1465	84	0	0	0	0	0	4226
Apprch %	0.2	99.8	0	0	18.2	0	59.1	22.7	0	94.6	5.4	0	0	0	0	0	
Total %	0.1	62.7	0	0	0.1	0	0.3	0.1	0	34.7	2	0	0	0	0	0	
Motorcycles	0	2	0	0	0	0	0	0	0	4	0	0	0	0	0	0	6
% Motorcycles	0	0.1	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0.1
Cars & Light Goods	4	2594	0	0	4	0	13	0	0	1408	80	0	0	0	0	0	4103
% Cars & Light Goods	100	97.8	0	0	100	0	100	0	0	96.1	95.2	0	0	0	0	0	97.1
Buses	0	16	0	0	0	0	0	0	0	8	1	0	0	0	0	0	25
% Buses	0	0.6	0	0	0	0	0	0	0	0.5	1.2	0	0	0	0	0	0.6
Single-Unit Trucks	0	33	0	0	0	0	0	0	0	42	3	0	0	0	0	0	78
% Single-Unit Trucks	0	1.2	0	0	0	0	0	0	0	2.9	3.6	0	0	0	0	0	1.8
Articulated Trucks	0	6	0	0	0	0	0	0	0	3	0	0	0	0	0	0	9
% Articulated Trucks	0	0.2	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0.2
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Crosswalk	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
% Bicycles on Crosswalk	0	0	0	0	0	0	0	60	0	0	0	0	0	0	0	0	0.1
Pedestrians	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
% Pedestrians	0	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	0

Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Papaloa Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	KUHIO HWY Southbound					PAPALOA RD Westbound					KUHIO HWY Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:45 AM to 08:30 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	1	404	0	0	405	0	0	1	2	3	0	159	9	0	168	0	0	0	0	0	576
07:15 AM	0	458	0	0	458	0	0	5	0	5	0	175	11	0	186	0	0	0	0	0	649
07:30 AM	1	325	0	0	326	0	0	2	0	2	0	191	10	0	201	0	0	0	0	0	529
07:45 AM	0	292	0	0	292	1	0	1	0	2	0	217	8	0	225	0	0	0	0	0	519
Total Volume	2	1479	0	0	1481	1	0	9	2	12	0	742	38	0	780	0	0	0	0	0	2273
% App. Total	0.1	99.9	0	0		8.3	0	75	16.7		0	95.1	4.9	0		0	0	0	0		
PHF	.500	.807	.000	.000	.808	.250	.000	.450	.250	.600	.000	.855	.864	.000	.867	.000	.000	.000	.000	.000	.876



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501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Kuamoo Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

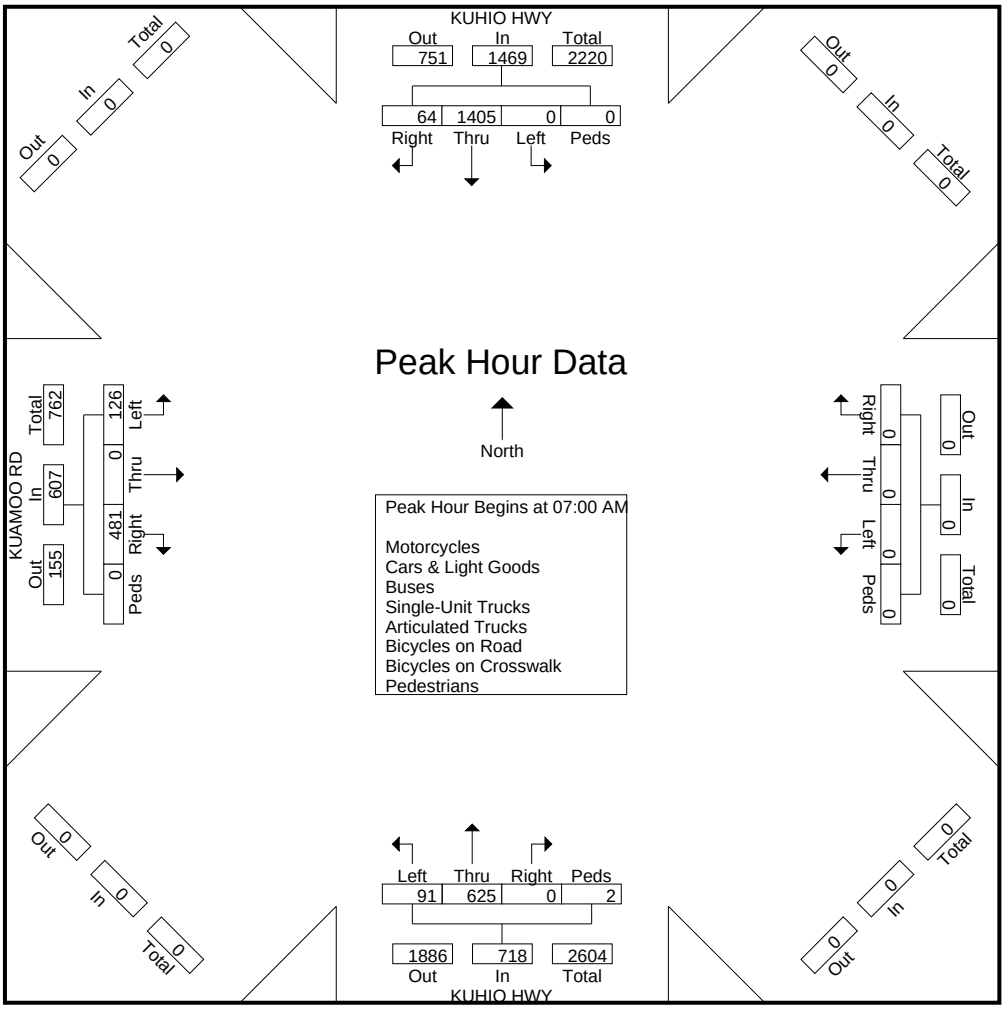
	KUHIO HWY Southbound				Westbound				KUHIO HWY Northbound				KUAMOO RD Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:45 AM	0	292	11	0	0	0	0	0	9	138	0	2	33	0	124	0	609
Total	0	292	11	0	0	0	0	0	9	138	0	2	33	0	124	0	609
07:00 AM	0	375	17	0	0	0	0	0	19	121	0	1	35	0	126	0	694
07:15 AM	0	423	24	0	0	0	0	0	18	152	0	0	15	0	118	0	750
07:30 AM	0	335	13	0	0	0	0	0	17	168	0	0	36	0	142	0	711
07:45 AM	0	272	10	0	0	0	0	0	37	184	0	1	40	0	95	0	639
Total	0	1405	64	0	0	0	0	0	91	625	0	2	126	0	481	0	2794
08:00 AM	0	250	19	0	0	0	0	0	46	169	0	1	26	0	62	0	573
08:15 AM	0	290	26	0	0	0	0	0	44	182	0	0	28	0	85	0	655
08:30 AM	0	251	28	0	0	0	0	0	24	161	0	2	23	0	75	0	564
Grand Total	0	2488	148	0	0	0	0	0	214	1275	0	7	236	0	827	0	5195
Apprch %	0	94.4	5.6	0	0	0	0	0	14.3	85.2	0	0.5	22.2	0	77.8	0	
Total %	0	47.9	2.8	0	0	0	0	0	4.1	24.5	0	0.1	4.5	0	15.9	0	
Motorcycles	0	2	0	0	0	0	0	0	0	5	0	0	1	0	1	0	9
% Motorcycles	0	0.1	0	0	0	0	0	0	0	0.4	0	0	0.4	0	0.1	0	0.2
Cars & Light Goods	0	2435	142	0	0	0	0	0	207	1210	0	0	232	0	812	0	5038
% Cars & Light Goods	0	97.9	95.9	0	0	0	0	0	96.7	94.9	0	0	98.3	0	98.2	0	97
Buses	0	13	3	0	0	0	0	0	4	7	0	0	2	0	7	0	36
% Buses	0	0.5	2	0	0	0	0	0	1.9	0.5	0	0	0.8	0	0.8	0	0.7
Single-Unit Trucks	0	31	2	0	0	0	0	0	3	46	0	0	1	0	6	0	89
% Single-Unit Trucks	0	1.2	1.4	0	0	0	0	0	1.4	3.6	0	0	0.4	0	0.7	0	1.7
Articulated Trucks	0	7	1	0	0	0	0	0	0	7	0	0	0	0	1	0	16
% Articulated Trucks	0	0.3	0.7	0	0	0	0	0	0	0.5	0	0	0	0	0.1	0	0.3
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	7
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0.1

Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Kuamoo Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	KUHIO HWY Southbound					Westbound					KUHIO HWY Northbound					KUAMOO RD Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:45 AM to 08:30 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	375	17	0	392	0	0	0	0	0	19	121	0	1	141	35	0	126	0	161	694
07:15 AM	0	423	24	0	447	0	0	0	0	0	18	152	0	0	170	15	0	118	0	133	750
07:30 AM	0	335	13	0	348	0	0	0	0	0	17	168	0	0	185	36	0	142	0	178	711
07:45 AM	0	272	10	0	282	0	0	0	0	0	37	184	0	1	222	40	0	95	0	135	639
Total Volume	0	1405	64	0	1469	0	0	0	0	0	91	625	0	2	718	126	0	481	0	607	2794
% App. Total	0	95.6	4.4	0		0	0	0	0		12.7	87	0	0.3		20.8	0	79.2	0		
PHF	.000	.830	.667	.000	.822	.000	.000	.000	.000	.000	.615	.849	.000	.500	.809	.788	.000	.847	.000	.853	.931



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501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Papaloa Rd - Lanikai St
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

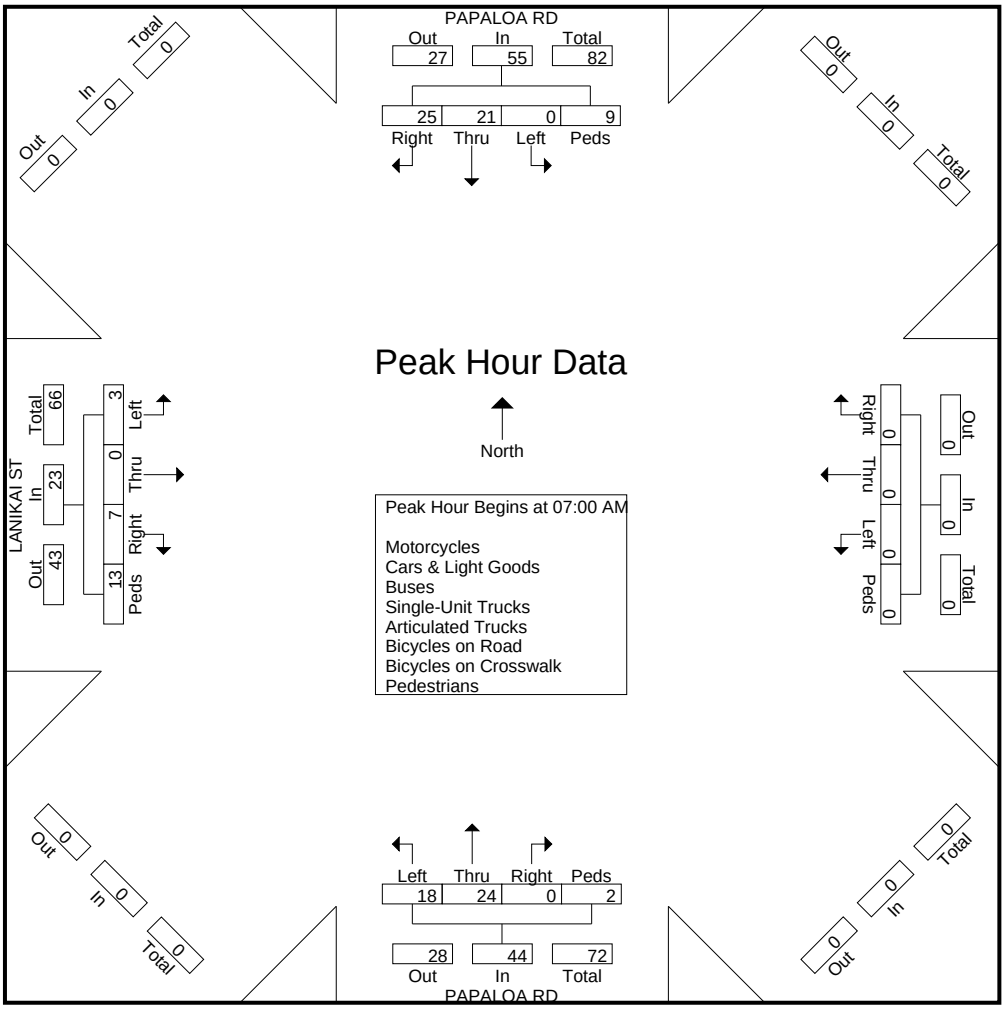
	PAPALOA RD Southbound				Westbound				PAPALOA RD Northbound				LANIKAI ST Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:45 AM	0	3	7	0	0	0	0	0	5	5	0	0	1	0	0	1	22
Total	0	3	7	0	0	0	0	0	5	5	0	0	1	0	0	1	22
07:00 AM	0	6	3	3	0	0	0	0	4	3	0	0	0	0	2	5	26
07:15 AM	0	6	9	0	0	0	0	0	6	9	0	0	1	0	1	2	34
07:30 AM	0	2	6	6	0	0	0	0	4	3	0	0	1	0	2	6	30
07:45 AM	0	7	7	0	0	0	0	0	4	9	0	2	1	0	2	0	32
Total	0	21	25	9	0	0	0	0	18	24	0	2	3	0	7	13	122
08:00 AM	0	3	6	2	0	0	0	0	8	5	0	0	0	0	3	18	45
08:15 AM	0	2	6	3	0	0	0	0	9	5	0	0	1	0	2	3	31
08:30 AM	0	7	2	2	0	0	0	0	5	6	0	0	0	0	1	2	25
Grand Total	0	36	46	16	0	0	0	0	45	45	0	2	5	0	13	37	245
Apprch %	0	36.7	46.9	16.3	0	0	0	0	48.9	48.9	0	2.2	9.1	0	23.6	67.3	
Total %	0	14.7	18.8	6.5	0	0	0	0	18.4	18.4	0	0.8	2	0	5.3	15.1	
Motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cars & Light Goods	0	34	45	0	0	0	0	0	44	38	0	0	5	0	13	0	179
% Cars & Light Goods	0	94.4	97.8	0	0	0	0	0	97.8	84.4	0	0	100	0	100	0	73.1
Buses	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
% Buses	0	0	0	0	0	0	0	0	0	2.2	0	0	0	0	0	0	0.4
Single-Unit Trucks	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	3
% Single-Unit Trucks	0	0	0	0	0	0	0	0	2.2	4.4	0	0	0	0	0	0	1.2
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	2	1	0	0	0	0	0	0	4	0	0	0	0	0	0	7
% Bicycles on Road	0	5.6	2.2	0	0	0	0	0	0	8.9	0	0	0	0	0	0	2.9
Bicycles on Crosswalk	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3	6
% Bicycles on Crosswalk	0	0	0	18.8	0	0	0	0	0	0	0	0	0	0	0	8.1	2.4
Pedestrians	0	0	0	13	0	0	0	0	0	0	0	2	0	0	0	34	49
% Pedestrians	0	0	0	81.2	0	0	0	0	0	0	0	100	0	0	0	91.9	20

Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Papaloa Rd - Lanikai St
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	PAPALOA RD Southbound					Westbound					PAPALOA RD Northbound					LANIKAI ST Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	6	3	3	12	0	0	0	0	0	4	3	0	0	7	0	0	2	5	7	26
07:15 AM	0	6	9	0	15	0	0	0	0	0	6	9	0	0	15	1	0	1	2	4	34
07:30 AM	0	2	6	6	14	0	0	0	0	0	4	3	0	0	7	1	0	2	6	9	30
07:45 AM	0	7	7	0	14	0	0	0	0	0	4	9	0	2	15	1	0	2	0	3	32
Total Volume	0	21	25	9	55	0	0	0	0	0	18	24	0	2	44	3	0	7	13	23	122
% App. Total	0	38.2	45.5	16.4		0	0	0	0		40.9	54.5	0	4.5		13	0	30.4	56.5		
PHF	.000	.750	.694	.375	.917	.000	.000	.000	.000	.000	.750	.667	.000	.250	.733	.750	.000	.875	.542	.639	.897



Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Aleka Lp North
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

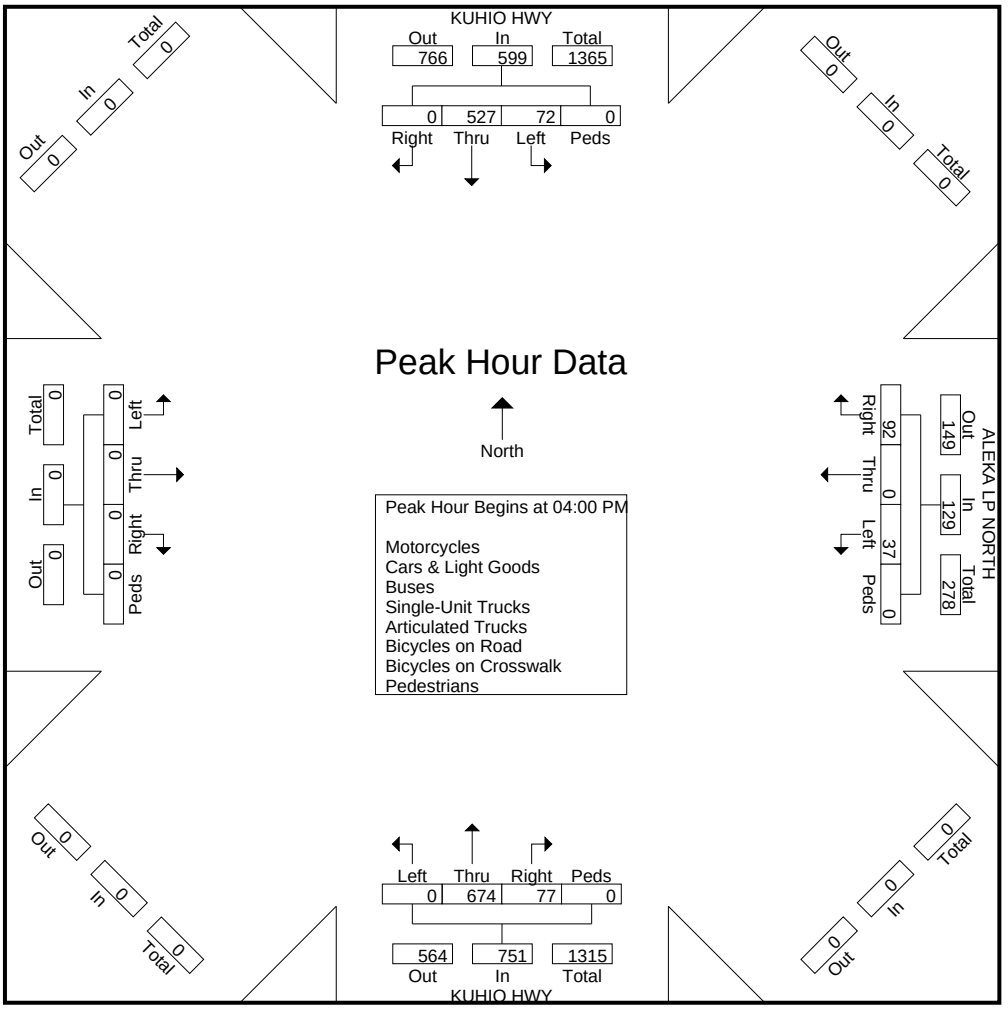
	KUHIO HWY Southbound				ALEKA LP NORTH Westbound				KUHIO HWY Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	13	139	0	0	8	0	21	0	0	173	23	0	0	0	0	0	377
03:15 PM	16	129	0	0	11	0	14	0	0	184	17	0	0	0	0	0	371
03:30 PM	18	129	0	0	5	0	21	2	0	154	19	0	0	0	0	0	348
03:45 PM	27	110	0	0	8	0	24	0	0	142	26	0	0	0	0	0	337
Total	74	507	0	0	32	0	80	2	0	653	85	0	0	0	0	0	1433
04:00 PM	19	122	0	0	14	0	23	0	0	185	19	0	0	0	0	0	382
04:15 PM	16	139	0	0	12	0	26	0	0	183	16	0	0	0	0	0	392
04:30 PM	16	142	0	0	6	0	23	0	0	164	16	0	0	0	0	0	367
04:45 PM	21	124	0	0	5	0	20	0	0	142	26	0	0	0	0	0	338
Total	72	527	0	0	37	0	92	0	0	674	77	0	0	0	0	0	1479
Grand Total	146	1034	0	0	69	0	172	2	0	1327	162	0	0	0	0	0	2912
Apprch %	12.4	87.6	0	0	28.4	0	70.8	0.8	0	89.1	10.9	0	0	0	0	0	
Total %	5	35.5	0	0	2.4	0	5.9	0.1	0	45.6	5.6	0	0	0	0	0	
Motorcycles	1	2	0	0	0	0	3	0	0	3	0	0	0	0	0	0	9
% Motorcycles	0.7	0.2	0	0	0	0	1.7	0	0	0.2	0	0	0	0	0	0	0.3
Cars & Light Goods	144	1006	0	0	67	0	163	0	0	1303	160	0	0	0	0	0	2843
% Cars & Light Goods	98.6	97.3	0	0	97.1	0	94.8	0	0	98.2	98.8	0	0	0	0	0	97.6
Buses	0	8	0	0	0	0	0	0	0	7	0	0	0	0	0	0	15
% Buses	0	0.8	0	0	0	0	0	0	0	0.5	0	0	0	0	0	0	0.5
Single-Unit Trucks	1	13	0	0	1	0	1	0	0	13	2	0	0	0	0	0	31
% Single-Unit Trucks	0.7	1.3	0	0	1.4	0	0.6	0	0	1	1.2	0	0	0	0	0	1.1
Articulated Trucks	0	4	0	0	0	0	0	0	0	1	0	0	0	0	0	0	5
% Articulated Trucks	0	0.4	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0.2
Bicycles on Road	0	1	0	0	1	0	5	0	0	0	0	0	0	0	0	0	7
% Bicycles on Road	0	0.1	0	0	1.4	0	2.9	0	0	0	0	0	0	0	0	0	0.2
Bicycles on Crosswalk	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
% Bicycles on Crosswalk	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0.1
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Aleka Lp North
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	KUHIO HWY Southbound					ALEKA LP NORTH Westbound					KUHIO HWY Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	19	122	0	0	141	14	0	23	0	37	0	185	19	0	204	0	0	0	0	0	382
04:15 PM	16	139	0	0	155	12	0	26	0	38	0	183	16	0	199	0	0	0	0	0	392
04:30 PM	16	142	0	0	158	6	0	23	0	29	0	164	16	0	180	0	0	0	0	0	367
04:45 PM	21	124	0	0	145	5	0	20	0	25	0	142	26	0	168	0	0	0	0	0	338
Total Volume	72	527	0	0	599	37	0	92	0	129	0	674	77	0	751	0	0	0	0	0	1479
% App. Total	12	88	0	0		28.7	0	71.3	0		0	89.7	10.3	0		0	0	0	0		
PHF	.857	.928	.000	.000	.948	.661	.000	.885	.000	.849	.000	.911	.740	.000	.920	.000	.000	.000	.000	.000	.943



Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Aleka Lp South
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

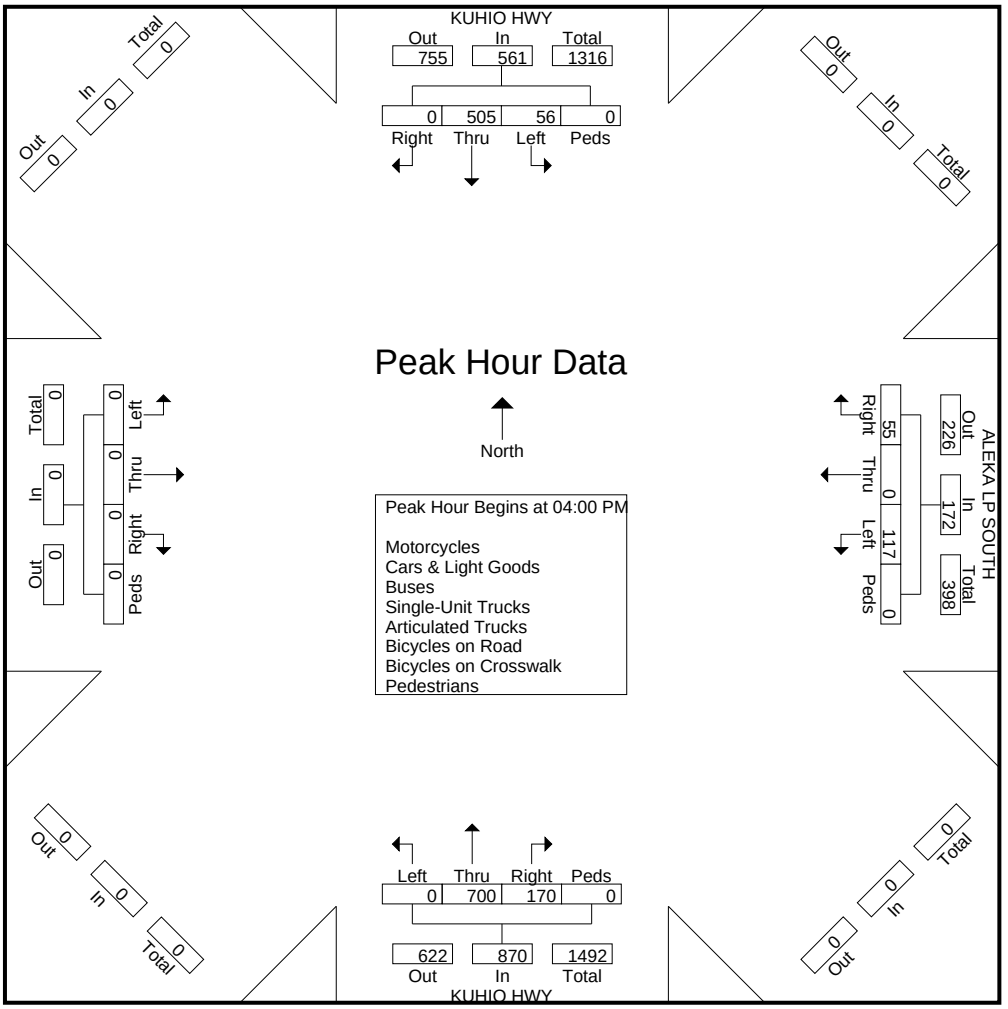
	KUHIO HWY Southbound				ALEKA LP SOUTH Westbound				KUHIO HWY Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	16	130	0	0	19	0	23	0	0	184	28	0	0	0	0	0	400
03:15 PM	12	131	0	0	20	0	15	0	0	181	33	0	0	0	0	0	392
03:30 PM	14	123	0	0	21	0	14	0	0	164	18	0	0	0	0	0	354
03:45 PM	13	102	0	0	26	0	14	0	0	155	40	0	0	0	0	0	350
Total	55	486	0	0	86	0	66	0	0	684	119	0	0	0	0	0	1496
04:00 PM	12	125	0	0	27	0	19	0	0	181	41	0	0	0	0	0	405
04:15 PM	17	129	0	0	28	0	16	0	0	183	46	0	0	0	0	0	419
04:30 PM	17	132	0	0	31	0	11	0	0	166	40	0	0	0	0	0	397
04:45 PM	10	119	0	0	31	0	9	0	0	170	43	0	0	0	0	0	382
Total	56	505	0	0	117	0	55	0	0	700	170	0	0	0	0	0	1603
Grand Total	111	991	0	0	203	0	121	0	0	1384	289	0	0	0	0	0	3099
Apprch %	10.1	89.9	0	0	62.7	0	37.3	0	0	82.7	17.3	0	0	0	0	0	
Total %	3.6	32	0	0	6.6	0	3.9	0	0	44.7	9.3	0	0	0	0	0	
Motorcycles	0	2	0	0	0	0	0	0	0	2	2	0	0	0	0	0	6
% Motorcycles	0	0.2	0	0	0	0	0	0	0	0.1	0.7	0	0	0	0	0	0.2
Cars & Light Goods	110	963	0	0	201	0	120	0	0	1363	285	0	0	0	0	0	3042
% Cars & Light Goods	99.1	97.2	0	0	99	0	99.2	0	0	98.5	98.6	0	0	0	0	0	98.2
Buses	0	8	0	0	0	0	1	0	0	6	1	0	0	0	0	0	16
% Buses	0	0.8	0	0	0	0	0.8	0	0	0.4	0.3	0	0	0	0	0	0.5
Single-Unit Trucks	1	13	0	0	2	0	0	0	0	10	1	0	0	0	0	0	27
% Single-Unit Trucks	0.9	1.3	0	0	1	0	0	0	0	0.7	0.3	0	0	0	0	0	0.9
Articulated Trucks	0	4	0	0	0	0	0	0	0	3	0	0	0	0	0	0	7
% Articulated Trucks	0	0.4	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0.2
Bicycles on Road	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Bicycles on Road	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Aleka Lp South
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	KUHIO HWY Southbound					ALEKA LP SOUTH Westbound					KUHIO HWY Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	12	125	0	0	137	27	0	19	0	46	0	181	41	0	222	0	0	0	0	0	405
04:15 PM	17	129	0	0	146	28	0	16	0	44	0	183	46	0	229	0	0	0	0	0	419
04:30 PM	17	132	0	0	149	31	0	11	0	42	0	166	40	0	206	0	0	0	0	0	397
04:45 PM	10	119	0	0	129	31	0	9	0	40	0	170	43	0	213	0	0	0	0	0	382
Total Volume	56	505	0	0	561	117	0	55	0	172	0	700	170	0	870	0	0	0	0	0	1603
% App. Total	10	90	0	0		68	0	32	0		0	80.5	19.5	0		0	0	0	0		
PHF	.824	.956	.000	.000	.941	.944	.000	.724	.000	.935	.000	.956	.924	.000	.950	.000	.000	.000	.000	.000	.956



Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Papaloa Rd North
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

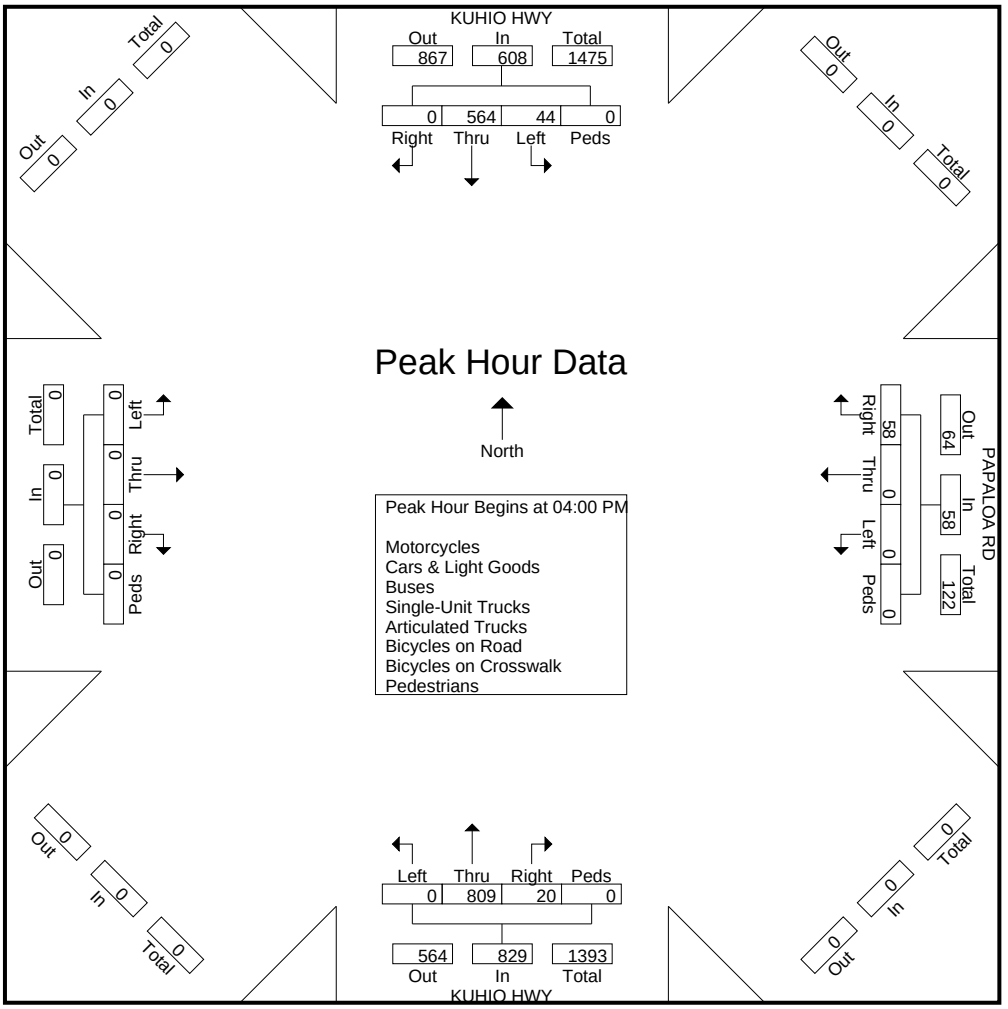
	KUHIO HWY Southbound				PAPALOA RD Westbound				KUHIO HWY Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	12	130	0	0	0	0	15	0	0	201	1	0	0	0	0	0	359
03:15 PM	11	142	0	0	0	0	10	0	0	202	4	0	0	0	0	0	369
03:30 PM	7	127	0	0	0	0	8	0	0	174	6	0	0	0	0	0	322
03:45 PM	6	123	0	0	0	0	12	0	0	181	3	0	0	0	0	0	325
Total	36	522	0	0	0	0	45	0	0	758	14	0	0	0	0	0	1375
04:00 PM	8	142	0	0	0	0	20	0	0	201	6	0	0	0	0	0	377
04:15 PM	13	141	0	0	0	0	16	0	0	213	3	0	0	0	0	0	386
04:30 PM	9	146	0	0	0	0	7	0	0	199	6	0	0	0	0	0	367
04:45 PM	14	135	0	0	0	0	15	0	0	196	5	0	0	0	0	0	365
Total	44	564	0	0	0	0	58	0	0	809	20	0	0	0	0	0	1495
Grand Total	80	1086	0	0	0	0	103	0	0	1567	34	0	0	0	0	0	2870
Apprch %	6.9	93.1	0	0	0	0	100	0	0	97.9	2.1	0	0	0	0	0	
Total %	2.8	37.8	0	0	0	0	3.6	0	0	54.6	1.2	0	0	0	0	0	
Motorcycles	0	3	0	0	0	0	0	0	0	4	0	0	0	0	0	0	7
% Motorcycles	0	0.3	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0.2
Cars & Light Goods	79	1053	0	0	0	0	102	0	0	1541	34	0	0	0	0	0	2809
% Cars & Light Goods	98.8	97	0	0	0	0	99	0	0	98.3	100	0	0	0	0	0	97.9
Buses	0	9	0	0	0	0	1	0	0	6	0	0	0	0	0	0	16
% Buses	0	0.8	0	0	0	0	1	0	0	0.4	0	0	0	0	0	0	0.6
Single-Unit Trucks	1	17	0	0	0	0	0	0	0	12	0	0	0	0	0	0	30
% Single-Unit Trucks	1.2	1.6	0	0	0	0	0	0	0	0.8	0	0	0	0	0	0	1
Articulated Trucks	0	4	0	0	0	0	0	0	0	3	0	0	0	0	0	0	7
% Articulated Trucks	0	0.4	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0.2
Bicycles on Road	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Papaloa Rd North
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	KUHIO HWY Southbound					PAPALOA RD Westbound					KUHIO HWY Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	8	142	0	0	150	0	0	20	0	20	0	201	6	0	207	0	0	0	0	0	377
04:15 PM	13	141	0	0	154	0	0	16	0	16	0	213	3	0	216	0	0	0	0	0	386
04:30 PM	9	146	0	0	155	0	0	7	0	7	0	199	6	0	205	0	0	0	0	0	367
04:45 PM	14	135	0	0	149	0	0	15	0	15	0	196	5	0	201	0	0	0	0	0	365
Total Volume	44	564	0	0	608	0	0	58	0	58	0	809	20	0	829	0	0	0	0	0	1495
% App. Total	7.2	92.8	0	0		0	0	100	0		0	97.6	2.4	0		0	0	0	0		
PHF	.786	.966	.000	.000	.981	.000	.000	.725	.000	.725	.000	.950	.833	.000	.959	.000	.000	.000	.000	.000	.968



Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Kapaa Bypass Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

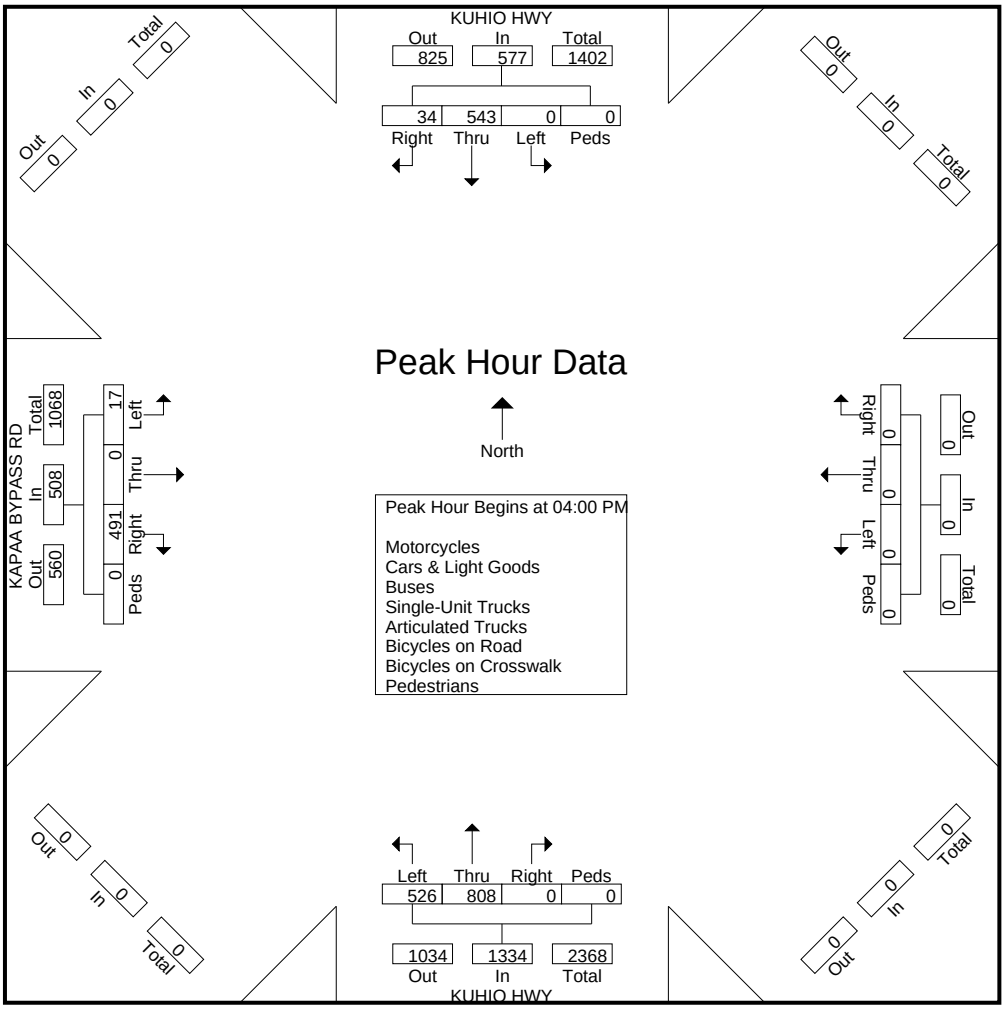
	KUHIO HWY Southbound				Westbound				KUHIO HWY Northbound				KAPAA BYPASS RD Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	0	143	6	0	0	0	0	0	97	193	0	0	3	0	134	0	576
03:15 PM	0	123	12	0	0	0	0	0	119	210	0	0	5	0	138	0	607
03:30 PM	0	118	18	0	0	0	0	0	132	169	0	0	3	0	115	0	555
03:45 PM	0	123	4	0	0	0	0	0	118	183	0	0	4	0	161	0	593
Total	0	507	40	0	0	0	0	0	466	755	0	0	15	0	548	0	2331
04:00 PM	0	138	9	0	0	0	0	0	136	204	0	0	2	0	122	0	611
04:15 PM	0	130	9	0	0	0	0	0	121	210	0	0	4	0	122	0	596
04:30 PM	0	138	14	0	0	0	0	0	139	206	0	0	7	0	129	0	633
04:45 PM	0	137	2	0	0	0	0	0	130	188	0	0	4	0	118	0	579
Total	0	543	34	0	0	0	0	0	526	808	0	0	17	0	491	0	2419
Grand Total	0	1050	74	0	0	0	0	0	992	1563	0	0	32	0	1039	0	4750
Apprch %	0	93.4	6.6	0	0	0	0	0	38.8	61.2	0	0	3	0	97	0	
Total %	0	22.1	1.6	0	0	0	0	0	20.9	32.9	0	0	0.7	0	21.9	0	
Motorcycles	0	1	0	0	0	0	0	0	0	5	0	0	0	0	5	0	11
% Motorcycles	0	0.1	0	0	0	0	0	0	0	0.3	0	0	0	0	0.5	0	0.2
Cars & Light Goods	0	1025	72	0	0	0	0	0	982	1536	0	0	32	0	1013	0	4660
% Cars & Light Goods	0	97.6	97.3	0	0	0	0	0	99	98.3	0	0	100	0	97.5	0	98.1
Buses	0	8	0	0	0	0	0	0	3	5	0	0	0	0	6	0	22
% Buses	0	0.8	0	0	0	0	0	0	0.3	0.3	0	0	0	0	0.6	0	0.5
Single-Unit Trucks	0	12	1	0	0	0	0	0	7	14	0	0	0	0	13	0	47
% Single-Unit Trucks	0	1.1	1.4	0	0	0	0	0	0.7	0.9	0	0	0	0	1.3	0	1
Articulated Trucks	0	3	1	0	0	0	0	0	0	3	0	0	0	0	2	0	9
% Articulated Trucks	0	0.3	1.4	0	0	0	0	0	0	0.2	0	0	0	0	0.2	0	0.2
Bicycles on Road	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Bicycles on Road	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Kapaa Bypass Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	KUHIO HWY Southbound					Westbound					KUHIO HWY Northbound					KAPAA BYPASS RD Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 04:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	0	138	9	0	147	0	0	0	0	0	136	204	0	0	340	2	0	122	0	124	611
04:15 PM	0	130	9	0	139	0	0	0	0	0	121	210	0	0	331	4	0	122	0	126	596
04:30 PM	0	138	14	0	152	0	0	0	0	0	139	206	0	0	345	7	0	129	0	136	633
04:45 PM	0	137	2	0	139	0	0	0	0	0	130	188	0	0	318	4	0	118	0	122	579
Total Volume	0	543	34	0	577	0	0	0	0	0	526	808	0	0	1334	17	0	491	0	508	2419
% App. Total	0	94.1	5.9	0		0	0	0	0		39.4	60.6	0	0		3.3	0	96.7	0		
PHF	.000	.984	.607	.000	.949	.000	.000	.000	.000	.000	.946	.962	.000	.000	.967	.607	.000	.952	.000	.934	.955



Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Lanikai St
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

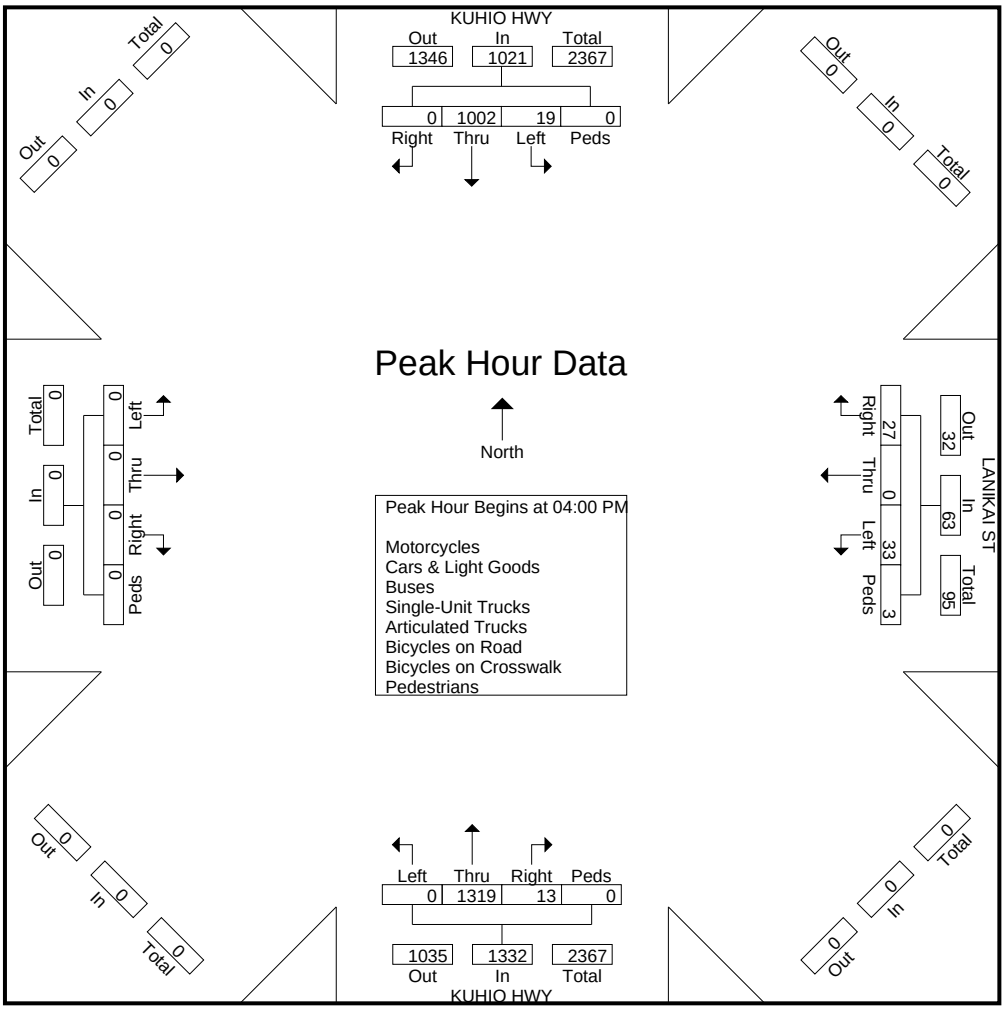
	KUHIO HWY Southbound				LANIKAI ST Westbound				KUHIO HWY Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	0	282	0	0	12	0	2	0	0	301	4	0	0	0	0	0	601
03:15 PM	1	260	0	0	10	0	4	0	0	322	1	0	0	0	0	0	598
03:30 PM	5	227	0	0	7	0	7	4	0	301	0	0	0	0	0	0	551
03:45 PM	10	269	0	0	6	0	7	3	0	309	1	0	0	0	0	0	605
Total	16	1038	0	0	35	0	20	7	0	1233	6	0	0	0	0	0	2355
04:00 PM	9	248	0	0	10	0	10	3	0	322	4	0	0	0	0	0	606
04:15 PM	4	241	0	0	10	0	2	0	0	326	4	0	0	0	0	0	587
04:30 PM	2	272	0	0	7	0	8	0	0	341	3	0	0	0	0	0	633
04:45 PM	4	241	0	0	6	0	7	0	0	330	2	0	0	0	0	0	590
Total	19	1002	0	0	33	0	27	3	0	1319	13	0	0	0	0	0	2416
Grand Total	35	2040	0	0	68	0	47	10	0	2552	19	0	0	0	0	0	4771
Apprch %	1.7	98.3	0	0	54.4	0	37.6	8	0	99.3	0.7	0	0	0	0	0	
Total %	0.7	42.8	0	0	1.4	0	1	0.2	0	53.5	0.4	0	0	0	0	0	
Motorcycles	1	4	0	0	0	0	0	0	0	5	0	0	0	0	0	0	10
% Motorcycles	2.9	0.2	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0.2
Cars & Light Goods	34	1985	0	0	67	0	47	0	0	2517	19	0	0	0	0	0	4669
% Cars & Light Goods	97.1	97.3	0	0	98.5	0	100	0	0	98.6	100	0	0	0	0	0	97.9
Buses	0	14	0	0	0	0	0	0	0	9	0	0	0	0	0	0	23
% Buses	0	0.7	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0.5
Single-Unit Trucks	0	31	0	0	1	0	0	0	0	18	0	0	0	0	0	0	50
% Single-Unit Trucks	0	1.5	0	0	1.5	0	0	0	0	0.7	0	0	0	0	0	0	1
Articulated Trucks	0	4	0	0	0	0	0	0	0	3	0	0	0	0	0	0	7
% Articulated Trucks	0	0.2	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0.1
Bicycles on Road	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
% Bicycles on Road	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	10
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0.2

Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Lanikai St
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	KUHIO HWY Southbound					LANIKAI ST Westbound					KUHIO HWY Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 04:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	9	248	0	0	257	10	0	10	3	23	0	322	4	0	326	0	0	0	0	0	606
04:15 PM	4	241	0	0	245	10	0	2	0	12	0	326	4	0	330	0	0	0	0	0	587
04:30 PM	2	272	0	0	274	7	0	8	0	15	0	341	3	0	344	0	0	0	0	0	633
04:45 PM	4	241	0	0	245	6	0	7	0	13	0	330	2	0	332	0	0	0	0	0	590
Total Volume	19	1002	0	0	1021	33	0	27	3	63	0	1319	13	0	1332	0	0	0	0	0	2416
% App. Total																					
PHF	.528	.921	.000	.000	.932	.825	.000	.675	.250	.685	.000	.967	.813	.000	.968	.000	.000	.000	.000	.000	.954



Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Kinipoo Shopping Village Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

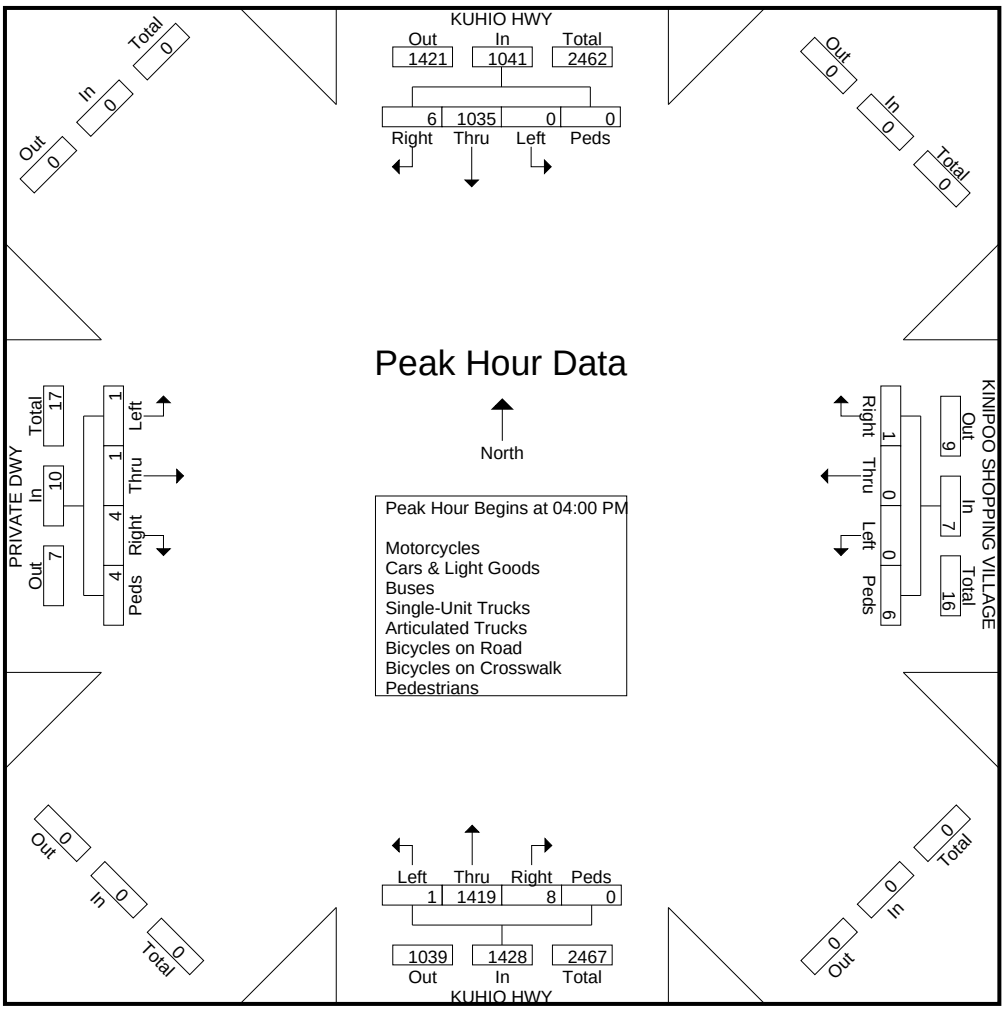
	KUHIO HWY Southbound				KINIPOO SHOPPING VILLAGE Westbound				KUHIO HWY Northbound				PRIVATE DWY Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	0	293	2	0	0	0	0	0	1	300	2	0	0	0	1	0	599
03:15 PM	0	260	2	0	0	0	0	2	0	329	0	0	0	0	2	6	601
03:30 PM	0	225	1	0	0	0	0	5	0	294	3	0	0	0	0	0	528
03:45 PM	1	263	7	0	0	0	0	2	0	316	1	0	0	1	0	0	591
Total	1	1041	12	0	0	0	0	9	1	1239	6	0	0	1	3	6	2319
04:00 PM	0	268	0	0	0	0	0	3	0	332	1	0	1	0	0	2	607
04:15 PM	0	249	1	0	0	0	1	1	0	339	2	0	0	0	1	2	596
04:30 PM	0	265	2	0	0	0	0	0	1	365	1	0	0	0	1	0	635
04:45 PM	0	253	3	0	0	0	0	2	0	383	4	0	0	1	2	0	648
Total	0	1035	6	0	0	0	1	6	1	1419	8	0	1	1	4	4	2486
Grand Total	1	2076	18	0	0	0	1	15	2	2658	14	0	1	2	7	10	4805
Apprch %	0	99.1	0.9	0	0	0	6.2	93.8	0.1	99.4	0.5	0	5	10	35	50	
Total %	0	43.2	0.4	0	0	0	0	0.3	0	55.3	0.3	0	0	0	0.1	0.2	
Motorcycles	0	5	0	0	0	0	0	0	0	5	0	0	0	0	0	0	10
% Motorcycles	0	0.2	0	0	0	0	0	0	0	0.2	0	0	0	0	0	0	0.2
Cars & Light Goods	1	2023	18	0	0	0	1	0	2	2622	12	0	1	2	7	0	4689
% Cars & Light Goods	100	97.4	100	0	0	0	100	0	100	98.6	85.7	0	100	100	100	0	97.6
Buses	0	14	0	0	0	0	0	0	0	10	1	0	0	0	0	0	25
% Buses	0	0.7	0	0	0	0	0	0	0	0.4	7.1	0	0	0	0	0	0.5
Single-Unit Trucks	0	28	0	0	0	0	0	0	0	18	0	0	0	0	0	0	46
% Single-Unit Trucks	0	1.3	0	0	0	0	0	0	0	0.7	0	0	0	0	0	0	1
Articulated Trucks	0	5	0	0	0	0	0	0	0	3	0	0	0	0	0	0	8
% Articulated Trucks	0	0.2	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0.2
Bicycles on Road	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	7.1	0	0	0	0	0	0
Bicycles on Crosswalk	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
% Bicycles on Crosswalk	0	0	0	0	0	0	0	6.7	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	10	24
% Pedestrians	0	0	0	0	0	0	0	93.3	0	0	0	0	0	0	0	100	0.5

Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Kinipoo Shopping Village Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	KUHIO HWY Southbound					KINIPOO SHOPPING VILLAGE Westbound					KUHIO HWY Northbound					PRIVATE DWY Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	0	268	0	0	268	0	0	0	3	3	0	332	1	0	333	1	0	0	2	3	607
04:15 PM	0	249	1	0	250	0	0	1	1	2	0	339	2	0	341	0	0	1	2	3	596
04:30 PM	0	265	2	0	267	0	0	0	0	0	1	365	1	0	367	0	0	1	0	1	635
04:45 PM	0	253	3	0	256	0	0	0	2	2	0	383	4	0	387	0	1	2	0	3	648
Total Volume	0	1035	6	0	1041	0	0	1	6	7	1	1419	8	0	1428	1	1	4	4	10	2486
% App. Total																					
PHF	.000	.965	.500	.000	.971	.000	.000	.250	.500	.583	.250	.926	.500	.000	.922	.250	.250	.500	.500	.833	.959



Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Haleilio Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KUHIO HWY Southbound				Westbound				KUHIO HWY Northbound				HALEILIO RD Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	0	262	30	0	0	0	0	0	24	290	0	2	14	0	26	2	650
03:15 PM	0	237	29	0	0	0	0	0	34	298	0	2	26	0	28	6	660
03:30 PM	0	208	21	0	0	0	0	0	47	275	0	7	23	0	24	2	607
03:45 PM	0	257	19	0	0	0	0	0	50	292	0	4	23	0	13	2	660
Total	0	964	99	0	0	0	0	0	155	1155	0	15	86	0	91	12	2577
04:00 PM	0	238	29	0	0	0	0	0	45	295	0	0	21	0	24	4	656
04:15 PM	0	216	32	0	0	0	0	0	44	301	0	3	28	0	24	2	650
04:30 PM	0	228	34	0	0	0	0	0	41	287	0	2	34	0	19	0	645
04:45 PM	0	226	33	0	0	0	0	0	41	296	0	0	29	0	23	1	649
Total	0	908	128	0	0	0	0	0	171	1179	0	5	112	0	90	7	2600
Grand Total	0	1872	227	0	0	0	0	0	326	2334	0	20	198	0	181	19	5177
Apprch %	0	89.2	10.8	0	0	0	0	0	12.2	87.1	0	0.7	49.7	0	45.5	4.8	
Total %	0	36.2	4.4	0	0	0	0	0	6.3	45.1	0	0.4	3.8	0	3.5	0.4	
Motorcycles	0	4	1	0	0	0	0	0	2	4	0	0	0	0	0	0	11
% Motorcycles	0	0.2	0.4	0	0	0	0	0	0.6	0.2	0	0	0	0	0	0	0.2
Cars & Light Goods	0	1826	222	0	0	0	0	0	320	2299	0	0	195	0	178	0	5040
% Cars & Light Goods	0	97.5	97.8	0	0	0	0	0	98.2	98.5	0	0	98.5	0	98.3	0	97.4
Buses	0	11	0	0	0	0	0	0	2	11	0	0	1	0	1	0	26
% Buses	0	0.6	0	0	0	0	0	0	0.6	0.5	0	0	0.5	0	0.6	0	0.5
Single-Unit Trucks	0	26	3	0	0	0	0	0	2	17	0	0	1	0	2	0	51
% Single-Unit Trucks	0	1.4	1.3	0	0	0	0	0	0.6	0.7	0	0	0.5	0	1.1	0	1
Articulated Trucks	0	5	0	0	0	0	0	0	0	3	0	0	0	0	0	0	8
% Articulated Trucks	0	0.3	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0.2
Bicycles on Road	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	2
% Bicycles on Road	0	0	0.4	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	4
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	5.3	0.1
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	18	35
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	85	0	0	0	94.7	0.7

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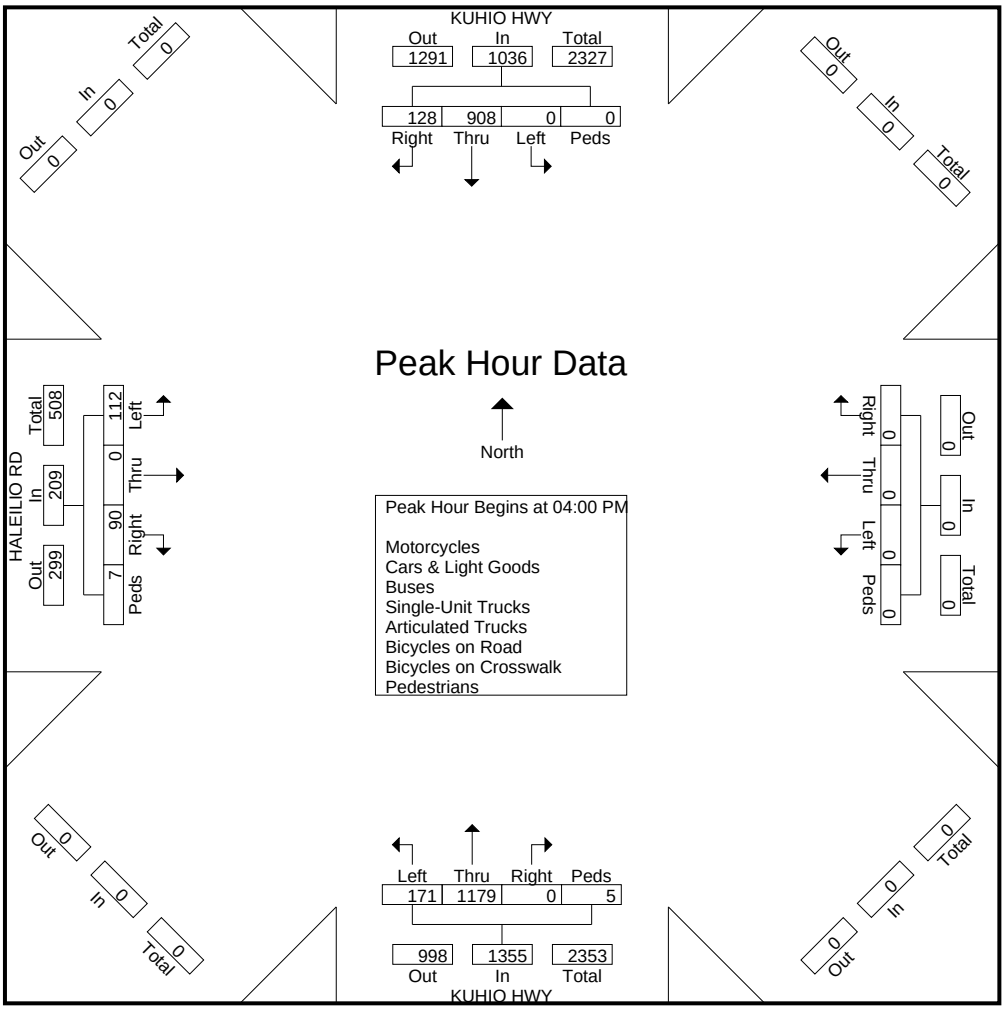
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Haleilio Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	KUHIO HWY Southbound					Westbound					KUHIO HWY Northbound					HALEILIO RD Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 04:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	0	238	29	0	267	0	0	0	0	0	45	295	0	0	340	21	0	24	4	49	656
04:15 PM	0	216	32	0	248	0	0	0	0	0	44	301	0	3	348	28	0	24	2	54	650
04:30 PM	0	228	34	0	262	0	0	0	0	0	41	287	0	2	330	34	0	19	0	53	645
04:45 PM	0	226	33	0	259	0	0	0	0	0	41	296	0	0	337	29	0	23	1	53	649
Total Volume	0	908	128	0	1036	0	0	0	0	0	171	1179	0	5	1355	112	0	90	7	209	2600
% App. Total																					
PHF	.000	.954	.941	.000	.970	.000	.000	.000	.000	.000	.950	.979	.000	.417	.973	.824	.000	.938	.438	.968	.991



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501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Papaloa Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	KUHIO HWY Southbound				PAPALOA RD Westbound				KUHIO HWY Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	0	299	0	0	0	0	1	0	0	310	19	0	0	0	0	0	629
03:15 PM	0	257	0	0	0	0	0	1	0	337	15	0	0	0	0	0	610
03:30 PM	0	233	0	0	0	0	1	0	0	328	24	0	0	0	0	0	586
03:45 PM	1	266	0	0	1	0	0	0	0	325	17	0	0	0	0	0	610
Total	1	1055	0	0	1	0	2	1	0	1300	75	0	0	0	0	0	2435
04:00 PM	0	263	0	0	0	0	1	0	0	340	20	0	0	0	0	0	624
04:15 PM	1	240	0	0	0	0	0	0	0	347	19	0	0	0	0	0	607
04:30 PM	0	242	0	0	0	0	0	2	0	355	26	0	0	0	0	0	625
04:45 PM	0	257	0	0	0	0	1	2	0	343	15	0	0	0	0	0	618
Total	1	1002	0	0	0	0	2	4	0	1385	80	0	0	0	0	0	2474
Grand Total	2	2057	0	0	1	0	4	5	0	2685	155	0	0	0	0	0	4909
Apprch %	0.1	99.9	0	0	10	0	40	50	0	94.5	5.5	0	0	0	0	0	
Total %	0	41.9	0	0	0	0	0.1	0.1	0	54.7	3.2	0	0	0	0	0	
Motorcycles	0	4	0	0	0	0	0	0	0	5	1	0	0	0	0	0	10
% Motorcycles	0	0.2	0	0	0	0	0	0	0	0.2	0.6	0	0	0	0	0	0.2
Cars & Light Goods	2	2006	0	0	1	0	4	0	0	2646	153	0	0	0	0	0	4812
% Cars & Light Goods	100	97.5	0	0	100	0	100	0	0	98.5	98.7	0	0	0	0	0	98
Buses	0	14	0	0	0	0	0	0	0	11	0	0	0	0	0	0	25
% Buses	0	0.7	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0.5
Single-Unit Trucks	0	27	0	0	0	0	0	0	0	18	1	0	0	0	0	0	46
% Single-Unit Trucks	0	1.3	0	0	0	0	0	0	0	0.7	0.6	0	0	0	0	0	0.9
Articulated Trucks	0	6	0	0	0	0	0	0	0	4	0	0	0	0	0	0	10
% Articulated Trucks	0	0.3	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0.2
Bicycles on Road	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrians	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	5
% Pedestrians	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0.1

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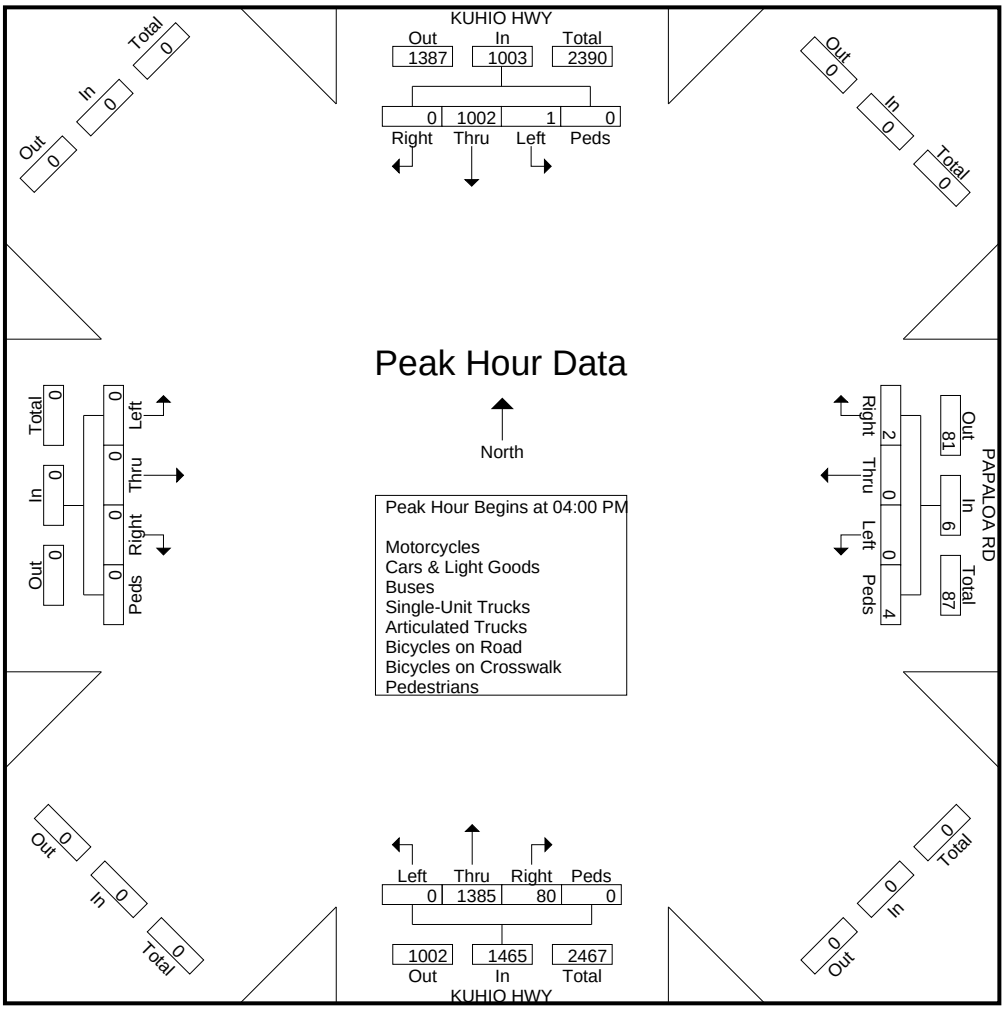
501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Papaloa Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	KUHIO HWY Southbound					PAPALOA RD Westbound					KUHIO HWY Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	0	263	0	0	263	0	0	1	0	1	0	340	20	0	360	0	0	0	0	0	624
04:15 PM	1	240	0	0	241	0	0	0	0	0	0	347	19	0	366	0	0	0	0	0	607
04:30 PM	0	242	0	0	242	0	0	0	2	2	0	355	26	0	381	0	0	0	0	0	625
04:45 PM	0	257	0	0	257	0	0	1	2	3	0	343	15	0	358	0	0	0	0	0	618
Total Volume	1	1002	0	0	1003	0	0	2	4	6	0	1385	80	0	1465	0	0	0	0	0	2474
% App. Total																					
PHF	.250	.952	.000	.000	.953	.000	.000	.500	.500	.500	.000	.975	.769	.000	.961	.000	.000	.000	.000	.000	.990



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501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Kuamoo Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

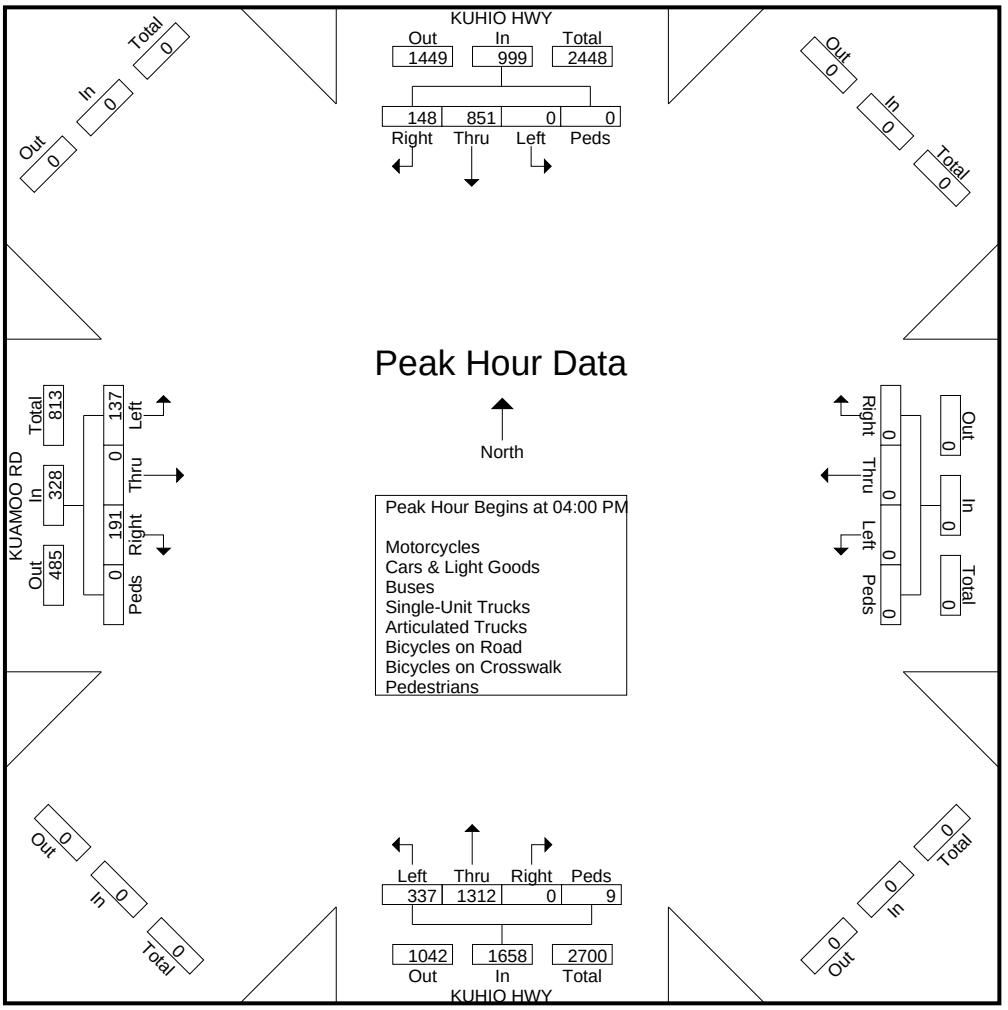
	KUHIO HWY Southbound				Westbound				KUHIO HWY Northbound				KUAMOO RD Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	0	246	43	0	0	0	0	0	72	291	0	0	31	0	44	0	727
03:15 PM	0	222	38	0	0	0	0	0	67	318	0	2	23	0	35	0	705
03:30 PM	0	211	25	0	0	0	0	0	74	313	0	0	38	0	36	0	697
03:45 PM	0	207	45	0	0	0	0	0	91	319	0	1	28	0	44	0	735
Total	0	886	151	0	0	0	0	0	304	1241	0	3	120	0	159	0	2864
04:00 PM	0	219	34	0	0	0	0	0	76	328	0	2	29	0	43	0	731
04:15 PM	0	191	33	0	0	0	0	0	93	320	0	4	38	0	53	0	732
04:30 PM	0	234	38	0	0	0	0	0	79	336	0	1	41	0	56	0	785
04:45 PM	0	207	43	0	0	0	0	0	89	328	0	2	29	0	39	0	737
Total	0	851	148	0	0	0	0	0	337	1312	0	9	137	0	191	0	2985
Grand Total	0	1737	299	0	0	0	0	0	641	2553	0	12	257	0	350	0	5849
Apprch %	0	85.3	14.7	0	0	0	0	0	20	79.6	0	0.4	42.3	0	57.7	0	
Total %	0	29.7	5.1	0	0	0	0	0	11	43.6	0	0.2	4.4	0	6	0	
Motorcycles	0	4	0	0	0	0	0	0	2	4	0	0	0	0	1	0	11
% Motorcycles	0	0.2	0	0	0	0	0	0	0.3	0.2	0	0	0	0	0.3	0	0.2
Cars & Light Goods	0	1691	296	0	0	0	0	0	635	2518	0	0	254	0	345	0	5739
% Cars & Light Goods	0	97.4	99	0	0	0	0	0	99.1	98.6	0	0	98.8	0	98.6	0	98.1
Buses	0	11	1	0	0	0	0	0	2	9	0	0	2	0	1	0	26
% Buses	0	0.6	0.3	0	0	0	0	0	0.3	0.4	0	0	0.8	0	0.3	0	0.4
Single-Unit Trucks	0	26	2	0	0	0	0	0	1	19	0	0	1	0	2	0	51
% Single-Unit Trucks	0	1.5	0.7	0	0	0	0	0	0.2	0.7	0	0	0.4	0	0.6	0	0.9
Articulated Trucks	0	5	0	0	0	0	0	0	1	3	0	0	0	0	0	0	9
% Articulated Trucks	0	0.3	0	0	0	0	0	0	0.2	0.1	0	0	0	0	0	0	0.2
Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
% Bicycles on Road	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0
Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	4
% Bicycles on Crosswalk	0	0	0	0	0	0	0	0	0	0	0	33.3	0	0	0	0	0.1
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	8
% Pedestrians	0	0	0	0	0	0	0	0	0	0	0	66.7	0	0	0	0	0.1

Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Kuhio Hwy - Kuamoo Rd
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	KUHIO HWY Southbound					Westbound					KUHIO HWY Northbound					KUAMOO RD Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	0	219	34	0	253	0	0	0	0	0	76	328	0	2	406	29	0	43	0	72	731
04:15 PM	0	191	33	0	224	0	0	0	0	0	93	320	0	4	417	38	0	53	0	91	732
04:30 PM	0	234	38	0	272	0	0	0	0	0	79	336	0	1	416	41	0	56	0	97	785
04:45 PM	0	207	43	0	250	0	0	0	0	0	89	328	0	2	419	29	0	39	0	68	737
Total Volume	0	851	148	0	999	0	0	0	0	0	337	1312	0	9	1658	137	0	191	0	328	2985
% App. Total																					
PHF	.000	.909	.860	.000	.918	.000	.000	.000	.000	.000	.906	.976	.000	.563	.989	.835	.000	.853	.000	.845	.951



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501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

File Name : Papaloa Rd - Lanikai St
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 1

Groups Printed- Motorcycles - Cars & Light Goods - Buses - Unit Trucks - Articulated Trucks - Bicycles on Road - Bicycles on Crosswalk - Pedestrians

	PAPALOA RD Southbound				Westbound				PAPALOA RD Northbound				LANIKAI ST Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
03:00 PM	0	6	9	0	0	0	0	0	5	13	0	0	2	0	0	0	35
03:15 PM	0	2	5	0	0	0	0	0	7	10	0	0	1	0	0	0	25
03:30 PM	0	3	11	0	0	0	0	0	2	14	0	0	3	0	1	0	34
03:45 PM	0	2	8	2	0	0	0	0	8	11	0	0	4	0	1	0	36
Total	0	13	33	2	0	0	0	0	22	48	0	0	10	0	2	0	130
04:00 PM	0	5	12	0	0	0	0	0	4	16	0	0	7	0	1	1	46
04:15 PM	0	3	9	1	0	0	0	0	8	14	0	0	2	0	3	0	40
04:30 PM	0	2	6	0	0	0	0	0	11	14	0	0	3	0	0	1	37
04:45 PM	0	4	5	1	0	0	0	0	6	14	0	0	1	0	3	1	35
Total	0	14	32	2	0	0	0	0	29	58	0	0	13	0	7	3	158
Grand Total	0	27	65	4	0	0	0	0	51	106	0	0	23	0	9	3	288
Apprch %	0	28.1	67.7	4.2	0	0	0	0	32.5	67.5	0	0	65.7	0	25.7	8.6	
Total %	0	9.4	22.6	1.4	0	0	0	0	17.7	36.8	0	0	8	0	3.1	1	
Motorcycles	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2
% Motorcycles	0	0	0	0	0	0	0	0	2	0	0	0	4.3	0	0	0	0.7
Cars & Light Goods	0	24	64	0	0	0	0	0	50	101	0	0	22	0	9	0	270
% Cars & Light Goods	0	88.9	98.5	0	0	0	0	0	98	95.3	0	0	95.7	0	100	0	93.8
Buses	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
% Buses	0	0	0	0	0	0	0	0	0	0.9	0	0	0	0	0	0	0.3
Single-Unit Trucks	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
% Single-Unit Trucks	0	0	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3
Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Articulated Trucks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles on Road	0	3	0	0	0	0	0	0	0	4	0	0	0	0	0	0	7
% Bicycles on Road	0	11.1	0	0	0	0	0	0	0	3.8	0	0	0	0	0	0	2.4
Bicycles on Crosswalk	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
% Bicycles on Crosswalk	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0.3
Pedestrians	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3	6
% Pedestrians	0	0	0	75	0	0	0	0	0	0	0	0	0	0	0	100	2.1

Austin Tsutsumi & Associates

501 Sumner St, Suite 521
Honolulu, Hawaii 96817
Phone: (808)533-3646 Fax: (808)526-1267

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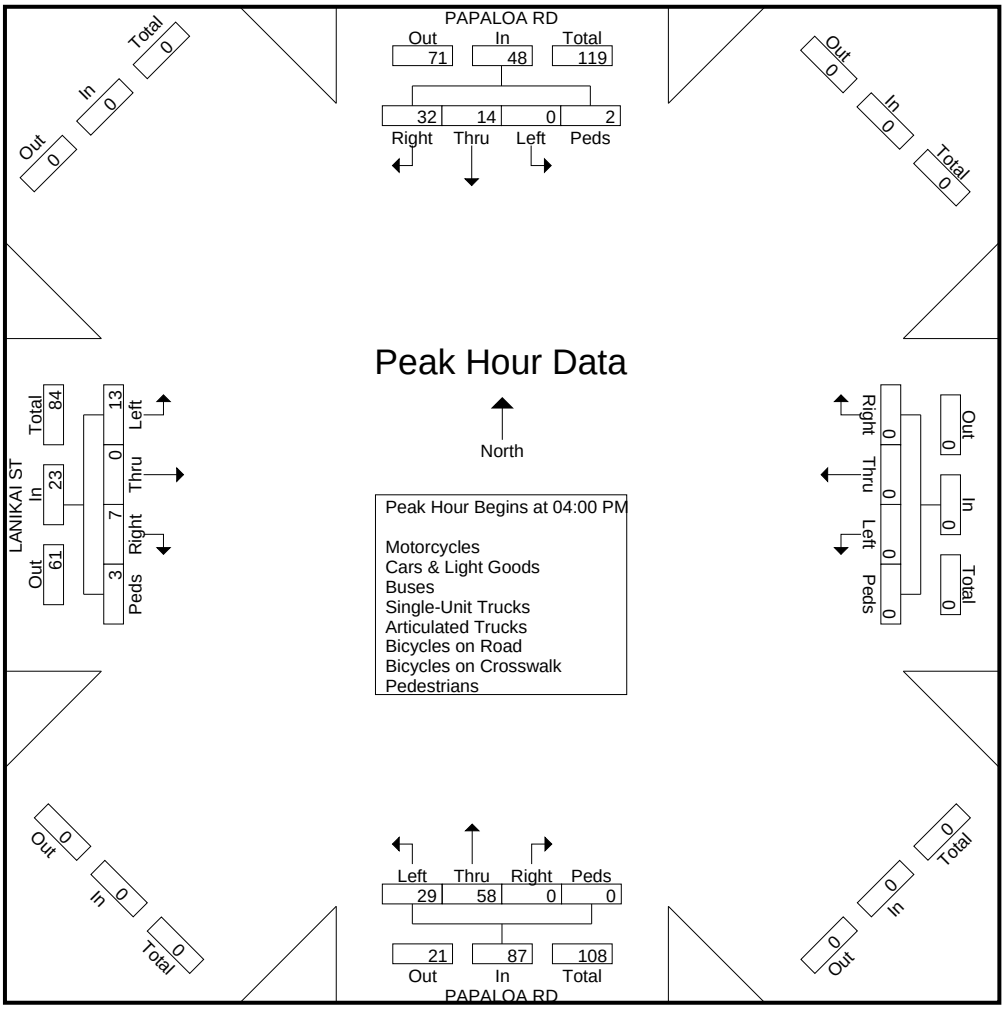
Site Code : 22-042.02 Kauai IDIQ Roundabout
Start Date : 9/12/2023
Page No : 2

	PAPALOA RD Southbound					Westbound					PAPALOA RD Northbound					LANIKAI ST Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 04:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	0	5	12	0	17	0	0	0	0	0	4	16	0	0	20	7	0	1	1	9	46
04:15 PM	0	3	9	1	13	0	0	0	0	0	8	14	0	0	22	2	0	3	0	5	40
04:30 PM	0	2	6	0	8	0	0	0	0	0	11	14	0	0	25	3	0	0	1	4	37
04:45 PM	0	4	5	1	10	0	0	0	0	0	6	14	0	0	20	1	0	3	1	5	35
Total Volume	0	14	32	2	48	0	0	0	0	0	29	58	0	0	87	13	0	7	3	23	158
% App. Total	0	29.2	66.7	4.2		0	0	0	0		33.3	66.7	0	0		56.5	0	30.4	13		
PHF	.000	.700	.667	.500	.706	.000	.000	.000	.000	.000	.659	.906	.000	.000	.870	.464	.000	.583	.750	.639	.859



APPENDIX B

VISSIM SIMULATION RESULTS

APPENDIX B

VISSIM SIMULATION RESULTS

- Existing Conditions

Existing AM - Travel Time Results

SimRun	TimeInt	VehicleTravelTimeMeasurement	Vehs(All)	TravTm(All)	DistTrav(All)
1	900-4500	1: Kuhio SB	531	180.695524	7551.947481
1	900-4500	2: Kuhio NB	358	165.295727	7587.922266
1	900-4500	3: Kapaa Bypass Rd SB	660	188.890185	7563.895414
1	900-4500	4: Kapaa Bypass Rd NB	95	173.911852	7646.553502
2	900-4500	1: Kuhio SB	489	181.677335	7551.947481
2	900-4500	2: Kuhio NB	371	166.196563	7587.922266
2	900-4500	3: Kapaa Bypass Rd SB	612	190.991328	7563.895414
2	900-4500	4: Kapaa Bypass Rd NB	88	174.658486	7646.553502
3	900-4500	1: Kuhio SB	505	180.304024	7551.947481
3	900-4500	2: Kuhio NB	377	166.277268	7587.922266
3	900-4500	3: Kapaa Bypass Rd SB	616	186.623381	7563.895414
3	900-4500	4: Kapaa Bypass Rd NB	82	172.313005	7646.553502
4	900-4500	1: Kuhio SB	507	180.330226	7551.947481
4	900-4500	2: Kuhio NB	393	164.12951	7587.922266
4	900-4500	3: Kapaa Bypass Rd SB	608	188.768405	7563.895414
4	900-4500	4: Kapaa Bypass Rd NB	79	171.119614	7646.553502
5	900-4500	1: Kuhio SB	523	177.288616	7551.947481
5	900-4500	2: Kuhio NB	387	167.315979	7587.922266
5	900-4500	3: Kapaa Bypass Rd SB	584	182.809762	7563.895414
5	900-4500	4: Kapaa Bypass Rd NB	101	175.48946	7646.553502
Avg	900-4500	1: Kuhio SB	511	180.059145	7551.947481
Avg	900-4500	2: Kuhio NB	377	165.843009	7587.922266
Avg	900-4500	3: Kapaa Bypass Rd SB	616	187.616612	7563.895414
Avg	900-4500	4: Kapaa Bypass Rd NB	89	173.498484	7646.553502
Standard deviation	900-4500	1: Kuhio SB	16	1.645661	0
Standard deviation	900-4500	2: Kuhio NB	14	1.195703	0
Standard deviation	900-4500	3: Kapaa Bypass Rd SB	28	3.099582	0
Standard deviation	900-4500	4: Kapaa Bypass Rd NB	9	1.770935	0
Minimum	900-4500	1: Kuhio SB	489	177.288616	7551.947481
Minimum	900-4500	2: Kuhio NB	358	164.12951	7587.922266
Minimum	900-4500	3: Kapaa Bypass Rd SB	584	182.809762	7563.895414
Minimum	900-4500	4: Kapaa Bypass Rd NB	79	171.119614	7646.553502
Maximum	900-4500	1: Kuhio SB	531	181.677335	7551.947481
Maximum	900-4500	2: Kuhio NB	393	167.315979	7587.922266
Maximum	900-4500	3: Kapaa Bypass Rd SB	660	190.991328	7563.895414
Maximum	900-4500	4: Kapaa Bypass Rd NB	101	175.48946	7646.553502
95% percentile	900-4500	1: Kuhio SB	531	181.677335	7551.947481
95% percentile	900-4500	2: Kuhio NB	393	167.315979	7587.922266
95% percentile	900-4500	3: Kapaa Bypass Rd SB	660	190.991328	7563.895414
95% percentile	900-4500	4: Kapaa Bypass Rd NB	101	175.48946	7646.553502

Existing AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
1	900-4500	1: Kuhio-Aleka N SBLT	0	0	0
1	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
1	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
1	900-4500	4: Kuhio-Aleka N NBRT	0.045849	45.393266	1
1	900-4500	5: Kuhio-Aleka N WBLT	0.00047	16.914194	1
1	900-4500	6: Kuhio-Aleka N WBRT	0.299139	52.760044	9
1	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
1	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
1	900-4500	9: Kuhio-Aleka S NBTH	0.054258	110.354862	1
1	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
1	900-4500	11: Kuhio-Aleka S WBLT	1.286256	63.463765	62
1	900-4500	12: Kuhio-Aleka S WBRT	0.160668	38.275774	29
1	900-4500	13: Kuhio-Papaloa N SBLT	0.050087	41.327855	1
1	900-4500	14: Kuhio-Papaloa N NBTH	0.131436	79.434527	2
1	900-4500	15: Kuhio-Papaloa N NBRT	0.141892	85.137709	2
1	900-4500	16: Kuhio-Papaloa N WBRT	0.083811	47.315113	2
1	900-4500	17: Kuhio-KBR SBTH	0	0	0
1	900-4500	18: Kuhio-KBR SBRT	0	0	0
1	900-4500	19: Kuhio-KBR NBLT	0.612337	107.416953	12
1	900-4500	20: Kuhio-KBR NBTH	0	0	0
1	900-4500	21: Kuhio-KBR EBLT	0.027013	47.307668	3
1	900-4500	22: Kuhio-KBR EBRT	0	0	0
1	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
1	900-4500	24: Kuhio-Lanikai NBTH	0.035434	40.664051	1
1	900-4500	25: Kuhio-Lanikai WBLT	1.302289	47.287996	33
1	900-4500	26: Kuhio-Lanikai WBRT	0.418526	49.446682	13
1	900-4500	27: Kuhio-Haleilio SBTH	47.858101	449.239482	519
1	900-4500	28: Kuhio-Haleilio NBLT	0.391054	45.083019	1
1	900-4500	29: Kuhio-Haleilio NBTH	4.615401	173.690307	78
1	900-4500	30: Kuhio-Haleilio EBLT	22.565449	242.213137	82
1	900-4500	31: Kuhio-Haleilio EBRT	4.297992	137.545341	36
1	900-4500	33: Kuhio-Papaloa S NBRT	0.040952	53.238484	1
1	900-4500	34: Kuhio-Papaloa S WBRT	0.58554	73.043064	8
1	900-4500	35: Kuhio-Kuamoo SBTH	98.196787	782.132576	743
1	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
1	900-4500	37: Kuhio-Kuamoo NBLT	6.230247	192.413544	50
1	900-4500	38: Kuhio-Kuamoo NBTH	11.063442	201.436169	165
1	900-4500	39: Kuhio-Kuamoo EBLT	40.111725	302.00396	96
1	900-4500	40: Kuhio-Kuamoo EBRT	142.688122	875.243843	567
2	900-4500	1: Kuhio-Aleka N SBLT	0.049954	34.147919	1
2	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
2	900-4500	3: Kuhio-Aleka N NBTH	0.035858	73.180404	2

Existing AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
2	900-4500	4: Kuhio-Aleka N NBRT	0.064026	79.814692	1
2	900-4500	5: Kuhio-Aleka N WBLT	0.133364	56.852209	6
2	900-4500	6: Kuhio-Aleka N WBRT	0.2615	50.650143	5
2	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
2	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
2	900-4500	9: Kuhio-Aleka S NBTH	0.142203	126.726277	0
2	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
2	900-4500	11: Kuhio-Aleka S WBLT	0.563816	62.453559	46
2	900-4500	12: Kuhio-Aleka S WBRT	0.107481	74.457904	42
2	900-4500	13: Kuhio-Papaloa N SBLT	0	0	0
2	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
2	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
2	900-4500	16: Kuhio-Papaloa N WBRT	0.064558	47.94571	2
2	900-4500	17: Kuhio-KBR SBTH	0	0	0
2	900-4500	18: Kuhio-KBR SBRT	0	0	0
2	900-4500	19: Kuhio-KBR NBLT	0.30801	33.086338	6
2	900-4500	20: Kuhio-KBR NBTH	0	0	0
2	900-4500	21: Kuhio-KBR EBLT	0.011857	32.205746	2
2	900-4500	22: Kuhio-KBR EBRT	0	0	0
2	900-4500	23: Kuhio-Lanikai SBTH	0.019407	43.123724	2
2	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
2	900-4500	25: Kuhio-Lanikai WBLT	1.218973	28.23987	42
2	900-4500	26: Kuhio-Lanikai WBRT	0.39125	43.571453	13
2	900-4500	27: Kuhio-Haleilio SBTH	52.598085	487.016542	549
2	900-4500	28: Kuhio-Haleilio NBLT	0.930758	48.578258	7
2	900-4500	29: Kuhio-Haleilio NBTH	4.244136	136.966771	82
2	900-4500	30: Kuhio-Haleilio EBLT	16.615511	176.592659	87
2	900-4500	31: Kuhio-Haleilio EBRT	4.499417	104.207707	35
2	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
2	900-4500	34: Kuhio-Papaloa S WBRT	0.559785	53.255615	7
2	900-4500	35: Kuhio-Kuamoo SBTH	93.643314	700.345755	733
2	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
2	900-4500	37: Kuhio-Kuamoo NBLT	6.47637	147.997768	45
2	900-4500	38: Kuhio-Kuamoo NBTH	14.421563	218.14639	190
2	900-4500	39: Kuhio-Kuamoo EBLT	40.496261	420.700796	111
2	900-4500	40: Kuhio-Kuamoo EBRT	172.63451	1146.903849	714
3	900-4500	1: Kuhio-Aleka N SBLT	0.412737	93.855256	2
3	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
3	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
3	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
3	900-4500	5: Kuhio-Aleka N WBLT	0.000435	15.653673	1
3	900-4500	6: Kuhio-Aleka N WBRT	0.138145	50.784188	5

Existing AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
3	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
3	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
3	900-4500	9: Kuhio-Aleka S NBTH	0.10063	123.841985	1
3	900-4500	10: Kuhio-Aleka S NBRT	0.057849	124.187903	0
3	900-4500	11: Kuhio-Aleka S WBLT	0.823379	84.530023	53
3	900-4500	12: Kuhio-Aleka S WBRT	0.113173	69.140489	29
3	900-4500	13: Kuhio-Papaloa N SBLT	0.064659	27.918238	1
3	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
3	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
3	900-4500	16: Kuhio-Papaloa N WBRT	0.449113	48.082992	5
3	900-4500	17: Kuhio-KBR SBTH	0	0	0
3	900-4500	18: Kuhio-KBR SBRT	0	0	0
3	900-4500	19: Kuhio-KBR NBLT	0.179535	48.266013	4
3	900-4500	20: Kuhio-KBR NBTH	0	0	0
3	900-4500	21: Kuhio-KBR EBLT	0.006419	55.461343	2
3	900-4500	22: Kuhio-KBR EBRT	0	0	0
3	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
3	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
3	900-4500	25: Kuhio-Lanikai WBLT	1.865088	47.62272	43
3	900-4500	26: Kuhio-Lanikai WBRT	0.176374	26.335892	5
3	900-4500	27: Kuhio-Haleilio SBTH	61.763509	436.586958	561
3	900-4500	28: Kuhio-Haleilio NBLT	2.579287	67.412767	14
3	900-4500	29: Kuhio-Haleilio NBTH	7.833899	313.247867	104
3	900-4500	30: Kuhio-Haleilio EBLT	19.071011	219.977689	92
3	900-4500	31: Kuhio-Haleilio EBRT	6.94208	129.860965	53
3	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
3	900-4500	34: Kuhio-Papaloa S WBRT	0.902823	73.807822	11
3	900-4500	35: Kuhio-Kuamoo SBTH	78.715276	782.773118	703
3	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
3	900-4500	37: Kuhio-Kuamoo NBLT	9.311166	232.567977	55
3	900-4500	38: Kuhio-Kuamoo NBTH	14.594964	195.847438	189
3	900-4500	39: Kuhio-Kuamoo EBLT	24.320041	158.531943	69
3	900-4500	40: Kuhio-Kuamoo EBRT	106.82915	720.289192	465
4	900-4500	1: Kuhio-Aleka N SBLT	0	0	0
4	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
4	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
4	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
4	900-4500	5: Kuhio-Aleka N WBLT	0.000429	15.456648	1
4	900-4500	6: Kuhio-Aleka N WBRT	0.20211	51.225927	7
4	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
4	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
4	900-4500	9: Kuhio-Aleka S NBTH	0.006862	83.074118	0

Existing AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
4	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
4	900-4500	11: Kuhio-Aleka S WBLT	1.318212	84.863736	66
4	900-4500	12: Kuhio-Aleka S WBRT	0.280642	40.8786	36
4	900-4500	13: Kuhio-Papaloa N SBLT	0	0	0
4	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
4	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
4	900-4500	16: Kuhio-Papaloa N WBRT	0.14818	49.250608	3
4	900-4500	17: Kuhio-KBR SBTH	0	0	0
4	900-4500	18: Kuhio-KBR SBRT	0	0	0
4	900-4500	19: Kuhio-KBR NBLT	1.058706	118.704435	7
4	900-4500	20: Kuhio-KBR NBTH	0	0	0
4	900-4500	21: Kuhio-KBR EBLT	0.004171	33.561554	3
4	900-4500	22: Kuhio-KBR EBRT	0	0	0
4	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
4	900-4500	24: Kuhio-Lanikai NBTH	0.056248	36.494505	1
4	900-4500	25: Kuhio-Lanikai WBLT	1.448046	66.486607	33
4	900-4500	26: Kuhio-Lanikai WBRT	0.375476	26.835902	12
4	900-4500	27: Kuhio-Haleilio SBTH	49.670951	491.718267	517
4	900-4500	28: Kuhio-Haleilio NBLT	0.84984	72.410454	8
4	900-4500	29: Kuhio-Haleilio NBTH	3.530358	153.403458	62
4	900-4500	30: Kuhio-Haleilio EBLT	19.486196	141.203286	78
4	900-4500	31: Kuhio-Haleilio EBRT	2.95304	104.773269	32
4	900-4500	33: Kuhio-Papaloa S NBRT	0.018807	38.057512	1
4	900-4500	34: Kuhio-Papaloa S WBRT	0.6206	52.189491	10
4	900-4500	35: Kuhio-Kuamoo SBTH	80.984621	849.690057	646
4	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
4	900-4500	37: Kuhio-Kuamoo NBLT	3.04364	73.856005	44
4	900-4500	38: Kuhio-Kuamoo NBTH	12.611856	175.403985	170
4	900-4500	39: Kuhio-Kuamoo EBLT	30.492156	204.589462	84
4	900-4500	40: Kuhio-Kuamoo EBRT	177.248118	1191.973265	659
5	900-4500	1: Kuhio-Aleka N SBLT	0.094512	34.58748	1
5	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
5	900-4500	3: Kuhio-Aleka N NBTH	0.132951	122.200421	2
5	900-4500	4: Kuhio-Aleka N NBRT	0.122732	128.698467	0
5	900-4500	5: Kuhio-Aleka N WBLT	0.09377	39.077324	3
5	900-4500	6: Kuhio-Aleka N WBRT	0.020188	50.905929	1
5	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
5	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
5	900-4500	9: Kuhio-Aleka S NBTH	0.18302	148.16599	1
5	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
5	900-4500	11: Kuhio-Aleka S WBLT	1.090497	105.985073	55
5	900-4500	12: Kuhio-Aleka S WBRT	0.380673	90.327467	34

Existing AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
5	900-4500	13: Kuhio-Papaloa N SBLT	0.040846	27.165555	1
5	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
5	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
5	900-4500	16: Kuhio-Papaloa N WBRT	0.176608	47.916402	4
5	900-4500	17: Kuhio-KBR SBTH	0	0	0
5	900-4500	18: Kuhio-KBR SBRT	0	0	0
5	900-4500	19: Kuhio-KBR NBLT	0.361354	51.063639	7
5	900-4500	20: Kuhio-KBR NBTH	0	0	0
5	900-4500	21: Kuhio-KBR EBLT	0.007881	55.383993	3
5	900-4500	22: Kuhio-KBR EBRT	0	0	0
5	900-4500	23: Kuhio-Lanikai SBTH	0.014145	40.718271	2
5	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
5	900-4500	25: Kuhio-Lanikai WBLT	1.049366	46.568182	28
5	900-4500	26: Kuhio-Lanikai WBRT	0.432779	47.606441	12
5	900-4500	27: Kuhio-Haleilio SBTH	38.250863	405.697435	425
5	900-4500	28: Kuhio-Haleilio NBLT	0.355746	53.977119	5
5	900-4500	29: Kuhio-Haleilio NBTH	4.95787	186.657578	97
5	900-4500	30: Kuhio-Haleilio EBLT	22.589759	209.249999	102
5	900-4500	31: Kuhio-Haleilio EBRT	3.676164	128.34299	36
5	900-4500	33: Kuhio-Papaloa S NBRT	0.207697	126.402115	4
5	900-4500	34: Kuhio-Papaloa S WBRT	0.835222	53.050419	13
5	900-4500	35: Kuhio-Kuamoo SBTH	67.939275	472.600277	620
5	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
5	900-4500	37: Kuhio-Kuamoo NBLT	7.234289	135.373705	54
5	900-4500	38: Kuhio-Kuamoo NBTH	17.526727	237.398024	224
5	900-4500	39: Kuhio-Kuamoo EBLT	25.930151	247.993217	83
5	900-4500	40: Kuhio-Kuamoo EBRT	132.115713	676.438837	611
Avg	900-4500	1: Kuhio-Aleka N SBLT	0.111441	32.518131	1
Avg	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Avg	900-4500	3: Kuhio-Aleka N NBTH	0.033762	39.076165	1
Avg	900-4500	4: Kuhio-Aleka N NBRT	0.046521	50.781285	0
Avg	900-4500	5: Kuhio-Aleka N WBLT	0.045694	28.790809	2
Avg	900-4500	6: Kuhio-Aleka N WBRT	0.184216	51.265246	5
Avg	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
Avg	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Avg	900-4500	9: Kuhio-Aleka S NBTH	0.097395	118.432646	1
Avg	900-4500	10: Kuhio-Aleka S NBRT	0.01157	24.837581	0
Avg	900-4500	11: Kuhio-Aleka S WBLT	1.016432	80.259231	56
Avg	900-4500	12: Kuhio-Aleka S WBRT	0.208527	62.616047	34
Avg	900-4500	13: Kuhio-Papaloa N SBLT	0.031118	19.28233	1
Avg	900-4500	14: Kuhio-Papaloa N NBTH	0.026287	15.886905	0
Avg	900-4500	15: Kuhio-Papaloa N NBRT	0.028378	17.027542	0

Existing AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Avg	900-4500	16: Kuhio-Papaloa N WBRT	0.184454	48.102165	3
Avg	900-4500	17: Kuhio-KBR SBTH	0	0	0
Avg	900-4500	18: Kuhio-KBR SBRT	0	0	0
Avg	900-4500	19: Kuhio-KBR NBLT	0.503989	71.707476	7
Avg	900-4500	20: Kuhio-KBR NBTH	0	0	0
Avg	900-4500	21: Kuhio-KBR EBLT	0.011468	44.784061	3
Avg	900-4500	22: Kuhio-KBR EBRT	0	0	0
Avg	900-4500	23: Kuhio-Lanikai SBTH	0.00671	16.768399	1
Avg	900-4500	24: Kuhio-Lanikai NBTH	0.018336	15.431711	0
Avg	900-4500	25: Kuhio-Lanikai WBLT	1.376752	47.241075	36
Avg	900-4500	26: Kuhio-Lanikai WBRT	0.358881	38.759274	11
Avg	900-4500	27: Kuhio-Haleilio SBTH	50.028302	454.051737	514
Avg	900-4500	28: Kuhio-Haleilio NBLT	1.021337	57.492323	7
Avg	900-4500	29: Kuhio-Haleilio NBTH	5.036333	192.793196	85
Avg	900-4500	30: Kuhio-Haleilio EBLT	20.065585	197.847354	88
Avg	900-4500	31: Kuhio-Haleilio EBRT	4.473738	120.946054	38
Avg	900-4500	33: Kuhio-Papaloa S NBRT	0.053491	43.539622	1
Avg	900-4500	34: Kuhio-Papaloa S WBRT	0.700794	61.069282	10
Avg	900-4500	35: Kuhio-Kuamoo SBTH	83.895855	717.508357	689
Avg	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Avg	900-4500	37: Kuhio-Kuamoo NBLT	6.459143	156.4418	50
Avg	900-4500	38: Kuhio-Kuamoo NBTH	14.043711	205.646401	188
Avg	900-4500	39: Kuhio-Kuamoo EBLT	32.270067	266.763876	89
Avg	900-4500	40: Kuhio-Kuamoo EBRT	146.303123	922.169797	603
Standard deviation	900-4500	1: Kuhio-Aleka N SBLT	0.172977	38.353745	1
Standard deviation	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Standard deviation	900-4500	3: Kuhio-Aleka N NBTH	0.057581	56.244069	1
Standard deviation	900-4500	4: Kuhio-Aleka N NBRT	0.051097	55.001215	1
Standard deviation	900-4500	5: Kuhio-Aleka N WBLT	0.063522	18.60573	2
Standard deviation	900-4500	6: Kuhio-Aleka N WBRT	0.110145	0.862387	3
Standard deviation	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
Standard deviation	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Standard deviation	900-4500	9: Kuhio-Aleka S NBTH	0.069654	23.966608	1
Standard deviation	900-4500	10: Kuhio-Aleka S NBRT	0.025871	55.538519	0
Standard deviation	900-4500	11: Kuhio-Aleka S WBLT	0.320739	18.030458	8
Standard deviation	900-4500	12: Kuhio-Aleka S WBRT	0.118773	22.448197	5
Standard deviation	900-4500	13: Kuhio-Papaloa N SBLT	0.029648	18.482058	1
Standard deviation	900-4500	14: Kuhio-Papaloa N NBTH	0.05878	35.524201	1
Standard deviation	900-4500	15: Kuhio-Papaloa N NBRT	0.063456	38.074741	1
Standard deviation	900-4500	16: Kuhio-Papaloa N WBRT	0.15486	0.706704	1
Standard deviation	900-4500	17: Kuhio-KBR SBTH	0	0	0
Standard deviation	900-4500	18: Kuhio-KBR SBRT	0	0	0

Existing AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Standard deviation	900-4500	19: Kuhio-KBR NBLT	0.347661	38.571827	3
Standard deviation	900-4500	20: Kuhio-KBR NBTH	0	0	0
Standard deviation	900-4500	21: Kuhio-KBR EBLT	0.00913	11.367609	1
Standard deviation	900-4500	22: Kuhio-KBR EBRT	0	0	0
Standard deviation	900-4500	23: Kuhio-Lanikai SBTH	0.009375	22.976821	1
Standard deviation	900-4500	24: Kuhio-Lanikai NBTH	0.026164	21.1821	1
Standard deviation	900-4500	25: Kuhio-Lanikai WBLT	0.308697	13.52809	6
Standard deviation	900-4500	26: Kuhio-Lanikai WBRT	0.104463	11.315447	3
Standard deviation	900-4500	27: Kuhio-Haleilio SBTH	8.483284	35.957477	53
Standard deviation	900-4500	28: Kuhio-Haleilio NBLT	0.908996	11.903507	5
Standard deviation	900-4500	29: Kuhio-Haleilio NBTH	1.651155	69.964339	17
Standard deviation	900-4500	30: Kuhio-Haleilio EBLT	2.542078	39.523434	9
Standard deviation	900-4500	31: Kuhio-Haleilio EBRT	1.506063	15.422855	8
Standard deviation	900-4500	33: Kuhio-Papaloa S NBRT	0.087838	51.917511	2
Standard deviation	900-4500	34: Kuhio-Papaloa S WBRT	0.156911	11.289908	2
Standard deviation	900-4500	35: Kuhio-Kuamoo SBTH	12.139355	146.784113	54
Standard deviation	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Standard deviation	900-4500	37: Kuhio-Kuamoo NBLT	2.261263	60.051522	5
Standard deviation	900-4500	38: Kuhio-Kuamoo NBTH	2.424369	23.413483	23
Standard deviation	900-4500	39: Kuhio-Kuamoo EBLT	7.676593	101.082374	16
Standard deviation	900-4500	40: Kuhio-Kuamoo EBRT	29.255256	238.034049	95
Minimum	900-4500	1: Kuhio-Aleka N SBLT	0	0	0
Minimum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Minimum	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
Minimum	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
Minimum	900-4500	5: Kuhio-Aleka N WBLT	0.000429	15.456648	1
Minimum	900-4500	6: Kuhio-Aleka N WBRT	0.020188	50.650143	1
Minimum	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
Minimum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Minimum	900-4500	9: Kuhio-Aleka S NBTH	0.006862	83.074118	0
Minimum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Minimum	900-4500	11: Kuhio-Aleka S WBLT	0.563816	62.453559	46
Minimum	900-4500	12: Kuhio-Aleka S WBRT	0.107481	38.275774	29
Minimum	900-4500	13: Kuhio-Papaloa N SBLT	0	0	0
Minimum	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
Minimum	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
Minimum	900-4500	16: Kuhio-Papaloa N WBRT	0.064558	47.315113	2
Minimum	900-4500	17: Kuhio-KBR SBTH	0	0	0
Minimum	900-4500	18: Kuhio-KBR SBRT	0	0	0
Minimum	900-4500	19: Kuhio-KBR NBLT	0.179535	33.086338	4
Minimum	900-4500	20: Kuhio-KBR NBTH	0	0	0
Minimum	900-4500	21: Kuhio-KBR EBLT	0.004171	32.205746	2

Existing AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Minimum	900-4500	22: Kuhio-KBR EBRT	0	0	0
Minimum	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
Minimum	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
Minimum	900-4500	25: Kuhio-Lanikai WBLT	1.049366	28.23987	28
Minimum	900-4500	26: Kuhio-Lanikai WBRT	0.176374	26.335892	5
Minimum	900-4500	27: Kuhio-Haleilio SBTH	38.250863	405.697435	425
Minimum	900-4500	28: Kuhio-Haleilio NBLT	0.355746	45.083019	1
Minimum	900-4500	29: Kuhio-Haleilio NBTH	3.530358	136.966771	62
Minimum	900-4500	30: Kuhio-Haleilio EBLT	16.615511	141.203286	78
Minimum	900-4500	31: Kuhio-Haleilio EBRT	2.95304	104.207707	32
Minimum	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
Minimum	900-4500	34: Kuhio-Papaloa S WBRT	0.559785	52.189491	7
Minimum	900-4500	35: Kuhio-Kuamoo SBTH	67.939275	472.600277	620
Minimum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Minimum	900-4500	37: Kuhio-Kuamoo NBLT	3.04364	73.856005	44
Minimum	900-4500	38: Kuhio-Kuamoo NBTH	11.063442	175.403985	165
Minimum	900-4500	39: Kuhio-Kuamoo EBLT	24.320041	158.531943	69
Minimum	900-4500	40: Kuhio-Kuamoo EBRT	106.82915	676.438837	465
Maximum	900-4500	1: Kuhio-Aleka N SBLT	0.412737	93.855256	2
Maximum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Maximum	900-4500	3: Kuhio-Aleka N NBTH	0.132951	122.200421	2
Maximum	900-4500	4: Kuhio-Aleka N NBRT	0.122732	128.698467	1
Maximum	900-4500	5: Kuhio-Aleka N WBLT	0.133364	56.852209	6
Maximum	900-4500	6: Kuhio-Aleka N WBRT	0.299139	52.760044	9
Maximum	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
Maximum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Maximum	900-4500	9: Kuhio-Aleka S NBTH	0.18302	148.16599	1
Maximum	900-4500	10: Kuhio-Aleka S NBRT	0.057849	124.187903	0
Maximum	900-4500	11: Kuhio-Aleka S WBLT	1.318212	105.985073	66
Maximum	900-4500	12: Kuhio-Aleka S WBRT	0.380673	90.327467	42
Maximum	900-4500	13: Kuhio-Papaloa N SBLT	0.064659	41.327855	1
Maximum	900-4500	14: Kuhio-Papaloa N NBTH	0.131436	79.434527	2
Maximum	900-4500	15: Kuhio-Papaloa N NBRT	0.141892	85.137709	2
Maximum	900-4500	16: Kuhio-Papaloa N WBRT	0.449113	49.250608	5
Maximum	900-4500	17: Kuhio-KBR SBTH	0	0	0
Maximum	900-4500	18: Kuhio-KBR SBRT	0	0	0
Maximum	900-4500	19: Kuhio-KBR NBLT	1.058706	118.704435	12
Maximum	900-4500	20: Kuhio-KBR NBTH	0	0	0
Maximum	900-4500	21: Kuhio-KBR EBLT	0.027013	55.461343	3
Maximum	900-4500	22: Kuhio-KBR EBRT	0	0	0
Maximum	900-4500	23: Kuhio-Lanikai SBTH	0.019407	43.123724	2
Maximum	900-4500	24: Kuhio-Lanikai NBTH	0.056248	40.664051	1

Existing AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Maximum	900-4500	25: Kuhio-Lanikai WBLT	1.865088	66.486607	43
Maximum	900-4500	26: Kuhio-Lanikai WBRT	0.432779	49.446682	13
Maximum	900-4500	27: Kuhio-Haleilio SBTH	61.763509	491.718267	561
Maximum	900-4500	28: Kuhio-Haleilio NBLT	2.579287	72.410454	14
Maximum	900-4500	29: Kuhio-Haleilio NBTH	7.833899	313.247867	104
Maximum	900-4500	30: Kuhio-Haleilio EBLT	22.589759	242.213137	102
Maximum	900-4500	31: Kuhio-Haleilio EBRT	6.94208	137.545341	53
Maximum	900-4500	33: Kuhio-Papaloa S NBRT	0.207697	126.402115	4
Maximum	900-4500	34: Kuhio-Papaloa S WBRT	0.902823	73.807822	13
Maximum	900-4500	35: Kuhio-Kuamoo SBTH	98.196787	849.690057	743
Maximum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Maximum	900-4500	37: Kuhio-Kuamoo NBLT	9.311166	232.567977	55
Maximum	900-4500	38: Kuhio-Kuamoo NBTH	17.526727	237.398024	224
Maximum	900-4500	39: Kuhio-Kuamoo EBLT	40.496261	420.700796	111
Maximum	900-4500	40: Kuhio-Kuamoo EBRT	177.248118	1191.973265	714
95% percentile	900-4500	1: Kuhio-Aleka N SBLT	0.412737	93.855256	2
95% percentile	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
95% percentile	900-4500	3: Kuhio-Aleka N NBTH	0.132951	122.200421	2
95% percentile	900-4500	4: Kuhio-Aleka N NBRT	0.122732	128.698467	1
95% percentile	900-4500	5: Kuhio-Aleka N WBLT	0.133364	56.852209	6
95% percentile	900-4500	6: Kuhio-Aleka N WBRT	0.299139	52.760044	9
95% percentile	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
95% percentile	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
95% percentile	900-4500	9: Kuhio-Aleka S NBTH	0.18302	148.16599	1
95% percentile	900-4500	10: Kuhio-Aleka S NBRT	0.057849	124.187903	0
95% percentile	900-4500	11: Kuhio-Aleka S WBLT	1.318212	105.985073	66
95% percentile	900-4500	12: Kuhio-Aleka S WBRT	0.380673	90.327467	42
95% percentile	900-4500	13: Kuhio-Papaloa N SBLT	0.064659	41.327855	1
95% percentile	900-4500	14: Kuhio-Papaloa N NBTH	0.131436	79.434527	2
95% percentile	900-4500	15: Kuhio-Papaloa N NBRT	0.141892	85.137709	2
95% percentile	900-4500	16: Kuhio-Papaloa N WBRT	0.449113	49.250608	5
95% percentile	900-4500	17: Kuhio-KBR SBTH	0	0	0
95% percentile	900-4500	18: Kuhio-KBR SBRT	0	0	0
95% percentile	900-4500	19: Kuhio-KBR NBLT	1.058706	118.704435	12
95% percentile	900-4500	20: Kuhio-KBR NBTH	0	0	0
95% percentile	900-4500	21: Kuhio-KBR EBLT	0.027013	55.461343	3
95% percentile	900-4500	22: Kuhio-KBR EBRT	0	0	0
95% percentile	900-4500	23: Kuhio-Lanikai SBTH	0.019407	43.123724	2
95% percentile	900-4500	24: Kuhio-Lanikai NBTH	0.056248	40.664051	1
95% percentile	900-4500	25: Kuhio-Lanikai WBLT	1.865088	66.486607	43
95% percentile	900-4500	26: Kuhio-Lanikai WBRT	0.432779	49.446682	13
95% percentile	900-4500	27: Kuhio-Haleilio SBTH	61.763509	491.718267	561

Existing AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
95% percentile	900-4500	28: Kuhio-Haleilio NBLT	2.579287	72.410454	14
95% percentile	900-4500	29: Kuhio-Haleilio NBTH	7.833899	313.247867	104
95% percentile	900-4500	30: Kuhio-Haleilio EBLT	22.589759	242.213137	102
95% percentile	900-4500	31: Kuhio-Haleilio EBRT	6.94208	137.545341	53
95% percentile	900-4500	33: Kuhio-Papaloa S NBRT	0.207697	126.402115	4
95% percentile	900-4500	34: Kuhio-Papaloa S WBRT	0.902823	73.807822	13
95% percentile	900-4500	35: Kuhio-Kuamoo SBTH	98.196787	849.690057	743
95% percentile	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
95% percentile	900-4500	37: Kuhio-Kuamoo NBLT	9.311166	232.567977	55
95% percentile	900-4500	38: Kuhio-Kuamoo NBTH	17.526727	237.398024	224
95% percentile	900-4500	39: Kuhio-Kuamoo EBLT	40.496261	420.700796	111
95% percentile	900-4500	40: Kuhio-Kuamoo EBRT	177.248118	1191.973265	714

Existing PM - Travel Time Results

SimRun	TimeInt	VehicleTravelTimeMeasurement	Vehs(All)	TravTm(All)	DistTrav(All)
1	900-4500	1: Kuhio SB	309	245.260454	7551.947481
1	900-4500	2: Kuhio NB	457	167.842973	7587.922266
1	900-4500	3: Kapaa Bypass Rd SB	399	219.555567	7563.895414
1	900-4500	4: Kapaa Bypass Rd NB	400	188.485919	7646.553502
2	900-4500	1: Kuhio SB	290	242.267438	7551.947481
2	900-4500	2: Kuhio NB	432	167.554236	7587.922266
2	900-4500	3: Kapaa Bypass Rd SB	369	216.948749	7563.895414
2	900-4500	4: Kapaa Bypass Rd NB	397	183.719711	7646.553502
3	900-4500	1: Kuhio SB	299	241.385746	7551.947481
3	900-4500	2: Kuhio NB	431	166.606748	7587.922266
3	900-4500	3: Kapaa Bypass Rd SB	344	218.829667	7563.895414
3	900-4500	4: Kapaa Bypass Rd NB	437	184.109729	7646.553502
4	900-4500	1: Kuhio SB	270	243.815245	7551.947481
4	900-4500	2: Kuhio NB	449	167.160866	7587.922266
4	900-4500	3: Kapaa Bypass Rd SB	357	216.645586	7563.895414
4	900-4500	4: Kapaa Bypass Rd NB	427	185.62073	7646.553502
5	900-4500	1: Kuhio SB	304	240.90114	7551.947481
5	900-4500	2: Kuhio NB	441	168.142554	7587.922266
5	900-4500	3: Kapaa Bypass Rd SB	368	214.011034	7563.895414
5	900-4500	4: Kapaa Bypass Rd NB	409	184.694257	7646.553502
Avg	900-4500	1: Kuhio SB	294	242.726005	7551.947481
Avg	900-4500	2: Kuhio NB	442	167.461475	7587.922266
Avg	900-4500	3: Kapaa Bypass Rd SB	367	217.198121	7563.895414
Avg	900-4500	4: Kapaa Bypass Rd NB	414	185.326069	7646.553502
Standard deviation	900-4500	1: Kuhio SB	15	1.799068	0
Standard deviation	900-4500	2: Kuhio NB	11	0.599779	0
Standard deviation	900-4500	3: Kapaa Bypass Rd SB	20	2.164746	0
Standard deviation	900-4500	4: Kapaa Bypass Rd NB	17	1.905947	0
Minimum	900-4500	1: Kuhio SB	270	240.90114	7551.947481
Minimum	900-4500	2: Kuhio NB	431	166.606748	7587.922266
Minimum	900-4500	3: Kapaa Bypass Rd SB	344	214.011034	7563.895414
Minimum	900-4500	4: Kapaa Bypass Rd NB	397	183.719711	7646.553502
Maximum	900-4500	1: Kuhio SB	309	245.260454	7551.947481
Maximum	900-4500	2: Kuhio NB	457	168.142554	7587.922266
Maximum	900-4500	3: Kapaa Bypass Rd SB	399	219.555567	7563.895414
Maximum	900-4500	4: Kapaa Bypass Rd NB	437	188.485919	7646.553502
95% percentile	900-4500	1: Kuhio SB	309	245.260454	7551.947481
95% percentile	900-4500	2: Kuhio NB	457	168.142554	7587.922266
95% percentile	900-4500	3: Kapaa Bypass Rd SB	399	219.555567	7563.895414
95% percentile	900-4500	4: Kapaa Bypass Rd NB	437	188.485919	7646.553502

Existing PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
1	900-4500	1: Kuhio-Aleka N SBLT	1.370574	90.950648	6
1	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
1	900-4500	3: Kuhio-Aleka N NBTH	0.008667	23.259712	1
1	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
1	900-4500	5: Kuhio-Aleka N WBLT	0.042401	35.023228	3
1	900-4500	6: Kuhio-Aleka N WBRT	0.675563	70.91449	21
1	900-4500	7: Kuhio-Aleka S SBLT	1.309288	112.609612	3
1	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
1	900-4500	9: Kuhio-Aleka S NBTH	0.024032	97.716523	0
1	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
1	900-4500	11: Kuhio-Aleka S WBLT	5.560653	107.860501	143
1	900-4500	12: Kuhio-Aleka S WBRT	1.060849	96.656773	49
1	900-4500	13: Kuhio-Papaloa N SBLT	0.247765	39.046315	2
1	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
1	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
1	900-4500	16: Kuhio-Papaloa N WBRT	0.184551	48.010812	3
1	900-4500	17: Kuhio-KBR SBTH	0	0	0
1	900-4500	18: Kuhio-KBR SBRT	0.206726	59.020447	3
1	900-4500	19: Kuhio-KBR NBLT	42.53788	607.031719	306
1	900-4500	20: Kuhio-KBR NBTH	0	0	0
1	900-4500	21: Kuhio-KBR EBLT	0.009662	47.270214	3
1	900-4500	22: Kuhio-KBR EBRT	0	0	0
1	900-4500	23: Kuhio-Lanikai SBTH	0.197716	113.124497	7
1	900-4500	24: Kuhio-Lanikai NBTH	1.841797	212.937929	22
1	900-4500	25: Kuhio-Lanikai WBLT	0.870024	47.372722	29
1	900-4500	26: Kuhio-Lanikai WBRT	1.479098	49.558107	33
1	900-4500	27: Kuhio-Haleilio SBTH	52.264074	519.812236	494
1	900-4500	28: Kuhio-Haleilio NBLT	5.25834	153.154656	36
1	900-4500	29: Kuhio-Haleilio NBTH	10.723877	361.213147	157
1	900-4500	30: Kuhio-Haleilio EBLT	22.839335	174.939084	70
1	900-4500	31: Kuhio-Haleilio EBRT	0.325524	92.003339	4
1	900-4500	33: Kuhio-Papaloa S NBRT	1.250608	221.403742	12
1	900-4500	34: Kuhio-Papaloa S WBRT	0	0	0
1	900-4500	35: Kuhio-Kuamoo SBTH	29.502164	527.119808	323
1	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
1	900-4500	37: Kuhio-Kuamoo NBLT	27.699157	362.395181	194
1	900-4500	38: Kuhio-Kuamoo NBTH	28.486128	732.539249	338
1	900-4500	39: Kuhio-Kuamoo EBLT	59.178123	501.641669	124
1	900-4500	40: Kuhio-Kuamoo EBRT	6.725389	167.915449	87
2	900-4500	1: Kuhio-Aleka N SBLT	0.528703	78.656455	5
2	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
2	900-4500	3: Kuhio-Aleka N NBTH	0.040202	74.057547	2

Existing PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
2	900-4500	4: Kuhio-Aleka N NBRT	0.017512	79.94845	0
2	900-4500	5: Kuhio-Aleka N WBLT	0.192519	56.970056	7
2	900-4500	6: Kuhio-Aleka N WBRT	0.552462	70.667972	14
2	900-4500	7: Kuhio-Aleka S SBLT	0.675416	78.911066	3
2	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
2	900-4500	9: Kuhio-Aleka S NBTH	0.109348	164.27654	0
2	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
2	900-4500	11: Kuhio-Aleka S WBLT	7.13966	216.163158	169
2	900-4500	12: Kuhio-Aleka S WBRT	0.75137	225.901943	51
2	900-4500	13: Kuhio-Papaloa N SBLT	0.030018	24.369717	1
2	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
2	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
2	900-4500	16: Kuhio-Papaloa N WBRT	0.240332	49.952497	8
2	900-4500	17: Kuhio-KBR SBTH	0	0	0
2	900-4500	18: Kuhio-KBR SBRT	0	0	0
2	900-4500	19: Kuhio-KBR NBLT	37.977483	471.566665	324
2	900-4500	20: Kuhio-KBR NBTH	0	0	0
2	900-4500	21: Kuhio-KBR EBLT	0.058663	54.490308	7
2	900-4500	22: Kuhio-KBR EBRT	0	0	0
2	900-4500	23: Kuhio-Lanikai SBTH	0.28177	84.44378	4
2	900-4500	24: Kuhio-Lanikai NBTH	0.438765	197.313878	9
2	900-4500	25: Kuhio-Lanikai WBLT	1.541114	49.420485	31
2	900-4500	26: Kuhio-Lanikai WBRT	1.984538	85.724271	34
2	900-4500	27: Kuhio-Haleilio SBTH	38.841236	325.943866	398
2	900-4500	28: Kuhio-Haleilio NBLT	5.156457	108.955429	51
2	900-4500	29: Kuhio-Haleilio NBTH	8.602945	196.474068	150
2	900-4500	30: Kuhio-Haleilio EBLT	20.706194	150.585649	66
2	900-4500	31: Kuhio-Haleilio EBRT	0.281889	63.000678	4
2	900-4500	33: Kuhio-Papaloa S NBRT	0.217185	121.826875	6
2	900-4500	34: Kuhio-Papaloa S WBRT	0.144117	51.041757	2
2	900-4500	35: Kuhio-Kuamoo SBTH	31.380796	364.666567	307
2	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
2	900-4500	37: Kuhio-Kuamoo NBLT	29.930992	369.417566	229
2	900-4500	38: Kuhio-Kuamoo NBTH	23.737434	525.304163	293
2	900-4500	39: Kuhio-Kuamoo EBLT	61.46105	397.268343	129
2	900-4500	40: Kuhio-Kuamoo EBRT	6.170895	196.96064	83
3	900-4500	1: Kuhio-Aleka N SBLT	0.382768	72.971934	5
3	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
3	900-4500	3: Kuhio-Aleka N NBTH	0.026672	76.635721	1
3	900-4500	4: Kuhio-Aleka N NBRT	0.010984	80.409985	0
3	900-4500	5: Kuhio-Aleka N WBLT	0	0	0
3	900-4500	6: Kuhio-Aleka N WBRT	0.575201	70.072557	12

Existing PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
3	900-4500	7: Kuhio-Aleka S SBLT	0.173472	41.123497	3
3	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
3	900-4500	9: Kuhio-Aleka S NBTH	0.096	145.693767	0
3	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
3	900-4500	11: Kuhio-Aleka S WBLT	3.137944	105.775914	131
3	900-4500	12: Kuhio-Aleka S WBRT	0.656914	80.843032	58
3	900-4500	13: Kuhio-Papaloa N SBLT	0.040111	27.232766	1
3	900-4500	14: Kuhio-Papaloa N NBTH	0.262031	155.422657	2
3	900-4500	15: Kuhio-Papaloa N NBRT	0.271344	161.125839	1
3	900-4500	16: Kuhio-Papaloa N WBRT	0.385411	69.425013	7
3	900-4500	17: Kuhio-KBR SBTH	0	0	0
3	900-4500	18: Kuhio-KBR SBRT	0.028129	30.230885	1
3	900-4500	19: Kuhio-KBR NBLT	30.930645	396.822241	243
3	900-4500	20: Kuhio-KBR NBTH	0	0	0
3	900-4500	21: Kuhio-KBR EBLT	0.134723	77.544018	8
3	900-4500	22: Kuhio-KBR EBRT	0	0	0
3	900-4500	23: Kuhio-Lanikai SBTH	0.353247	83.504645	7
3	900-4500	24: Kuhio-Lanikai NBTH	0.017262	28.123291	2
3	900-4500	25: Kuhio-Lanikai WBLT	0.988835	47.273028	39
3	900-4500	26: Kuhio-Lanikai WBRT	0.90467	46.123061	23
3	900-4500	27: Kuhio-Haleilio SBTH	40.23976	408.608804	428
3	900-4500	28: Kuhio-Haleilio NBLT	5.922352	118.385366	57
3	900-4500	29: Kuhio-Haleilio NBTH	10.290722	328.207247	176
3	900-4500	30: Kuhio-Haleilio EBLT	19.204351	143.132732	67
3	900-4500	31: Kuhio-Haleilio EBRT	1.249464	106.752437	10
3	900-4500	33: Kuhio-Papaloa S NBRT	0.187019	92.775853	3
3	900-4500	34: Kuhio-Papaloa S WBRT	0.04417	51.091239	1
3	900-4500	35: Kuhio-Kuamoo SBTH	28.135376	316.433505	282
3	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
3	900-4500	37: Kuhio-Kuamoo NBLT	33.372698	391.227372	250
3	900-4500	38: Kuhio-Kuamoo NBTH	22.980713	536.268765	281
3	900-4500	39: Kuhio-Kuamoo EBLT	67.802751	686.262127	120
3	900-4500	40: Kuhio-Kuamoo EBRT	4.040593	106.500132	79
4	900-4500	1: Kuhio-Aleka N SBLT	1.069645	80.143599	11
4	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
4	900-4500	3: Kuhio-Aleka N NBTH	0.031464	73.724258	1
4	900-4500	4: Kuhio-Aleka N NBRT	0.01991	81.037643	1
4	900-4500	5: Kuhio-Aleka N WBLT	0.211519	78.320436	7
4	900-4500	6: Kuhio-Aleka N WBRT	1.059559	95.695042	22
4	900-4500	7: Kuhio-Aleka S SBLT	0.015593	21.495019	1
4	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
4	900-4500	9: Kuhio-Aleka S NBTH	0.107234	131.342823	1

Existing PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
4	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
4	900-4500	11: Kuhio-Aleka S WBLT	6.726338	129.032171	161
4	900-4500	12: Kuhio-Aleka S WBRT	0.816984	106.134382	61
4	900-4500	13: Kuhio-Papaloa N SBLT	0.313912	39.707563	4
4	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
4	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
4	900-4500	16: Kuhio-Papaloa N WBRT	0.473728	67.559338	7
4	900-4500	17: Kuhio-KBR SBTH	0	0	0
4	900-4500	18: Kuhio-KBR SBRT	0.057452	30.223193	2
4	900-4500	19: Kuhio-KBR NBLT	34.17229	480.694031	284
4	900-4500	20: Kuhio-KBR NBTH	0	0	0
4	900-4500	21: Kuhio-KBR EBLT	0.335981	56.625135	5
4	900-4500	22: Kuhio-KBR EBRT	0	0	0
4	900-4500	23: Kuhio-Lanikai SBTH	0.082144	41.825882	3
4	900-4500	24: Kuhio-Lanikai NBTH	0.067118	65.949423	4
4	900-4500	25: Kuhio-Lanikai WBLT	1.20273	68.640614	40
4	900-4500	26: Kuhio-Lanikai WBRT	1.133647	44.465161	26
4	900-4500	27: Kuhio-Haleilio SBTH	45.500685	401.198078	458
4	900-4500	28: Kuhio-Haleilio NBLT	7.241767	167.001762	44
4	900-4500	29: Kuhio-Haleilio NBTH	11.61608	438.176887	190
4	900-4500	30: Kuhio-Haleilio EBLT	21.197175	137.978334	65
4	900-4500	31: Kuhio-Haleilio EBRT	0.488563	120.064789	5
4	900-4500	33: Kuhio-Papaloa S NBRT	2.000888	372.113962	9
4	900-4500	34: Kuhio-Papaloa S WBRT	0.477024	52.142494	4
4	900-4500	35: Kuhio-Kuamoo SBTH	23.936098	330.082974	272
4	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
4	900-4500	37: Kuhio-Kuamoo NBLT	22.036035	285.477477	182
4	900-4500	38: Kuhio-Kuamoo NBTH	21.247535	458.414577	299
4	900-4500	39: Kuhio-Kuamoo EBLT	54.685502	414.972495	127
4	900-4500	40: Kuhio-Kuamoo EBRT	12.372592	284.545603	117
5	900-4500	1: Kuhio-Aleka N SBLT	0.142398	32.515714	3
5	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
5	900-4500	3: Kuhio-Aleka N NBTH	0.167662	122.743923	4
5	900-4500	4: Kuhio-Aleka N NBRT	0.109612	128.032956	0
5	900-4500	5: Kuhio-Aleka N WBLT	0.271556	51.942433	7
5	900-4500	6: Kuhio-Aleka N WBRT	0.456231	53.404944	12
5	900-4500	7: Kuhio-Aleka S SBLT	0.037188	21.152652	1
5	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
5	900-4500	9: Kuhio-Aleka S NBTH	0.162354	158.930389	0
5	900-4500	10: Kuhio-Aleka S NBRT	0.077043	164.702863	0
5	900-4500	11: Kuhio-Aleka S WBLT	6.865951	214.902771	136
5	900-4500	12: Kuhio-Aleka S WBRT	2.597047	165.057057	71

Existing PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
5	900-4500	13: Kuhio-Papaloa N SBLT	0.183763	28.729313	2
5	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
5	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
5	900-4500	16: Kuhio-Papaloa N WBRT	0.119301	47.878732	3
5	900-4500	17: Kuhio-KBR SBTH	0	0	0
5	900-4500	18: Kuhio-KBR SBRT	0.064011	31.071367	1
5	900-4500	19: Kuhio-KBR NBLT	40.778454	615.607044	290
5	900-4500	20: Kuhio-KBR NBTH	0	0	0
5	900-4500	21: Kuhio-KBR EBLT	0.095823	55.347801	7
5	900-4500	22: Kuhio-KBR EBRT	0	0	0
5	900-4500	23: Kuhio-Lanikai SBTH	0.454641	150.199413	6
5	900-4500	24: Kuhio-Lanikai NBTH	0.177041	91.118248	5
5	900-4500	25: Kuhio-Lanikai WBLT	2.215342	71.28707	38
5	900-4500	26: Kuhio-Lanikai WBRT	1.036755	48.504019	27
5	900-4500	27: Kuhio-Haleilio SBTH	39.144943	453.155845	400
5	900-4500	28: Kuhio-Haleilio NBLT	3.840765	117.779909	49
5	900-4500	29: Kuhio-Haleilio NBTH	9.885452	353.887491	169
5	900-4500	30: Kuhio-Haleilio EBLT	15.937006	233.043451	53
5	900-4500	31: Kuhio-Haleilio EBRT	0.384201	60.656751	5
5	900-4500	33: Kuhio-Papaloa S NBRT	0.647196	186.835772	10
5	900-4500	34: Kuhio-Papaloa S WBRT	0.109361	51.794258	1
5	900-4500	35: Kuhio-Kuamoo SBTH	23.507363	304.367008	239
5	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
5	900-4500	37: Kuhio-Kuamoo NBLT	22.621161	224.939188	168
5	900-4500	38: Kuhio-Kuamoo NBTH	34.252976	732.242927	348
5	900-4500	39: Kuhio-Kuamoo EBLT	61.063754	457.140067	121
5	900-4500	40: Kuhio-Kuamoo EBRT	12.965972	276.987685	119
Avg	900-4500	1: Kuhio-Aleka N SBLT	0.698818	71.04767	6
Avg	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Avg	900-4500	3: Kuhio-Aleka N NBTH	0.054933	74.084232	2
Avg	900-4500	4: Kuhio-Aleka N NBRT	0.031604	73.885807	0
Avg	900-4500	5: Kuhio-Aleka N WBLT	0.143599	44.451231	5
Avg	900-4500	6: Kuhio-Aleka N WBRT	0.663803	72.151001	16
Avg	900-4500	7: Kuhio-Aleka S SBLT	0.442191	55.058369	2
Avg	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Avg	900-4500	9: Kuhio-Aleka S NBTH	0.099794	139.592008	0
Avg	900-4500	10: Kuhio-Aleka S NBRT	0.015409	32.940573	0
Avg	900-4500	11: Kuhio-Aleka S WBLT	5.886109	154.746903	148
Avg	900-4500	12: Kuhio-Aleka S WBRT	1.176633	134.918637	58
Avg	900-4500	13: Kuhio-Papaloa N SBLT	0.163114	31.817135	2
Avg	900-4500	14: Kuhio-Papaloa N NBTH	0.052406	31.084531	0
Avg	900-4500	15: Kuhio-Papaloa N NBRT	0.054269	32.225168	0

Existing PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Avg	900-4500	16: Kuhio-Papaloa N WBRT	0.280665	56.565278	6
Avg	900-4500	17: Kuhio-KBR SBTH	0	0	0
Avg	900-4500	18: Kuhio-KBR SBRT	0.071264	30.109179	1
Avg	900-4500	19: Kuhio-KBR NBLT	37.279351	514.34434	289
Avg	900-4500	20: Kuhio-KBR NBTH	0	0	0
Avg	900-4500	21: Kuhio-KBR EBLT	0.12697	58.255495	6
Avg	900-4500	22: Kuhio-KBR EBRT	0	0	0
Avg	900-4500	23: Kuhio-Lanikai SBTH	0.273904	94.619643	5
Avg	900-4500	24: Kuhio-Lanikai NBTH	0.508397	119.088554	8
Avg	900-4500	25: Kuhio-Lanikai WBLT	1.363609	56.798784	35
Avg	900-4500	26: Kuhio-Lanikai WBRT	1.307742	54.874924	29
Avg	900-4500	27: Kuhio-Haleilio SBTH	43.19814	421.743766	436
Avg	900-4500	28: Kuhio-Haleilio NBLT	5.483936	133.055425	47
Avg	900-4500	29: Kuhio-Haleilio NBTH	10.223815	335.591768	168
Avg	900-4500	30: Kuhio-Haleilio EBLT	19.976812	167.93585	64
Avg	900-4500	31: Kuhio-Haleilio EBRT	0.545928	88.495599	6
Avg	900-4500	33: Kuhio-Papaloa S NBRT	0.860579	198.991241	8
Avg	900-4500	34: Kuhio-Papaloa S WBRT	0.154934	41.213949	2
Avg	900-4500	35: Kuhio-Kuamoo SBTH	27.292359	368.533972	285
Avg	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Avg	900-4500	37: Kuhio-Kuamoo NBLT	27.132009	326.691357	205
Avg	900-4500	38: Kuhio-Kuamoo NBTH	26.140957	596.953936	312
Avg	900-4500	39: Kuhio-Kuamoo EBLT	60.838236	491.45694	124
Avg	900-4500	40: Kuhio-Kuamoo EBRT	8.455088	206.581902	97
Standard deviation	900-4500	1: Kuhio-Aleka N SBLT	0.506754	22.500958	3
Standard deviation	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Standard deviation	900-4500	3: Kuhio-Aleka N NBTH	0.06406	35.204892	1
Standard deviation	900-4500	4: Kuhio-Aleka N NBRT	0.044285	46.155973	0
Standard deviation	900-4500	5: Kuhio-Aleka N WBLT	0.116448	29.26073	3
Standard deviation	900-4500	6: Kuhio-Aleka N WBRT	0.234571	15.114437	5
Standard deviation	900-4500	7: Kuhio-Aleka S SBLT	0.55328	39.847753	1
Standard deviation	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Standard deviation	900-4500	9: Kuhio-Aleka S NBTH	0.049535	26.655843	0
Standard deviation	900-4500	10: Kuhio-Aleka S NBRT	0.034455	73.65736	0
Standard deviation	900-4500	11: Kuhio-Aleka S WBLT	1.650439	56.232608	16
Standard deviation	900-4500	12: Kuhio-Aleka S WBRT	0.807974	60.006168	9
Standard deviation	900-4500	13: Kuhio-Papaloa N SBLT	0.125675	7.080519	1
Standard deviation	900-4500	14: Kuhio-Papaloa N NBTH	0.117184	69.507125	1
Standard deviation	900-4500	15: Kuhio-Papaloa N NBRT	0.121349	72.057666	0
Standard deviation	900-4500	16: Kuhio-Papaloa N WBRT	0.145901	10.938533	2
Standard deviation	900-4500	17: Kuhio-KBR SBTH	0	0	0
Standard deviation	900-4500	18: Kuhio-KBR SBRT	0.079894	20.876887	1

Existing PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Standard deviation	900-4500	19: Kuhio-KBR NBLT	4.75245	94.364721	30
Standard deviation	900-4500	20: Kuhio-KBR NBTH	0	0	0
Standard deviation	900-4500	21: Kuhio-KBR EBLT	0.125641	11.379948	2
Standard deviation	900-4500	22: Kuhio-KBR EBRT	0	0	0
Standard deviation	900-4500	23: Kuhio-Lanikai SBTH	0.142828	40.14291	2
Standard deviation	900-4500	24: Kuhio-Lanikai NBTH	0.762978	81.865272	8
Standard deviation	900-4500	25: Kuhio-Lanikai WBLT	0.540121	12.084798	5
Standard deviation	900-4500	26: Kuhio-Lanikai WBRT	0.434058	17.360137	5
Standard deviation	900-4500	27: Kuhio-Haleilio SBTH	5.73707	71.372994	41
Standard deviation	900-4500	28: Kuhio-Haleilio NBLT	1.238984	25.424863	8
Standard deviation	900-4500	29: Kuhio-Haleilio NBTH	1.110703	87.924912	16
Standard deviation	900-4500	30: Kuhio-Haleilio EBLT	2.604422	39.05676	7
Standard deviation	900-4500	31: Kuhio-Haleilio EBRT	0.400844	26.302198	3
Standard deviation	900-4500	33: Kuhio-Papaloa S NBRT	0.769025	109.3819	4
Standard deviation	900-4500	34: Kuhio-Papaloa S WBRT	0.188553	23.044046	2
Standard deviation	900-4500	35: Kuhio-Kuamoo SBTH	3.460488	91.480546	32
Standard deviation	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Standard deviation	900-4500	37: Kuhio-Kuamoo NBLT	4.832671	69.493304	34
Standard deviation	900-4500	38: Kuhio-Kuamoo NBTH	5.268167	127.177064	29
Standard deviation	900-4500	39: Kuhio-Kuamoo EBLT	4.731684	116.137633	4
Standard deviation	900-4500	40: Kuhio-Kuamoo EBRT	3.980957	75.23187	19
Minimum	900-4500	1: Kuhio-Aleka N SBLT	0.142398	32.515714	3
Minimum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Minimum	900-4500	3: Kuhio-Aleka N NBTH	0.008667	23.259712	1
Minimum	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
Minimum	900-4500	5: Kuhio-Aleka N WBLT	0	0	0
Minimum	900-4500	6: Kuhio-Aleka N WBRT	0.456231	53.404944	12
Minimum	900-4500	7: Kuhio-Aleka S SBLT	0.015593	21.152652	1
Minimum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Minimum	900-4500	9: Kuhio-Aleka S NBTH	0.024032	97.716523	0
Minimum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Minimum	900-4500	11: Kuhio-Aleka S WBLT	3.137944	105.775914	131
Minimum	900-4500	12: Kuhio-Aleka S WBRT	0.656914	80.843032	49
Minimum	900-4500	13: Kuhio-Papaloa N SBLT	0.030018	24.369717	1
Minimum	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
Minimum	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
Minimum	900-4500	16: Kuhio-Papaloa N WBRT	0.119301	47.878732	3
Minimum	900-4500	17: Kuhio-KBR SBTH	0	0	0
Minimum	900-4500	18: Kuhio-KBR SBRT	0	0	0
Minimum	900-4500	19: Kuhio-KBR NBLT	30.930645	396.822241	243
Minimum	900-4500	20: Kuhio-KBR NBTH	0	0	0
Minimum	900-4500	21: Kuhio-KBR EBLT	0.009662	47.270214	3

Existing PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Minimum	900-4500	22: Kuhio-KBR EBRT	0	0	0
Minimum	900-4500	23: Kuhio-Lanikai SBTH	0.082144	41.825882	3
Minimum	900-4500	24: Kuhio-Lanikai NBTH	0.017262	28.123291	2
Minimum	900-4500	25: Kuhio-Lanikai WBLT	0.870024	47.273028	29
Minimum	900-4500	26: Kuhio-Lanikai WBRT	0.90467	44.465161	23
Minimum	900-4500	27: Kuhio-Haleilio SBTH	38.841236	325.943866	398
Minimum	900-4500	28: Kuhio-Haleilio NBLT	3.840765	108.955429	36
Minimum	900-4500	29: Kuhio-Haleilio NBTH	8.602945	196.474068	150
Minimum	900-4500	30: Kuhio-Haleilio EBLT	15.937006	137.978334	53
Minimum	900-4500	31: Kuhio-Haleilio EBRT	0.281889	60.656751	4
Minimum	900-4500	33: Kuhio-Papaloa S NBRT	0.187019	92.775853	3
Minimum	900-4500	34: Kuhio-Papaloa S WBRT	0	0	0
Minimum	900-4500	35: Kuhio-Kuamoo SBTH	23.507363	304.367008	239
Minimum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Minimum	900-4500	37: Kuhio-Kuamoo NBLT	22.036035	224.939188	168
Minimum	900-4500	38: Kuhio-Kuamoo NBTH	21.247535	458.414577	281
Minimum	900-4500	39: Kuhio-Kuamoo EBLT	54.685502	397.268343	120
Minimum	900-4500	40: Kuhio-Kuamoo EBRT	4.040593	106.500132	79
Maximum	900-4500	1: Kuhio-Aleka N SBLT	1.370574	90.950648	11
Maximum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Maximum	900-4500	3: Kuhio-Aleka N NBTH	0.167662	122.743923	4
Maximum	900-4500	4: Kuhio-Aleka N NBRT	0.109612	128.032956	1
Maximum	900-4500	5: Kuhio-Aleka N WBLT	0.271556	78.320436	7
Maximum	900-4500	6: Kuhio-Aleka N WBRT	1.059559	95.695042	22
Maximum	900-4500	7: Kuhio-Aleka S SBLT	1.309288	112.609612	3
Maximum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Maximum	900-4500	9: Kuhio-Aleka S NBTH	0.162354	164.27654	1
Maximum	900-4500	10: Kuhio-Aleka S NBRT	0.077043	164.702863	0
Maximum	900-4500	11: Kuhio-Aleka S WBLT	7.13966	216.163158	169
Maximum	900-4500	12: Kuhio-Aleka S WBRT	2.597047	225.901943	71
Maximum	900-4500	13: Kuhio-Papaloa N SBLT	0.313912	39.707563	4
Maximum	900-4500	14: Kuhio-Papaloa N NBTH	0.262031	155.422657	2
Maximum	900-4500	15: Kuhio-Papaloa N NBRT	0.271344	161.125839	1
Maximum	900-4500	16: Kuhio-Papaloa N WBRT	0.473728	69.425013	8
Maximum	900-4500	17: Kuhio-KBR SBTH	0	0	0
Maximum	900-4500	18: Kuhio-KBR SBRT	0.206726	59.020447	3
Maximum	900-4500	19: Kuhio-KBR NBLT	42.53788	615.607044	324
Maximum	900-4500	20: Kuhio-KBR NBTH	0	0	0
Maximum	900-4500	21: Kuhio-KBR EBLT	0.335981	77.544018	8
Maximum	900-4500	22: Kuhio-KBR EBRT	0	0	0
Maximum	900-4500	23: Kuhio-Lanikai SBTH	0.454641	150.199413	7
Maximum	900-4500	24: Kuhio-Lanikai NBTH	1.841797	212.937929	22

Existing PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Maximum	900-4500	25: Kuhio-Lanikai WBLT	2.215342	71.28707	40
Maximum	900-4500	26: Kuhio-Lanikai WBRT	1.984538	85.724271	34
Maximum	900-4500	27: Kuhio-Haleilio SBTH	52.264074	519.812236	494
Maximum	900-4500	28: Kuhio-Haleilio NBLT	7.241767	167.001762	57
Maximum	900-4500	29: Kuhio-Haleilio NBTH	11.61608	438.176887	190
Maximum	900-4500	30: Kuhio-Haleilio EBLT	22.839335	233.043451	70
Maximum	900-4500	31: Kuhio-Haleilio EBRT	1.249464	120.064789	10
Maximum	900-4500	33: Kuhio-Papaloa S NBRT	2.000888	372.113962	12
Maximum	900-4500	34: Kuhio-Papaloa S WBRT	0.477024	52.142494	4
Maximum	900-4500	35: Kuhio-Kuamoo SBTH	31.380796	527.119808	323
Maximum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Maximum	900-4500	37: Kuhio-Kuamoo NBLT	33.372698	391.227372	250
Maximum	900-4500	38: Kuhio-Kuamoo NBTH	34.252976	732.539249	348
Maximum	900-4500	39: Kuhio-Kuamoo EBLT	67.802751	686.262127	129
Maximum	900-4500	40: Kuhio-Kuamoo EBRT	12.965972	284.545603	119
95% percentile	900-4500	1: Kuhio-Aleka N SBLT	1.370574	90.950648	11
95% percentile	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
95% percentile	900-4500	3: Kuhio-Aleka N NBTH	0.167662	122.743923	4
95% percentile	900-4500	4: Kuhio-Aleka N NBRT	0.109612	128.032956	1
95% percentile	900-4500	5: Kuhio-Aleka N WBLT	0.271556	78.320436	7
95% percentile	900-4500	6: Kuhio-Aleka N WBRT	1.059559	95.695042	22
95% percentile	900-4500	7: Kuhio-Aleka S SBLT	1.309288	112.609612	3
95% percentile	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
95% percentile	900-4500	9: Kuhio-Aleka S NBTH	0.162354	164.27654	1
95% percentile	900-4500	10: Kuhio-Aleka S NBRT	0.077043	164.702863	0
95% percentile	900-4500	11: Kuhio-Aleka S WBLT	7.13966	216.163158	169
95% percentile	900-4500	12: Kuhio-Aleka S WBRT	2.597047	225.901943	71
95% percentile	900-4500	13: Kuhio-Papaloa N SBLT	0.313912	39.707563	4
95% percentile	900-4500	14: Kuhio-Papaloa N NBTH	0.262031	155.422657	2
95% percentile	900-4500	15: Kuhio-Papaloa N NBRT	0.271344	161.125839	1
95% percentile	900-4500	16: Kuhio-Papaloa N WBRT	0.473728	69.425013	8
95% percentile	900-4500	17: Kuhio-KBR SBTH	0	0	0
95% percentile	900-4500	18: Kuhio-KBR SBRT	0.206726	59.020447	3
95% percentile	900-4500	19: Kuhio-KBR NBLT	42.53788	615.607044	324
95% percentile	900-4500	20: Kuhio-KBR NBTH	0	0	0
95% percentile	900-4500	21: Kuhio-KBR EBLT	0.335981	77.544018	8
95% percentile	900-4500	22: Kuhio-KBR EBRT	0	0	0
95% percentile	900-4500	23: Kuhio-Lanikai SBTH	0.454641	150.199413	7
95% percentile	900-4500	24: Kuhio-Lanikai NBTH	1.841797	212.937929	22
95% percentile	900-4500	25: Kuhio-Lanikai WBLT	2.215342	71.28707	40
95% percentile	900-4500	26: Kuhio-Lanikai WBRT	1.984538	85.724271	34
95% percentile	900-4500	27: Kuhio-Haleilio SBTH	52.264074	519.812236	494

Existing PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
95% percentile	900-4500	28: Kuhio-Haleilio NBLT	7.241767	167.001762	57
95% percentile	900-4500	29: Kuhio-Haleilio NBTH	11.61608	438.176887	190
95% percentile	900-4500	30: Kuhio-Haleilio EBLT	22.839335	233.043451	70
95% percentile	900-4500	31: Kuhio-Haleilio EBRT	1.249464	120.064789	10
95% percentile	900-4500	33: Kuhio-Papaloa S NBRT	2.000888	372.113962	12
95% percentile	900-4500	34: Kuhio-Papaloa S WBRT	0.477024	52.142494	4
95% percentile	900-4500	35: Kuhio-Kuamoo SBTH	31.380796	527.119808	323
95% percentile	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
95% percentile	900-4500	37: Kuhio-Kuamoo NBLT	33.372698	391.227372	250
95% percentile	900-4500	38: Kuhio-Kuamoo NBTH	34.252976	732.539249	348
95% percentile	900-4500	39: Kuhio-Kuamoo EBLT	67.802751	686.262127	129
95% percentile	900-4500	40: Kuhio-Kuamoo EBRT	12.965972	284.545603	119

APPENDIX B

VISSIM SIMULATION RESULTS

- Alternative 0: No Action

Alternative 0: No Action AM - Travel Time Results

SimRun	TimeInt	VehicleTravelTimeMeasurement	Vehs(All)	TravTm(All)	DistTrav(All)
1	900-4500	1: Kuhio SB	607	188.573026	7551.947481
1	900-4500	2: Kuhio NB	461	169.511517	7587.922266
1	900-4500	3: Kapaa Bypass Rd SB	714	196.41962	7563.895414
1	900-4500	4: Kapaa Bypass Rd NB	91	176.098059	7646.553502
2	900-4500	1: Kuhio SB	608	184.99622	7551.947481
2	900-4500	2: Kuhio NB	432	165.442959	7587.922266
2	900-4500	3: Kapaa Bypass Rd SB	685	193.21747	7563.895414
2	900-4500	4: Kapaa Bypass Rd NB	101	173.818044	7646.553502
3	900-4500	1: Kuhio SB	600	186.453555	7551.947481
3	900-4500	2: Kuhio NB	451	164.760748	7587.922266
3	900-4500	3: Kapaa Bypass Rd SB	708	194.714138	7563.895414
3	900-4500	4: Kapaa Bypass Rd NB	96	171.948973	7646.553502
4	900-4500	1: Kuhio SB	575	184.57128	7551.947481
4	900-4500	2: Kuhio NB	441	166.09724	7587.922266
4	900-4500	3: Kapaa Bypass Rd SB	633	191.894911	7563.895414
4	900-4500	4: Kapaa Bypass Rd NB	102	173.810507	7646.553502
5	900-4500	1: Kuhio SB	596	185.297288	7551.947481
5	900-4500	2: Kuhio NB	466	167.45749	7587.922266
5	900-4500	3: Kapaa Bypass Rd SB	650	190.909043	7563.895414
5	900-4500	4: Kapaa Bypass Rd NB	107	173.373558	7646.553502
Avg	900-4500	1: Kuhio SB	597	185.978274	7551.947481
Avg	900-4500	2: Kuhio NB	450	166.653991	7587.922266
Avg	900-4500	3: Kapaa Bypass Rd SB	678	193.431036	7563.895414
Avg	900-4500	4: Kapaa Bypass Rd NB	99	173.809828	7646.553502
Standard deviation	900-4500	1: Kuhio SB	13	1.609848	0
Standard deviation	900-4500	2: Kuhio NB	14	1.882286	0
Standard deviation	900-4500	3: Kapaa Bypass Rd SB	36	2.199075	0
Standard deviation	900-4500	4: Kapaa Bypass Rd NB	6	1.490737	0
Minimum	900-4500	1: Kuhio SB	575	184.57128	7551.947481
Minimum	900-4500	2: Kuhio NB	432	164.760748	7587.922266
Minimum	900-4500	3: Kapaa Bypass Rd SB	633	190.909043	7563.895414
Minimum	900-4500	4: Kapaa Bypass Rd NB	91	171.948973	7646.553502
Maximum	900-4500	1: Kuhio SB	608	188.573026	7551.947481
Maximum	900-4500	2: Kuhio NB	466	169.511517	7587.922266
Maximum	900-4500	3: Kapaa Bypass Rd SB	714	196.41962	7563.895414
Maximum	900-4500	4: Kapaa Bypass Rd NB	107	176.098059	7646.553502
95% percentile	900-4500	1: Kuhio SB	608	188.573026	7551.947481
95% percentile	900-4500	2: Kuhio NB	466	169.511517	7587.922266
95% percentile	900-4500	3: Kapaa Bypass Rd SB	714	196.41962	7563.895414
95% percentile	900-4500	4: Kapaa Bypass Rd NB	107	176.098059	7646.553502

Alternative 0: No Action AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
1	900-4500	1: Kuhio-Aleka N SBLT	0.086135	32.590447	2
1	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
1	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
1	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
1	900-4500	5: Kuhio-Aleka N WBLT	0.198659	56.608391	5
1	900-4500	6: Kuhio-Aleka N WBRT	0.464931	51.583555	11
1	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
1	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
1	900-4500	9: Kuhio-Aleka S NBTH	0.259486	136.206169	0
1	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
1	900-4500	11: Kuhio-Aleka S WBLT	1.920749	63.834822	71
1	900-4500	12: Kuhio-Aleka S WBRT	0.063884	19.685098	31
1	900-4500	13: Kuhio-Papaloa N SBLT	0.032385	80.052282	0
1	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
1	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
1	900-4500	16: Kuhio-Papaloa N WBRT	0.099817	47.228366	2
1	900-4500	17: Kuhio-KBR SBTH	0	0	0
1	900-4500	18: Kuhio-KBR SBRT	0	0	0
1	900-4500	19: Kuhio-KBR NBLT	0.777682	68.678194	12
1	900-4500	20: Kuhio-KBR NBTH	0	0	0
1	900-4500	21: Kuhio-KBR EBLT	0.007059	47.196341	2
1	900-4500	22: Kuhio-KBR EBRT	0	0	0
1	900-4500	23: Kuhio-Lanikai SBTH	0.474469	128.689241	7
1	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
1	900-4500	25: Kuhio-Lanikai WBLT	1.4586	47.323438	36
1	900-4500	26: Kuhio-Lanikai WBRT	0.583852	49.546882	15
1	900-4500	27: Kuhio-Haleilio SBTH	65.674584	538.764816	642
1	900-4500	28: Kuhio-Haleilio NBLT	0.539705	34.375434	5
1	900-4500	29: Kuhio-Haleilio NBTH	6.001187	168.647756	103
1	900-4500	30: Kuhio-Haleilio EBLT	33.82354	215.019089	111
1	900-4500	31: Kuhio-Haleilio EBRT	6.130126	121.464952	44
1	900-4500	33: Kuhio-Papaloa S NBRT	0.116626	146.537934	1
1	900-4500	34: Kuhio-Papaloa S WBRT	0.929628	72.86903	10
1	900-4500	35: Kuhio-Kuamoo SBTH	166.43711	1143.062184	939
1	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
1	900-4500	37: Kuhio-Kuamoo NBLT	17.125459	195.892842	72
1	900-4500	38: Kuhio-Kuamoo NBTH	20.667359	250.846638	222
1	900-4500	39: Kuhio-Kuamoo EBLT	224.341432	1588.781377	487
1	900-4500	40: Kuhio-Kuamoo EBRT	1038.16338	1695.572479	2367
2	900-4500	1: Kuhio-Aleka N SBLT	0.097296	57.302341	3
2	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
2	900-4500	3: Kuhio-Aleka N NBTH	0	0	0

Alternative 0: No Action AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
2	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
2	900-4500	5: Kuhio-Aleka N WBLT	0.100481	56.479716	6
2	900-4500	6: Kuhio-Aleka N WBRT	0.23727	51.333832	7
2	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
2	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
2	900-4500	9: Kuhio-Aleka S NBTH	0.073952	119.263169	0
2	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
2	900-4500	11: Kuhio-Aleka S WBLT	1.217954	86.216495	65
2	900-4500	12: Kuhio-Aleka S WBRT	0.277862	83.065055	48
2	900-4500	13: Kuhio-Papaloa N SBLT	0	0	0
2	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
2	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
2	900-4500	16: Kuhio-Papaloa N WBRT	0.276513	48.457457	6
2	900-4500	17: Kuhio-KBR SBTH	0	0	0
2	900-4500	18: Kuhio-KBR SBRT	0	0	0
2	900-4500	19: Kuhio-KBR NBLT	0.314469	66.48639	9
2	900-4500	20: Kuhio-KBR NBTH	0	0	0
2	900-4500	21: Kuhio-KBR EBLT	0.011891	32.398415	2
2	900-4500	22: Kuhio-KBR EBRT	0	0	0
2	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
2	900-4500	24: Kuhio-Lanikai NBTH	0.000913	32.8624	1
2	900-4500	25: Kuhio-Lanikai WBLT	1.569733	47.372473	43
2	900-4500	26: Kuhio-Lanikai WBRT	0.503936	45.306456	13
2	900-4500	27: Kuhio-Haleilio SBTH	62.501724	539.178983	580
2	900-4500	28: Kuhio-Haleilio NBLT	1.588125	57.483229	9
2	900-4500	29: Kuhio-Haleilio NBTH	4.946015	175.33775	89
2	900-4500	30: Kuhio-Haleilio EBLT	40.619139	436.057003	122
2	900-4500	31: Kuhio-Haleilio EBRT	9.573186	191.145611	66
2	900-4500	33: Kuhio-Papaloa S NBRT	0.054769	39.930757	3
2	900-4500	34: Kuhio-Papaloa S WBRT	0.677746	53.230533	8
2	900-4500	35: Kuhio-Kuamoo SBTH	140.223498	1010.148072	875
2	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
2	900-4500	37: Kuhio-Kuamoo NBLT	11.408531	190.447114	65
2	900-4500	38: Kuhio-Kuamoo NBTH	15.359081	209.399209	200
2	900-4500	39: Kuhio-Kuamoo EBLT	69.028952	1112.30475	149
2	900-4500	40: Kuhio-Kuamoo EBRT	921.37946	1673.690455	2282
3	900-4500	1: Kuhio-Aleka N SBLT	0.181425	99.318366	2
3	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
3	900-4500	3: Kuhio-Aleka N NBTH	0.033532	73.87413	1
3	900-4500	4: Kuhio-Aleka N NBRT	0.01966	79.879925	0
3	900-4500	5: Kuhio-Aleka N WBLT	0.000872	15.766559	2
3	900-4500	6: Kuhio-Aleka N WBRT	0.53605	75.604517	10

Alternative 0: No Action AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
3	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
3	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
3	900-4500	9: Kuhio-Aleka S NBTH	0.082326	166.141755	0
3	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
3	900-4500	11: Kuhio-Aleka S WBLT	0.959294	84.822568	55
3	900-4500	12: Kuhio-Aleka S WBRT	0.084384	69.153907	35
3	900-4500	13: Kuhio-Papaloa N SBLT	0.077003	24.429401	1
3	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
3	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
3	900-4500	16: Kuhio-Papaloa N WBRT	0.232755	47.965372	4
3	900-4500	17: Kuhio-KBR SBTH	0	0	0
3	900-4500	18: Kuhio-KBR SBRT	0	0	0
3	900-4500	19: Kuhio-KBR NBLT	0.963996	101.09674	12
3	900-4500	20: Kuhio-KBR NBTH	0	0	0
3	900-4500	21: Kuhio-KBR EBLT	0.003073	55.534757	1
3	900-4500	22: Kuhio-KBR EBRT	0	0	0
3	900-4500	23: Kuhio-Lanikai SBTH	0.124653	50.221262	3
3	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
3	900-4500	25: Kuhio-Lanikai WBLT	1.36898	47.8585	44
3	900-4500	26: Kuhio-Lanikai WBRT	0.304438	48.603635	7
3	900-4500	27: Kuhio-Haleilio SBTH	58.959798	518.55448	585
3	900-4500	28: Kuhio-Haleilio NBLT	2.589586	62.496476	12
3	900-4500	29: Kuhio-Haleilio NBTH	4.622602	163.087545	91
3	900-4500	30: Kuhio-Haleilio EBLT	28.713873	212.381745	98
3	900-4500	31: Kuhio-Haleilio EBRT	6.841221	129.62665	48
3	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
3	900-4500	34: Kuhio-Papaloa S WBRT	0.660779	73.709073	10
3	900-4500	35: Kuhio-Kuamoo SBTH	159.149872	983.955333	893
3	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
3	900-4500	37: Kuhio-Kuamoo NBLT	12.236083	127.479822	70
3	900-4500	38: Kuhio-Kuamoo NBTH	17.379349	307.182521	196
3	900-4500	39: Kuhio-Kuamoo EBLT	38.089513	190.62002	79
3	900-4500	40: Kuhio-Kuamoo EBRT	316.794715	1031.300718	1165
4	900-4500	1: Kuhio-Aleka N SBLT	0.497881	60.127275	4
4	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
4	900-4500	3: Kuhio-Aleka N NBTH	0.021834	50.191183	1
4	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
4	900-4500	5: Kuhio-Aleka N WBLT	0.136521	36.743381	3
4	900-4500	6: Kuhio-Aleka N WBRT	0.346444	51.135277	9
4	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
4	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
4	900-4500	9: Kuhio-Aleka S NBTH	0.019924	81.347876	0

Alternative 0: No Action AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
4	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
4	900-4500	11: Kuhio-Aleka S WBLT	1.985256	85.157381	74
4	900-4500	12: Kuhio-Aleka S WBRT	0.629527	73.077015	38
4	900-4500	13: Kuhio-Papaloa N SBLT	0.065586	26.89405	1
4	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
4	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
4	900-4500	16: Kuhio-Papaloa N WBRT	0.246701	48.907236	3
4	900-4500	17: Kuhio-KBR SBTH	0	0	0
4	900-4500	18: Kuhio-KBR SBRT	0	0	0
4	900-4500	19: Kuhio-KBR NBLT	0.621877	62.228414	9
4	900-4500	20: Kuhio-KBR NBTH	0	0	0
4	900-4500	21: Kuhio-KBR EBLT	0.003679	33.36172	2
4	900-4500	22: Kuhio-KBR EBRT	0	0	0
4	900-4500	23: Kuhio-Lanikai SBTH	0.468519	76.152989	14
4	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
4	900-4500	25: Kuhio-Lanikai WBLT	1.709277	67.1091	36
4	900-4500	26: Kuhio-Lanikai WBRT	0.330912	27.862361	13
4	900-4500	27: Kuhio-Haleilio SBTH	76.899308	525.537709	701
4	900-4500	28: Kuhio-Haleilio NBLT	0.399521	51.216814	6
4	900-4500	29: Kuhio-Haleilio NBTH	6.863676	296.745606	114
4	900-4500	30: Kuhio-Haleilio EBLT	36.13426	343.084676	129
4	900-4500	31: Kuhio-Haleilio EBRT	3.422459	123.239656	36
4	900-4500	33: Kuhio-Papaloa S NBRT	0.069563	104.357236	1
4	900-4500	34: Kuhio-Papaloa S WBRT	0.59578	52.102219	11
4	900-4500	35: Kuhio-Kuamoo SBTH	105.69914	910.567377	698
4	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
4	900-4500	37: Kuhio-Kuamoo NBLT	6.057116	95.73863	50
4	900-4500	38: Kuhio-Kuamoo NBTH	16.287804	294.852037	186
4	900-4500	39: Kuhio-Kuamoo EBLT	78.760956	1611.072684	200
4	900-4500	40: Kuhio-Kuamoo EBRT	691.312305	1656.945558	2092
5	900-4500	1: Kuhio-Aleka N SBLT	0.089362	37.536682	3
5	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
5	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
5	900-4500	4: Kuhio-Aleka N NBRT	0.040085	42.845508	1
5	900-4500	5: Kuhio-Aleka N WBLT	0.179631	39.780955	5
5	900-4500	6: Kuhio-Aleka N WBRT	0.192355	53.016275	7
5	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
5	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
5	900-4500	9: Kuhio-Aleka S NBTH	0.050525	106.824634	0
5	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
5	900-4500	11: Kuhio-Aleka S WBLT	2.026876	105.726077	62
5	900-4500	12: Kuhio-Aleka S WBRT	0.215277	80.206027	35

Alternative 0: No Action AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
5	900-4500	13: Kuhio-Papaloa N SBLT	0	0	0
5	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
5	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
5	900-4500	16: Kuhio-Papaloa N WBRT	0.154392	48.14604	3
5	900-4500	17: Kuhio-KBR SBTH	0	0	0
5	900-4500	18: Kuhio-KBR SBRT	0	0	0
5	900-4500	19: Kuhio-KBR NBLT	0.851116	71.863983	13
5	900-4500	20: Kuhio-KBR NBTH	0	0	0
5	900-4500	21: Kuhio-KBR EBLT	0.077944	55.585206	5
5	900-4500	22: Kuhio-KBR EBRT	0	0	0
5	900-4500	23: Kuhio-Lanikai SBTH	0.44922	159.56625	8
5	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
5	900-4500	25: Kuhio-Lanikai WBLT	1.330523	46.571458	34
5	900-4500	26: Kuhio-Lanikai WBRT	0.504135	48.208356	15
5	900-4500	27: Kuhio-Haleilio SBTH	59.374792	510.548017	606
5	900-4500	28: Kuhio-Haleilio NBLT	1.055847	72.49299	5
5	900-4500	29: Kuhio-Haleilio NBTH	6.114157	190.488521	102
5	900-4500	30: Kuhio-Haleilio EBLT	40.826141	382.039718	153
5	900-4500	31: Kuhio-Haleilio EBRT	7.007692	126.155893	53
5	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
5	900-4500	34: Kuhio-Papaloa S WBRT	0.804787	53.066155	13
5	900-4500	35: Kuhio-Kuamoo SBTH	129.309471	927.046322	833
5	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
5	900-4500	37: Kuhio-Kuamoo NBLT	10.552719	138.396732	65
5	900-4500	38: Kuhio-Kuamoo NBTH	17.943743	214.522597	215
5	900-4500	39: Kuhio-Kuamoo EBLT	1050.647523	1713.900456	1957
5	900-4500	40: Kuhio-Kuamoo EBRT	1299.248677	1713.808199	2934
Avg	900-4500	1: Kuhio-Aleka N SBLT	0.19042	57.375022	3
Avg	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Avg	900-4500	3: Kuhio-Aleka N NBTH	0.011073	24.813063	0
Avg	900-4500	4: Kuhio-Aleka N NBRT	0.011949	24.545087	0
Avg	900-4500	5: Kuhio-Aleka N WBLT	0.123233	41.0758	4
Avg	900-4500	6: Kuhio-Aleka N WBRT	0.35541	56.534691	9
Avg	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
Avg	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Avg	900-4500	9: Kuhio-Aleka S NBTH	0.097242	121.956721	0
Avg	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Avg	900-4500	11: Kuhio-Aleka S WBLT	1.622026	85.151469	65
Avg	900-4500	12: Kuhio-Aleka S WBRT	0.254187	65.03742	37
Avg	900-4500	13: Kuhio-Papaloa N SBLT	0.034995	26.275147	0
Avg	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
Avg	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0

Alternative 0: No Action AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Avg	900-4500	16: Kuhio-Papaloa N WBRT	0.202036	48.140894	4
Avg	900-4500	17: Kuhio-KBR SBTH	0	0	0
Avg	900-4500	18: Kuhio-KBR SBRT	0	0	0
Avg	900-4500	19: Kuhio-KBR NBLT	0.705828	74.070744	11
Avg	900-4500	20: Kuhio-KBR NBTH	0	0	0
Avg	900-4500	21: Kuhio-KBR EBLT	0.020729	44.815288	2
Avg	900-4500	22: Kuhio-KBR EBRT	0	0	0
Avg	900-4500	23: Kuhio-Lanikai SBTH	0.303372	82.925948	6
Avg	900-4500	24: Kuhio-Lanikai NBTH	0.000183	6.57248	0
Avg	900-4500	25: Kuhio-Lanikai WBLT	1.487423	51.246994	39
Avg	900-4500	26: Kuhio-Lanikai WBRT	0.445454	43.905538	13
Avg	900-4500	27: Kuhio-Haleilio SBTH	64.682041	526.516801	623
Avg	900-4500	28: Kuhio-Haleilio NBLT	1.234557	55.612989	7
Avg	900-4500	29: Kuhio-Haleilio NBTH	5.709527	198.861436	100
Avg	900-4500	30: Kuhio-Haleilio EBLT	36.023391	317.716446	123
Avg	900-4500	31: Kuhio-Haleilio EBRT	6.594937	138.326552	49
Avg	900-4500	33: Kuhio-Papaloa S NBRT	0.048192	58.165185	1
Avg	900-4500	34: Kuhio-Papaloa S WBRT	0.733744	60.995402	10
Avg	900-4500	35: Kuhio-Kuamoo SBTH	140.163818	994.955857	848
Avg	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Avg	900-4500	37: Kuhio-Kuamoo NBLT	11.475982	149.591028	64
Avg	900-4500	38: Kuhio-Kuamoo NBTH	17.527467	255.3606	204
Avg	900-4500	39: Kuhio-Kuamoo EBLT	292.173675	1243.335857	574
Avg	900-4500	40: Kuhio-Kuamoo EBRT	853.379707	1554.263482	2168
Standard deviation	900-4500	1: Kuhio-Aleka N SBLT	0.176333	26.337517	1
Standard deviation	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Standard deviation	900-4500	3: Kuhio-Aleka N NBTH	0.015717	34.993219	1
Standard deviation	900-4500	4: Kuhio-Aleka N NBRT	0.017884	36.070187	0
Standard deviation	900-4500	5: Kuhio-Aleka N WBLT	0.07832	16.878582	2
Standard deviation	900-4500	6: Kuhio-Aleka N WBRT	0.145988	10.6859	2
Standard deviation	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
Standard deviation	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Standard deviation	900-4500	9: Kuhio-Aleka S NBTH	0.093873	31.783162	0
Standard deviation	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Standard deviation	900-4500	11: Kuhio-Aleka S WBLT	0.496881	14.8236	8
Standard deviation	900-4500	12: Kuhio-Aleka S WBRT	0.228037	25.94945	6
Standard deviation	900-4500	13: Kuhio-Papaloa N SBLT	0.035905	32.697618	1
Standard deviation	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
Standard deviation	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
Standard deviation	900-4500	16: Kuhio-Papaloa N WBRT	0.072808	0.622703	2
Standard deviation	900-4500	17: Kuhio-KBR SBTH	0	0	0
Standard deviation	900-4500	18: Kuhio-KBR SBRT	0	0	0

Alternative 0: No Action AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Standard deviation	900-4500	19: Kuhio-KBR NBLT	0.251561	15.509006	2
Standard deviation	900-4500	20: Kuhio-KBR NBTH	0	0	0
Standard deviation	900-4500	21: Kuhio-KBR EBLT	0.032175	11.422899	2
Standard deviation	900-4500	22: Kuhio-KBR EBRT	0	0	0
Standard deviation	900-4500	23: Kuhio-Lanikai SBTH	0.224608	63.166837	5
Standard deviation	900-4500	24: Kuhio-Lanikai NBTH	0.000408	14.696512	0
Standard deviation	900-4500	25: Kuhio-Lanikai WBLT	0.154492	8.879121	5
Standard deviation	900-4500	26: Kuhio-Lanikai WBRT	0.121473	9.107102	3
Standard deviation	900-4500	27: Kuhio-Haleilio SBTH	7.346964	12.546951	50
Standard deviation	900-4500	28: Kuhio-Haleilio NBLT	0.890668	14.196608	3
Standard deviation	900-4500	29: Kuhio-Haleilio NBTH	0.914495	55.671846	10
Standard deviation	900-4500	30: Kuhio-Haleilio EBLT	5.061324	100.533159	21
Standard deviation	900-4500	31: Kuhio-Haleilio EBRT	2.20123	29.688357	11
Standard deviation	900-4500	33: Kuhio-Papaloa S NBRT	0.049568	65.273119	1
Standard deviation	900-4500	34: Kuhio-Papaloa S WBRT	0.133146	11.234715	2
Standard deviation	900-4500	35: Kuhio-Kuamoo SBTH	24.271334	92.223125	92
Standard deviation	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Standard deviation	900-4500	37: Kuhio-Kuamoo NBLT	3.959653	42.800047	9
Standard deviation	900-4500	38: Kuhio-Kuamoo NBTH	2.018217	44.848782	15
Standard deviation	900-4500	39: Kuhio-Kuamoo EBLT	430.052645	632.726996	788
Standard deviation	900-4500	40: Kuhio-Kuamoo EBRT	371.401874	293.137857	642
Minimum	900-4500	1: Kuhio-Aleka N SBLT	0.086135	32.590447	2
Minimum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Minimum	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
Minimum	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
Minimum	900-4500	5: Kuhio-Aleka N WBLT	0.000872	15.766559	2
Minimum	900-4500	6: Kuhio-Aleka N WBRT	0.192355	51.135277	7
Minimum	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
Minimum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Minimum	900-4500	9: Kuhio-Aleka S NBTH	0.019924	81.347876	0
Minimum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Minimum	900-4500	11: Kuhio-Aleka S WBLT	0.959294	63.834822	55
Minimum	900-4500	12: Kuhio-Aleka S WBRT	0.063884	19.685098	31
Minimum	900-4500	13: Kuhio-Papaloa N SBLT	0	0	0
Minimum	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
Minimum	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
Minimum	900-4500	16: Kuhio-Papaloa N WBRT	0.099817	47.228366	2
Minimum	900-4500	17: Kuhio-KBR SBTH	0	0	0
Minimum	900-4500	18: Kuhio-KBR SBRT	0	0	0
Minimum	900-4500	19: Kuhio-KBR NBLT	0.314469	62.228414	9
Minimum	900-4500	20: Kuhio-KBR NBTH	0	0	0
Minimum	900-4500	21: Kuhio-KBR EBLT	0.003073	32.398415	1

Alternative 0: No Action AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Minimum	900-4500	22: Kuhio-KBR EBRT	0	0	0
Minimum	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
Minimum	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
Minimum	900-4500	25: Kuhio-Lanikai WBLT	1.330523	46.571458	34
Minimum	900-4500	26: Kuhio-Lanikai WBRT	0.304438	27.862361	7
Minimum	900-4500	27: Kuhio-Haleilio SBTH	58.959798	510.548017	580
Minimum	900-4500	28: Kuhio-Haleilio NBLT	0.399521	34.375434	5
Minimum	900-4500	29: Kuhio-Haleilio NBTH	4.622602	163.087545	89
Minimum	900-4500	30: Kuhio-Haleilio EBLT	28.713873	212.381745	98
Minimum	900-4500	31: Kuhio-Haleilio EBRT	3.422459	121.464952	36
Minimum	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
Minimum	900-4500	34: Kuhio-Papaloa S WBRT	0.59578	52.102219	8
Minimum	900-4500	35: Kuhio-Kuamoo SBTH	105.69914	910.567377	698
Minimum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Minimum	900-4500	37: Kuhio-Kuamoo NBLT	6.057116	95.73863	50
Minimum	900-4500	38: Kuhio-Kuamoo NBTH	15.359081	209.399209	186
Minimum	900-4500	39: Kuhio-Kuamoo EBLT	38.089513	190.62002	79
Minimum	900-4500	40: Kuhio-Kuamoo EBRT	316.794715	1031.300718	1165
Maximum	900-4500	1: Kuhio-Aleka N SBLT	0.497881	99.318366	4
Maximum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Maximum	900-4500	3: Kuhio-Aleka N NBTH	0.033532	73.87413	1
Maximum	900-4500	4: Kuhio-Aleka N NBRT	0.040085	79.879925	1
Maximum	900-4500	5: Kuhio-Aleka N WBLT	0.198659	56.608391	6
Maximum	900-4500	6: Kuhio-Aleka N WBRT	0.53605	75.604517	11
Maximum	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
Maximum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Maximum	900-4500	9: Kuhio-Aleka S NBTH	0.259486	166.141755	0
Maximum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Maximum	900-4500	11: Kuhio-Aleka S WBLT	2.026876	105.726077	74
Maximum	900-4500	12: Kuhio-Aleka S WBRT	0.629527	83.065055	48
Maximum	900-4500	13: Kuhio-Papaloa N SBLT	0.077003	80.052282	1
Maximum	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
Maximum	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
Maximum	900-4500	16: Kuhio-Papaloa N WBRT	0.276513	48.907236	6
Maximum	900-4500	17: Kuhio-KBR SBTH	0	0	0
Maximum	900-4500	18: Kuhio-KBR SBRT	0	0	0
Maximum	900-4500	19: Kuhio-KBR NBLT	0.963996	101.09674	13
Maximum	900-4500	20: Kuhio-KBR NBTH	0	0	0
Maximum	900-4500	21: Kuhio-KBR EBLT	0.077944	55.585206	5
Maximum	900-4500	22: Kuhio-KBR EBRT	0	0	0
Maximum	900-4500	23: Kuhio-Lanikai SBTH	0.474469	159.56625	14
Maximum	900-4500	24: Kuhio-Lanikai NBTH	0.000913	32.8624	1

Alternative 0: No Action AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Maximum	900-4500	25: Kuhio-Lanikai WBLT	1.709277	67.1091	44
Maximum	900-4500	26: Kuhio-Lanikai WBRT	0.583852	49.546882	15
Maximum	900-4500	27: Kuhio-Haleilio SBTH	76.899308	539.178983	701
Maximum	900-4500	28: Kuhio-Haleilio NBLT	2.589586	72.49299	12
Maximum	900-4500	29: Kuhio-Haleilio NBTH	6.863676	296.745606	114
Maximum	900-4500	30: Kuhio-Haleilio EBLT	40.826141	436.057003	153
Maximum	900-4500	31: Kuhio-Haleilio EBRT	9.573186	191.145611	66
Maximum	900-4500	33: Kuhio-Papaloa S NBRT	0.116626	146.537934	3
Maximum	900-4500	34: Kuhio-Papaloa S WBRT	0.929628	73.709073	13
Maximum	900-4500	35: Kuhio-Kuamoo SBTH	166.43711	1143.062184	939
Maximum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Maximum	900-4500	37: Kuhio-Kuamoo NBLT	17.125459	195.892842	72
Maximum	900-4500	38: Kuhio-Kuamoo NBTH	20.667359	307.182521	222
Maximum	900-4500	39: Kuhio-Kuamoo EBLT	1050.647523	1713.900456	1957
Maximum	900-4500	40: Kuhio-Kuamoo EBRT	1299.248677	1713.808199	2934
95% percentile	900-4500	1: Kuhio-Aleka N SBLT	0.497881	99.318366	4
95% percentile	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
95% percentile	900-4500	3: Kuhio-Aleka N NBTH	0.033532	73.87413	1
95% percentile	900-4500	4: Kuhio-Aleka N NBRT	0.040085	79.879925	1
95% percentile	900-4500	5: Kuhio-Aleka N WBLT	0.198659	56.608391	6
95% percentile	900-4500	6: Kuhio-Aleka N WBRT	0.53605	75.604517	11
95% percentile	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
95% percentile	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
95% percentile	900-4500	9: Kuhio-Aleka S NBTH	0.259486	166.141755	0
95% percentile	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
95% percentile	900-4500	11: Kuhio-Aleka S WBLT	2.026876	105.726077	74
95% percentile	900-4500	12: Kuhio-Aleka S WBRT	0.629527	83.065055	48
95% percentile	900-4500	13: Kuhio-Papaloa N SBLT	0.077003	80.052282	1
95% percentile	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
95% percentile	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
95% percentile	900-4500	16: Kuhio-Papaloa N WBRT	0.276513	48.907236	6
95% percentile	900-4500	17: Kuhio-KBR SBTH	0	0	0
95% percentile	900-4500	18: Kuhio-KBR SBRT	0	0	0
95% percentile	900-4500	19: Kuhio-KBR NBLT	0.963996	101.09674	13
95% percentile	900-4500	20: Kuhio-KBR NBTH	0	0	0
95% percentile	900-4500	21: Kuhio-KBR EBLT	0.077944	55.585206	5
95% percentile	900-4500	22: Kuhio-KBR EBRT	0	0	0
95% percentile	900-4500	23: Kuhio-Lanikai SBTH	0.474469	159.56625	14
95% percentile	900-4500	24: Kuhio-Lanikai NBTH	0.000913	32.8624	1
95% percentile	900-4500	25: Kuhio-Lanikai WBLT	1.709277	67.1091	44
95% percentile	900-4500	26: Kuhio-Lanikai WBRT	0.583852	49.546882	15
95% percentile	900-4500	27: Kuhio-Haleilio SBTH	76.899308	539.178983	701

Alternative 0: No Action AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
95% percentile	900-4500	28: Kuhio-Haleilio NBLT	2.589586	72.49299	12
95% percentile	900-4500	29: Kuhio-Haleilio NBTH	6.863676	296.745606	114
95% percentile	900-4500	30: Kuhio-Haleilio EBLT	40.826141	436.057003	153
95% percentile	900-4500	31: Kuhio-Haleilio EBRT	9.573186	191.145611	66
95% percentile	900-4500	33: Kuhio-Papaloa S NBRT	0.116626	146.537934	3
95% percentile	900-4500	34: Kuhio-Papaloa S WBRT	0.929628	73.709073	13
95% percentile	900-4500	35: Kuhio-Kuamoo SBTH	166.43711	1143.062184	939
95% percentile	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
95% percentile	900-4500	37: Kuhio-Kuamoo NBLT	17.125459	195.892842	72
95% percentile	900-4500	38: Kuhio-Kuamoo NBTH	20.667359	307.182521	222
95% percentile	900-4500	39: Kuhio-Kuamoo EBLT	1050.647523	1713.900456	1957
95% percentile	900-4500	40: Kuhio-Kuamoo EBRT	1299.248677	1713.808199	2934

Alternative 0: No Action PM - Travel Time Results

SimRun	TimeInt	VehicleTravelTimeMeasurement	Vehs(All)	TravTm(All)	DistTrav(All)
1	900-4500	1: Kuhio SB	373	250.857824	7551.947481
1	900-4500	2: Kuhio NB	584	197.886286	7587.922266
1	900-4500	3: Kapaa Bypass Rd SB	428	223.350649	7563.895414
1	900-4500	4: Kapaa Bypass Rd NB	506	225.517515	7646.553502
2	900-4500	1: Kuhio SB	363	247.686542	7551.947481
2	900-4500	2: Kuhio NB	589	188.448022	7587.922266
2	900-4500	3: Kapaa Bypass Rd SB	422	222.613137	7563.895414
2	900-4500	4: Kapaa Bypass Rd NB	503	217.389011	7646.553502
3	900-4500	1: Kuhio SB	345	247.912406	7551.947481
3	900-4500	2: Kuhio NB	568	195.655805	7587.922266
3	900-4500	3: Kapaa Bypass Rd SB	396	223.176088	7563.895414
3	900-4500	4: Kapaa Bypass Rd NB	523	227.136943	7646.553502
4	900-4500	1: Kuhio SB	334	246.015907	7551.947481
4	900-4500	2: Kuhio NB	575	187.360699	7587.922266
4	900-4500	3: Kapaa Bypass Rd SB	401	218.287834	7563.895414
4	900-4500	4: Kapaa Bypass Rd NB	526	210.971444	7646.553502
5	900-4500	1: Kuhio SB	385	247.430269	7551.947481
5	900-4500	2: Kuhio NB	565	198.013701	7587.922266
5	900-4500	3: Kapaa Bypass Rd SB	387	221.135338	7563.895414
5	900-4500	4: Kapaa Bypass Rd NB	496	236.542177	7646.553502
Avg	900-4500	1: Kuhio SB	360	247.980589	7551.947481
Avg	900-4500	2: Kuhio NB	576	193.472903	7587.922266
Avg	900-4500	3: Kapaa Bypass Rd SB	407	221.712609	7563.895414
Avg	900-4500	4: Kapaa Bypass Rd NB	511	223.511418	7646.553502
Standard deviation	900-4500	1: Kuhio SB	21	1.770058	0
Standard deviation	900-4500	2: Kuhio NB	10	5.183395	0
Standard deviation	900-4500	3: Kapaa Bypass Rd SB	17	2.103463	0
Standard deviation	900-4500	4: Kapaa Bypass Rd NB	13	9.768628	0
Minimum	900-4500	1: Kuhio SB	334	246.015907	7551.947481
Minimum	900-4500	2: Kuhio NB	565	187.360699	7587.922266
Minimum	900-4500	3: Kapaa Bypass Rd SB	387	218.287834	7563.895414
Minimum	900-4500	4: Kapaa Bypass Rd NB	496	210.971444	7646.553502
Maximum	900-4500	1: Kuhio SB	385	250.857824	7551.947481
Maximum	900-4500	2: Kuhio NB	589	198.013701	7587.922266
Maximum	900-4500	3: Kapaa Bypass Rd SB	428	223.350649	7563.895414
Maximum	900-4500	4: Kapaa Bypass Rd NB	526	236.542177	7646.553502
95% percentile	900-4500	1: Kuhio SB	385	250.857824	7551.947481
95% percentile	900-4500	2: Kuhio NB	589	198.013701	7587.922266
95% percentile	900-4500	3: Kapaa Bypass Rd SB	428	223.350649	7563.895414
95% percentile	900-4500	4: Kapaa Bypass Rd NB	526	236.542177	7646.553502

Alternative 0: No Action PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
1	900-4500	1: Kuhio-Aleka N SBLT	1.86962	96.707697	10
1	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
1	900-4500	3: Kuhio-Aleka N NBTH	0.004464	19.180034	2
1	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
1	900-4500	5: Kuhio-Aleka N WBLT	0.093564	35.621136	4
1	900-4500	6: Kuhio-Aleka N WBRT	0.787364	108.493045	20
1	900-4500	7: Kuhio-Aleka S SBLT	0.063037	21.458824	1
1	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
1	900-4500	9: Kuhio-Aleka S NBTH	1.284083	239.007657	2
1	900-4500	10: Kuhio-Aleka S NBRT	0.064409	146.388835	0
1	900-4500	11: Kuhio-Aleka S WBLT	14.740413	177.476179	196
1	900-4500	12: Kuhio-Aleka S WBRT	3.695116	186.350279	66
1	900-4500	13: Kuhio-Papaloa N SBLT	0.540771	46.544632	3
1	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
1	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
1	900-4500	16: Kuhio-Papaloa N WBRT	0.381148	48.774093	7
1	900-4500	17: Kuhio-KBR SBTH	0	0	0
1	900-4500	18: Kuhio-KBR SBRT	0.073034	31.264133	2
1	900-4500	19: Kuhio-KBR NBLT	300.469584	1240.108166	1719
1	900-4500	20: Kuhio-KBR NBTH	0	0	0
1	900-4500	21: Kuhio-KBR EBLT	0.12664	56.066198	6
1	900-4500	22: Kuhio-KBR EBRT	0	0	0
1	900-4500	23: Kuhio-Lanikai SBTH	2.707111	113.260274	42
1	900-4500	24: Kuhio-Lanikai NBTH	4.523687	354.318376	49
1	900-4500	25: Kuhio-Lanikai WBLT	1.585037	55.870269	34
1	900-4500	26: Kuhio-Lanikai WBRT	2.410608	69.073335	37
1	900-4500	27: Kuhio-Haleilio SBTH	65.611232	531.087532	583
1	900-4500	28: Kuhio-Haleilio NBLT	26.545094	625.218463	134
1	900-4500	29: Kuhio-Haleilio NBTH	24.336267	735.116959	234
1	900-4500	30: Kuhio-Haleilio EBLT	30.079455	264.643098	89
1	900-4500	31: Kuhio-Haleilio EBRT	0.627254	91.021826	8
1	900-4500	33: Kuhio-Papaloa S NBRT	14.811928	479.984102	76
1	900-4500	34: Kuhio-Papaloa S WBRT	0	0	0
1	900-4500	35: Kuhio-Kuamoo SBTH	39.648337	357.109369	315
1	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
1	900-4500	37: Kuhio-Kuamoo NBLT	38.538401	1025.792708	189
1	900-4500	38: Kuhio-Kuamoo NBTH	71.753993	1026.616838	529
1	900-4500	39: Kuhio-Kuamoo EBLT	76.159157	497.933932	147
1	900-4500	40: Kuhio-Kuamoo EBRT	8.133303	153.926458	118
2	900-4500	1: Kuhio-Aleka N SBLT	1.048449	101.674692	10
2	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
2	900-4500	3: Kuhio-Aleka N NBTH	0.327109	154.182064	6

Alternative 0: No Action PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
2	900-4500	4: Kuhio-Aleka N NBRT	0.281856	161.49545	3
2	900-4500	5: Kuhio-Aleka N WBLT	0.25335	57.072346	9
2	900-4500	6: Kuhio-Aleka N WBRT	0.901367	74.262133	25
2	900-4500	7: Kuhio-Aleka S SBLT	1.7715	75.943872	10
2	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
2	900-4500	9: Kuhio-Aleka S NBTH	0.513196	201.403437	1
2	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
2	900-4500	11: Kuhio-Aleka S WBLT	45.293569	218.16472	289
2	900-4500	12: Kuhio-Aleka S WBRT	5.230683	205.546063	67
2	900-4500	13: Kuhio-Papaloa N SBLT	0.335529	48.148586	5
2	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
2	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
2	900-4500	16: Kuhio-Papaloa N WBRT	0.267348	49.644282	7
2	900-4500	17: Kuhio-KBR SBTH	0	0	0
2	900-4500	18: Kuhio-KBR SBRT	0.248187	42.618434	4
2	900-4500	19: Kuhio-KBR NBLT	223.163585	1217.780776	1344
2	900-4500	20: Kuhio-KBR NBTH	0	0	0
2	900-4500	21: Kuhio-KBR EBLT	0.031292	34.927118	8
2	900-4500	22: Kuhio-KBR EBRT	0	0	0
2	900-4500	23: Kuhio-Lanikai SBTH	0.783795	139.512268	12
2	900-4500	24: Kuhio-Lanikai NBTH	2.065492	248.551883	35
2	900-4500	25: Kuhio-Lanikai WBLT	1.049328	49.659363	32
2	900-4500	26: Kuhio-Lanikai WBRT	2.566326	85.600083	40
2	900-4500	27: Kuhio-Haleilio SBTH	64.443066	531.231606	562
2	900-4500	28: Kuhio-Haleilio NBLT	19.873943	204.079066	122
2	900-4500	29: Kuhio-Haleilio NBTH	26.890703	721.876147	306
2	900-4500	30: Kuhio-Haleilio EBLT	31.231713	301.950518	75
2	900-4500	31: Kuhio-Haleilio EBRT	0.649373	60.979679	7
2	900-4500	33: Kuhio-Papaloa S NBRT	22.069128	862.74781	109
2	900-4500	34: Kuhio-Papaloa S WBRT	0.199062	51.041757	2
2	900-4500	35: Kuhio-Kuamoo SBTH	37.21332	449.728414	334
2	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
2	900-4500	37: Kuhio-Kuamoo NBLT	18.926675	475.748208	133
2	900-4500	38: Kuhio-Kuamoo NBTH	49.858363	940.201117	443
2	900-4500	39: Kuhio-Kuamoo EBLT	77.480228	376.145609	151
2	900-4500	40: Kuhio-Kuamoo EBRT	10.73632	196.934838	109
3	900-4500	1: Kuhio-Aleka N SBLT	1.282124	96.073861	5
3	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
3	900-4500	3: Kuhio-Aleka N NBTH	0.051969	74.444111	2
3	900-4500	4: Kuhio-Aleka N NBRT	0.030731	80.084115	0
3	900-4500	5: Kuhio-Aleka N WBLT	0.054456	75.96185	4
3	900-4500	6: Kuhio-Aleka N WBRT	0.810429	93.336456	19

Alternative 0: No Action PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
3	900-4500	7: Kuhio-Aleka S SBLT	2.110838	56.244626	8
3	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
3	900-4500	9: Kuhio-Aleka S NBTH	0.247469	164.437267	0
3	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
3	900-4500	11: Kuhio-Aleka S WBLT	7.342986	107.486789	151
3	900-4500	12: Kuhio-Aleka S WBRT	0.927177	80.657929	62
3	900-4500	13: Kuhio-Papaloa N SBLT	0.379501	47.231466	5
3	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
3	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
3	900-4500	16: Kuhio-Papaloa N WBRT	0.410211	69.218326	8
3	900-4500	17: Kuhio-KBR SBTH	0	0	0
3	900-4500	18: Kuhio-KBR SBRT	0	0	0
3	900-4500	19: Kuhio-KBR NBLT	328.700093	1256.103631	1777
3	900-4500	20: Kuhio-KBR NBTH	0	0	0
3	900-4500	21: Kuhio-KBR EBLT	0.012674	74.333868	6
3	900-4500	22: Kuhio-KBR EBRT	0	0	0
3	900-4500	23: Kuhio-Lanikai SBTH	0.377362	107.007427	14
3	900-4500	24: Kuhio-Lanikai NBTH	15.761174	520.850458	150
3	900-4500	25: Kuhio-Lanikai WBLT	1.332744	47.335187	43
3	900-4500	26: Kuhio-Lanikai WBRT	1.574545	47.708236	29
3	900-4500	27: Kuhio-Haleilio SBTH	58.658926	419.45366	518
3	900-4500	28: Kuhio-Haleilio NBLT	23.704851	340.612071	141
3	900-4500	29: Kuhio-Haleilio NBTH	18.985801	474.031768	258
3	900-4500	30: Kuhio-Haleilio EBLT	35.480996	266.108845	92
3	900-4500	31: Kuhio-Haleilio EBRT	1.680607	126.962081	16
3	900-4500	33: Kuhio-Papaloa S NBRT	4.403316	249.331526	38
3	900-4500	34: Kuhio-Papaloa S WBRT	0.04417	51.091239	1
3	900-4500	35: Kuhio-Kuamoo SBTH	40.648364	417.048126	391
3	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
3	900-4500	37: Kuhio-Kuamoo NBLT	23.421222	200.196742	149
3	900-4500	38: Kuhio-Kuamoo NBTH	62.24074	1121.879535	521
3	900-4500	39: Kuhio-Kuamoo EBLT	77.172184	661.485345	137
3	900-4500	40: Kuhio-Kuamoo EBRT	6.413515	92.096633	89
4	900-4500	1: Kuhio-Aleka N SBLT	1.43085	123.442276	12
4	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
4	900-4500	3: Kuhio-Aleka N NBTH	0.028774	70.246537	1
4	900-4500	4: Kuhio-Aleka N NBRT	0.017177	77.559923	1
4	900-4500	5: Kuhio-Aleka N WBLT	0.152308	51.343777	7
4	900-4500	6: Kuhio-Aleka N WBRT	1.426481	88.183896	27
4	900-4500	7: Kuhio-Aleka S SBLT	0.221314	22.864068	3
4	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
4	900-4500	9: Kuhio-Aleka S NBTH	0.609396	148.827199	0

Alternative 0: No Action PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
4	900-4500	10: Kuhio-Aleka S NBRT	0.007817	94.641146	0
4	900-4500	11: Kuhio-Aleka S WBLT	19.810685	216.036512	210
4	900-4500	12: Kuhio-Aleka S WBRT	2.80582	201.617919	63
4	900-4500	13: Kuhio-Papaloa N SBLT	0.460801	29.091888	4
4	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
4	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
4	900-4500	16: Kuhio-Papaloa N WBRT	0.687758	71.281196	10
4	900-4500	17: Kuhio-KBR SBTH	0	0	0
4	900-4500	18: Kuhio-KBR SBRT	0.034971	29.134693	1
4	900-4500	19: Kuhio-KBR NBLT	269.537247	1248.885886	1560
4	900-4500	20: Kuhio-KBR NBTH	0	0	0
4	900-4500	21: Kuhio-KBR EBLT	0.2502	56.757321	6
4	900-4500	22: Kuhio-KBR EBRT	0	0	0
4	900-4500	23: Kuhio-Lanikai SBTH	0.953062	124.799665	22
4	900-4500	24: Kuhio-Lanikai NBTH	17.342615	524.403863	135
4	900-4500	25: Kuhio-Lanikai WBLT	3.359817	75.80566	44
4	900-4500	26: Kuhio-Lanikai WBRT	1.503208	46.571221	31
4	900-4500	27: Kuhio-Haleilio SBTH	57.368718	524.304608	520
4	900-4500	28: Kuhio-Haleilio NBLT	20.671988	419.958506	127
4	900-4500	29: Kuhio-Haleilio NBTH	19.185885	617.155163	245
4	900-4500	30: Kuhio-Haleilio EBLT	25.903775	273.868512	78
4	900-4500	31: Kuhio-Haleilio EBRT	0.472597	63.207523	2
4	900-4500	33: Kuhio-Papaloa S NBRT	6.387255	524.842058	54
4	900-4500	34: Kuhio-Papaloa S WBRT	0.205862	52.142494	4
4	900-4500	35: Kuhio-Kuamoo SBTH	31.706941	363.002862	311
4	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
4	900-4500	37: Kuhio-Kuamoo NBLT	20.732921	441.4328	139
4	900-4500	38: Kuhio-Kuamoo NBTH	52.309652	867.808915	491
4	900-4500	39: Kuhio-Kuamoo EBLT	65.594778	301.135421	120
4	900-4500	40: Kuhio-Kuamoo EBRT	22.96299	597.013444	145
5	900-4500	1: Kuhio-Aleka N SBLT	0.596585	66.609458	8
5	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
5	900-4500	3: Kuhio-Aleka N NBTH	0.173744	124.362944	4
5	900-4500	4: Kuhio-Aleka N NBRT	0.017752	80.74728	1
5	900-4500	5: Kuhio-Aleka N WBLT	0.257875	38.896243	6
5	900-4500	6: Kuhio-Aleka N WBRT	0.446413	52.631507	13
5	900-4500	7: Kuhio-Aleka S SBLT	2.291409	250.641215	10
5	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
5	900-4500	9: Kuhio-Aleka S NBTH	0.119023	125.888411	0
5	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
5	900-4500	11: Kuhio-Aleka S WBLT	12.277866	217.041527	171
5	900-4500	12: Kuhio-Aleka S WBRT	1.918439	225.804584	81

Alternative 0: No Action PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
5	900-4500	13: Kuhio-Papaloa N SBLT	1.268451	75.833225	6
5	900-4500	14: Kuhio-Papaloa N NBTH	0.025215	55.275695	1
5	900-4500	15: Kuhio-Papaloa N NBRT	0.027909	60.978877	1
5	900-4500	16: Kuhio-Papaloa N WBRT	0.280437	49.334865	7
5	900-4500	17: Kuhio-KBR SBTH	0	0	0
5	900-4500	18: Kuhio-KBR SBRT	0.092539	29.757192	1
5	900-4500	19: Kuhio-KBR NBLT	384.753934	1235.549184	2321
5	900-4500	20: Kuhio-KBR NBTH	0	0	0
5	900-4500	21: Kuhio-KBR EBLT	1.412606	61.854369	12
5	900-4500	22: Kuhio-KBR EBRT	0.005408	19.857088	1
5	900-4500	23: Kuhio-Lanikai SBTH	1.141771	149.20918	22
5	900-4500	24: Kuhio-Lanikai NBTH	2.176789	129.799227	28
5	900-4500	25: Kuhio-Lanikai WBLT	3.968787	71.017035	42
5	900-4500	26: Kuhio-Lanikai WBRT	1.341766	98.175201	31
5	900-4500	27: Kuhio-Haleilio SBTH	54.338859	451.703716	503
5	900-4500	28: Kuhio-Haleilio NBLT	14.024832	261.287975	93
5	900-4500	29: Kuhio-Haleilio NBTH	18.008178	710.392152	216
5	900-4500	30: Kuhio-Haleilio EBLT	28.974245	256.67021	73
5	900-4500	31: Kuhio-Haleilio EBRT	0.595277	83.74453	5
5	900-4500	33: Kuhio-Papaloa S NBRT	20.304833	765.672401	133
5	900-4500	34: Kuhio-Papaloa S WBRT	0.047368	51.794258	1
5	900-4500	35: Kuhio-Kuamoo SBTH	42.843351	575.166871	371
5	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
5	900-4500	37: Kuhio-Kuamoo NBLT	19.336279	395.864378	152
5	900-4500	38: Kuhio-Kuamoo NBTH	65.670304	753.058112	552
5	900-4500	39: Kuhio-Kuamoo EBLT	89.261444	626.405291	164
5	900-4500	40: Kuhio-Kuamoo EBRT	13.511636	290.671613	122
Avg	900-4500	1: Kuhio-Aleka N SBLT	1.245526	96.901597	9
Avg	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Avg	900-4500	3: Kuhio-Aleka N NBTH	0.117212	88.483138	3
Avg	900-4500	4: Kuhio-Aleka N NBRT	0.069503	79.977354	1
Avg	900-4500	5: Kuhio-Aleka N WBLT	0.162311	51.77907	6
Avg	900-4500	6: Kuhio-Aleka N WBRT	0.874411	83.381407	21
Avg	900-4500	7: Kuhio-Aleka S SBLT	1.29162	85.430521	6
Avg	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Avg	900-4500	9: Kuhio-Aleka S NBTH	0.554633	175.912794	1
Avg	900-4500	10: Kuhio-Aleka S NBRT	0.014445	48.205996	0
Avg	900-4500	11: Kuhio-Aleka S WBLT	19.893104	187.241145	203
Avg	900-4500	12: Kuhio-Aleka S WBRT	2.915447	179.995355	68
Avg	900-4500	13: Kuhio-Papaloa N SBLT	0.597011	49.369959	5
Avg	900-4500	14: Kuhio-Papaloa N NBTH	0.005043	11.055139	0
Avg	900-4500	15: Kuhio-Papaloa N NBRT	0.005582	12.195775	0

Alternative 0: No Action PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Avg	900-4500	16: Kuhio-Papaloa N WBRT	0.40538	57.650552	8
Avg	900-4500	17: Kuhio-KBR SBTH	0	0	0
Avg	900-4500	18: Kuhio-KBR SBRT	0.089746	26.554891	2
Avg	900-4500	19: Kuhio-KBR NBLT	301.324889	1239.685529	1744
Avg	900-4500	20: Kuhio-KBR NBTH	0	0	0
Avg	900-4500	21: Kuhio-KBR EBLT	0.366682	56.787775	8
Avg	900-4500	22: Kuhio-KBR EBRT	0.001082	3.971418	0
Avg	900-4500	23: Kuhio-Lanikai SBTH	1.19262	126.757763	22
Avg	900-4500	24: Kuhio-Lanikai NBTH	8.373951	355.584761	79
Avg	900-4500	25: Kuhio-Lanikai WBLT	2.259142	59.937503	39
Avg	900-4500	26: Kuhio-Lanikai WBRT	1.879291	69.425615	34
Avg	900-4500	27: Kuhio-Haleilio SBTH	60.08416	491.556224	537
Avg	900-4500	28: Kuhio-Haleilio NBLT	20.964142	370.231216	123
Avg	900-4500	29: Kuhio-Haleilio NBTH	21.481367	651.714438	252
Avg	900-4500	30: Kuhio-Haleilio EBLT	30.334037	272.648237	81
Avg	900-4500	31: Kuhio-Haleilio EBRT	0.805022	85.183128	8
Avg	900-4500	33: Kuhio-Papaloa S NBRT	13.595292	576.515579	82
Avg	900-4500	34: Kuhio-Papaloa S WBRT	0.099292	41.213949	2
Avg	900-4500	35: Kuhio-Kuamoo SBTH	38.412063	432.411129	344
Avg	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Avg	900-4500	37: Kuhio-Kuamoo NBLT	24.191099	507.806967	152
Avg	900-4500	38: Kuhio-Kuamoo NBTH	60.36661	941.912903	507
Avg	900-4500	39: Kuhio-Kuamoo EBLT	77.133558	492.621119	144
Avg	900-4500	40: Kuhio-Kuamoo EBRT	12.351553	266.128597	117
Standard deviation	900-4500	1: Kuhio-Aleka N SBLT	0.47041	20.282545	3
Standard deviation	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Standard deviation	900-4500	3: Kuhio-Aleka N NBTH	0.134204	52.288377	2
Standard deviation	900-4500	4: Kuhio-Aleka N NBRT	0.11921	57.113977	1
Standard deviation	900-4500	5: Kuhio-Aleka N WBLT	0.092032	16.12499	2
Standard deviation	900-4500	6: Kuhio-Aleka N WBRT	0.353681	21.103784	5
Standard deviation	900-4500	7: Kuhio-Aleka S SBLT	1.067234	95.188399	4
Standard deviation	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Standard deviation	900-4500	9: Kuhio-Aleka S NBTH	0.453023	44.717141	1
Standard deviation	900-4500	10: Kuhio-Aleka S NBRT	0.028135	68.497349	0
Standard deviation	900-4500	11: Kuhio-Aleka S WBLT	14.89327	47.77451	53
Standard deviation	900-4500	12: Kuhio-Aleka S WBRT	1.652836	57.286929	8
Standard deviation	900-4500	13: Kuhio-Papaloa N SBLT	0.383481	16.774624	1
Standard deviation	900-4500	14: Kuhio-Papaloa N NBTH	0.011277	24.720042	0
Standard deviation	900-4500	15: Kuhio-Papaloa N NBRT	0.012481	27.270583	0
Standard deviation	900-4500	16: Kuhio-Papaloa N WBRT	0.169567	11.528773	1
Standard deviation	900-4500	17: Kuhio-KBR SBTH	0	0	0
Standard deviation	900-4500	18: Kuhio-KBR SBRT	0.095453	15.829456	2

Alternative 0: No Action PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Standard deviation	900-4500	19: Kuhio-KBR NBLT	60.889618	14.588581	363
Standard deviation	900-4500	20: Kuhio-KBR NBTH	0	0	0
Standard deviation	900-4500	21: Kuhio-KBR EBLT	0.592232	14.24733	3
Standard deviation	900-4500	22: Kuhio-KBR EBRT	0.002419	8.88036	0
Standard deviation	900-4500	23: Kuhio-Lanikai SBTH	0.89239	17.626937	12
Standard deviation	900-4500	24: Kuhio-Lanikai NBTH	7.550398	171.937043	58
Standard deviation	900-4500	25: Kuhio-Lanikai WBLT	1.314406	12.801908	6
Standard deviation	900-4500	26: Kuhio-Lanikai WBRT	0.565145	22.815806	5
Standard deviation	900-4500	27: Kuhio-Haleilio SBTH	4.79484	52.431667	34
Standard deviation	900-4500	28: Kuhio-Haleilio NBLT	4.692718	164.197868	18
Standard deviation	900-4500	29: Kuhio-Haleilio NBTH	3.904213	109.643963	34
Standard deviation	900-4500	30: Kuhio-Haleilio EBLT	3.494212	17.480389	9
Standard deviation	900-4500	31: Kuhio-Haleilio EBRT	0.494211	26.694452	5
Standard deviation	900-4500	33: Kuhio-Papaloa S NBRT	7.98048	243.283311	39
Standard deviation	900-4500	34: Kuhio-Papaloa S WBRT	0.096053	23.044046	2
Standard deviation	900-4500	35: Kuhio-Kuamoo SBTH	4.259148	88.604422	35
Standard deviation	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Standard deviation	900-4500	37: Kuhio-Kuamoo NBLT	8.210972	308.584557	22
Standard deviation	900-4500	38: Kuhio-Kuamoo NBTH	9.174037	142.05915	42
Standard deviation	900-4500	39: Kuhio-Kuamoo EBLT	8.386003	155.462917	16
Standard deviation	900-4500	40: Kuhio-Kuamoo EBRT	6.511745	198.589629	20
Minimum	900-4500	1: Kuhio-Aleka N SBLT	0.596585	66.609458	5
Minimum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Minimum	900-4500	3: Kuhio-Aleka N NBTH	0.004464	19.180034	1
Minimum	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
Minimum	900-4500	5: Kuhio-Aleka N WBLT	0.054456	35.621136	4
Minimum	900-4500	6: Kuhio-Aleka N WBRT	0.446413	52.631507	13
Minimum	900-4500	7: Kuhio-Aleka S SBLT	0.063037	21.458824	1
Minimum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Minimum	900-4500	9: Kuhio-Aleka S NBTH	0.119023	125.888411	0
Minimum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Minimum	900-4500	11: Kuhio-Aleka S WBLT	7.342986	107.486789	151
Minimum	900-4500	12: Kuhio-Aleka S WBRT	0.927177	80.657929	62
Minimum	900-4500	13: Kuhio-Papaloa N SBLT	0.335529	29.091888	3
Minimum	900-4500	14: Kuhio-Papaloa N NBTH	0	0	0
Minimum	900-4500	15: Kuhio-Papaloa N NBRT	0	0	0
Minimum	900-4500	16: Kuhio-Papaloa N WBRT	0.267348	48.774093	7
Minimum	900-4500	17: Kuhio-KBR SBTH	0	0	0
Minimum	900-4500	18: Kuhio-KBR SBRT	0	0	0
Minimum	900-4500	19: Kuhio-KBR NBLT	223.163585	1217.780776	1344
Minimum	900-4500	20: Kuhio-KBR NBTH	0	0	0
Minimum	900-4500	21: Kuhio-KBR EBLT	0.012674	34.927118	6

Alternative 0: No Action PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Minimum	900-4500	22: Kuhio-KBR EBRT	0	0	0
Minimum	900-4500	23: Kuhio-Lanikai SBTH	0.377362	107.007427	12
Minimum	900-4500	24: Kuhio-Lanikai NBTH	2.065492	129.799227	28
Minimum	900-4500	25: Kuhio-Lanikai WBLT	1.049328	47.335187	32
Minimum	900-4500	26: Kuhio-Lanikai WBRT	1.341766	46.571221	29
Minimum	900-4500	27: Kuhio-Haleilio SBTH	54.338859	419.45366	503
Minimum	900-4500	28: Kuhio-Haleilio NBLT	14.024832	204.079066	93
Minimum	900-4500	29: Kuhio-Haleilio NBTH	18.008178	474.031768	216
Minimum	900-4500	30: Kuhio-Haleilio EBLT	25.903775	256.67021	73
Minimum	900-4500	31: Kuhio-Haleilio EBRT	0.472597	60.979679	2
Minimum	900-4500	33: Kuhio-Papaloa S NBRT	4.403316	249.331526	38
Minimum	900-4500	34: Kuhio-Papaloa S WBRT	0	0	0
Minimum	900-4500	35: Kuhio-Kuamoo SBTH	31.706941	357.109369	311
Minimum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Minimum	900-4500	37: Kuhio-Kuamoo NBLT	18.926675	200.196742	133
Minimum	900-4500	38: Kuhio-Kuamoo NBTH	49.858363	753.058112	443
Minimum	900-4500	39: Kuhio-Kuamoo EBLT	65.594778	301.135421	120
Minimum	900-4500	40: Kuhio-Kuamoo EBRT	6.413515	92.096633	89
Maximum	900-4500	1: Kuhio-Aleka N SBLT	1.86962	123.442276	12
Maximum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Maximum	900-4500	3: Kuhio-Aleka N NBTH	0.327109	154.182064	6
Maximum	900-4500	4: Kuhio-Aleka N NBRT	0.281856	161.49545	3
Maximum	900-4500	5: Kuhio-Aleka N WBLT	0.257875	75.96185	9
Maximum	900-4500	6: Kuhio-Aleka N WBRT	1.426481	108.493045	27
Maximum	900-4500	7: Kuhio-Aleka S SBLT	2.291409	250.641215	10
Maximum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Maximum	900-4500	9: Kuhio-Aleka S NBTH	1.284083	239.007657	2
Maximum	900-4500	10: Kuhio-Aleka S NBRT	0.064409	146.388835	0
Maximum	900-4500	11: Kuhio-Aleka S WBLT	45.293569	218.16472	289
Maximum	900-4500	12: Kuhio-Aleka S WBRT	5.230683	225.804584	81
Maximum	900-4500	13: Kuhio-Papaloa N SBLT	1.268451	75.833225	6
Maximum	900-4500	14: Kuhio-Papaloa N NBTH	0.025215	55.275695	1
Maximum	900-4500	15: Kuhio-Papaloa N NBRT	0.027909	60.978877	1
Maximum	900-4500	16: Kuhio-Papaloa N WBRT	0.687758	71.281196	10
Maximum	900-4500	17: Kuhio-KBR SBTH	0	0	0
Maximum	900-4500	18: Kuhio-KBR SBRT	0.248187	42.618434	4
Maximum	900-4500	19: Kuhio-KBR NBLT	384.753934	1256.103631	2321
Maximum	900-4500	20: Kuhio-KBR NBTH	0	0	0
Maximum	900-4500	21: Kuhio-KBR EBLT	1.412606	74.333868	12
Maximum	900-4500	22: Kuhio-KBR EBRT	0.005408	19.857088	1
Maximum	900-4500	23: Kuhio-Lanikai SBTH	2.707111	149.20918	42
Maximum	900-4500	24: Kuhio-Lanikai NBTH	17.342615	524.403863	150

Alternative 0: No Action PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Maximum	900-4500	25: Kuhio-Lanikai WBLT	3.968787	75.80566	44
Maximum	900-4500	26: Kuhio-Lanikai WBRT	2.566326	98.175201	40
Maximum	900-4500	27: Kuhio-Haleilio SBTH	65.611232	531.231606	583
Maximum	900-4500	28: Kuhio-Haleilio NBLT	26.545094	625.218463	141
Maximum	900-4500	29: Kuhio-Haleilio NBTH	26.890703	735.116959	306
Maximum	900-4500	30: Kuhio-Haleilio EBLT	35.480996	301.950518	92
Maximum	900-4500	31: Kuhio-Haleilio EBRT	1.680607	126.962081	16
Maximum	900-4500	33: Kuhio-Papaloa S NBRT	22.069128	862.74781	133
Maximum	900-4500	34: Kuhio-Papaloa S WBRT	0.205862	52.142494	4
Maximum	900-4500	35: Kuhio-Kuamoo SBTH	42.843351	575.166871	391
Maximum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Maximum	900-4500	37: Kuhio-Kuamoo NBLT	38.538401	1025.792708	189
Maximum	900-4500	38: Kuhio-Kuamoo NBTH	71.753993	1121.879535	552
Maximum	900-4500	39: Kuhio-Kuamoo EBLT	89.261444	661.485345	164
Maximum	900-4500	40: Kuhio-Kuamoo EBRT	22.96299	597.013444	145
95% percentile	900-4500	1: Kuhio-Aleka N SBLT	1.86962	123.442276	12
95% percentile	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
95% percentile	900-4500	3: Kuhio-Aleka N NBTH	0.327109	154.182064	6
95% percentile	900-4500	4: Kuhio-Aleka N NBRT	0.281856	161.49545	3
95% percentile	900-4500	5: Kuhio-Aleka N WBLT	0.257875	75.96185	9
95% percentile	900-4500	6: Kuhio-Aleka N WBRT	1.426481	108.493045	27
95% percentile	900-4500	7: Kuhio-Aleka S SBLT	2.291409	250.641215	10
95% percentile	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
95% percentile	900-4500	9: Kuhio-Aleka S NBTH	1.284083	239.007657	2
95% percentile	900-4500	10: Kuhio-Aleka S NBRT	0.064409	146.388835	0
95% percentile	900-4500	11: Kuhio-Aleka S WBLT	45.293569	218.16472	289
95% percentile	900-4500	12: Kuhio-Aleka S WBRT	5.230683	225.804584	81
95% percentile	900-4500	13: Kuhio-Papaloa N SBLT	1.268451	75.833225	6
95% percentile	900-4500	14: Kuhio-Papaloa N NBTH	0.025215	55.275695	1
95% percentile	900-4500	15: Kuhio-Papaloa N NBRT	0.027909	60.978877	1
95% percentile	900-4500	16: Kuhio-Papaloa N WBRT	0.687758	71.281196	10
95% percentile	900-4500	17: Kuhio-KBR SBTH	0	0	0
95% percentile	900-4500	18: Kuhio-KBR SBRT	0.248187	42.618434	4
95% percentile	900-4500	19: Kuhio-KBR NBLT	384.753934	1256.103631	2321
95% percentile	900-4500	20: Kuhio-KBR NBTH	0	0	0
95% percentile	900-4500	21: Kuhio-KBR EBLT	1.412606	74.333868	12
95% percentile	900-4500	22: Kuhio-KBR EBRT	0.005408	19.857088	1
95% percentile	900-4500	23: Kuhio-Lanikai SBTH	2.707111	149.20918	42
95% percentile	900-4500	24: Kuhio-Lanikai NBTH	17.342615	524.403863	150
95% percentile	900-4500	25: Kuhio-Lanikai WBLT	3.968787	75.80566	44
95% percentile	900-4500	26: Kuhio-Lanikai WBRT	2.566326	98.175201	40
95% percentile	900-4500	27: Kuhio-Haleilio SBTH	65.611232	531.231606	583

Alternative 0: No Action PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
95% percentile	900-4500	28: Kuhio-Haleilio NBLT	26.545094	625.218463	141
95% percentile	900-4500	29: Kuhio-Haleilio NBTH	26.890703	735.116959	306
95% percentile	900-4500	30: Kuhio-Haleilio EBLT	35.480996	301.950518	92
95% percentile	900-4500	31: Kuhio-Haleilio EBRT	1.680607	126.962081	16
95% percentile	900-4500	33: Kuhio-Papaloa S NBRT	22.069128	862.74781	133
95% percentile	900-4500	34: Kuhio-Papaloa S WBRT	0.205862	52.142494	4
95% percentile	900-4500	35: Kuhio-Kuamoo SBTH	42.843351	575.166871	391
95% percentile	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
95% percentile	900-4500	37: Kuhio-Kuamoo NBLT	38.538401	1025.792708	189
95% percentile	900-4500	38: Kuhio-Kuamoo NBTH	71.753993	1121.879535	552
95% percentile	900-4500	39: Kuhio-Kuamoo EBLT	89.261444	661.485345	164
95% percentile	900-4500	40: Kuhio-Kuamoo EBRT	22.96299	597.013444	145

APPENDIX B

VISSIM SIMULATION RESULTS

- Alternative 1: Double-Lane Roundabout

Alternative 1: Double-Lane Roundabout AM - Travel Time Results

SimRun	TimeInt	VehicleTravelTimeMeasurement	Vehs(All)	TravTm(All)	DistTrav(All)
1	900-4500	1: Kuhio SB	623	193.068942	7592.677857
1	900-4500	2: Kuhio NB	462	171.259794	7602.991261
1	900-4500	3: Kapaa Bypass Rd SB	756	218.781408	7623.121988
1	900-4500	4: Kapaa Bypass Rd NB	85	179.591159	7840.158071
2	900-4500	1: Kuhio SB	610	192.120557	7592.677857
2	900-4500	2: Kuhio NB	436	171.029751	7602.991261
2	900-4500	3: Kapaa Bypass Rd SB	736	207.616041	7623.331236
2	900-4500	4: Kapaa Bypass Rd NB	99	177.443247	7840.158071
3	900-4500	1: Kuhio SB	606	192.604699	7592.677857
3	900-4500	2: Kuhio NB	437	169.040362	7602.991261
3	900-4500	3: Kapaa Bypass Rd SB	752	215.590079	7623.23891
3	900-4500	4: Kapaa Bypass Rd NB	102	178.213764	7840.158071
4	900-4500	1: Kuhio SB	588	196.032447	7592.677857
4	900-4500	2: Kuhio NB	441	169.508566	7602.991261
4	900-4500	3: Kapaa Bypass Rd SB	709	204.117452	7623.068459
4	900-4500	4: Kapaa Bypass Rd NB	96	178.262269	7840.158071
5	900-4500	1: Kuhio SB	600	194.566081	7592.677857
5	900-4500	2: Kuhio NB	466	172.279461	7602.991261
5	900-4500	3: Kapaa Bypass Rd SB	697	206.101444	7623.110704
5	900-4500	4: Kapaa Bypass Rd NB	105	174.353242	7840.158071
Avg	900-4500	1: Kuhio SB	605	193.678545	7592.677857
Avg	900-4500	2: Kuhio NB	448	170.623587	7602.991261
Avg	900-4500	3: Kapaa Bypass Rd SB	730	210.441285	7623.174259
Avg	900-4500	4: Kapaa Bypass Rd NB	97	177.572736	7840.158071
Standard deviation	900-4500	1: Kuhio SB	13	1.603174	0
Standard deviation	900-4500	2: Kuhio NB	14	1.328676	0
Standard deviation	900-4500	3: Kapaa Bypass Rd SB	26	6.381121	0.108151
Standard deviation	900-4500	4: Kapaa Bypass Rd NB	8	1.958463	0
Minimum	900-4500	1: Kuhio SB	588	192.120557	7592.677857
Minimum	900-4500	2: Kuhio NB	436	169.040362	7602.991261
Minimum	900-4500	3: Kapaa Bypass Rd SB	697	204.117452	7623.068459
Minimum	900-4500	4: Kapaa Bypass Rd NB	85	174.353242	7840.158071
Maximum	900-4500	1: Kuhio SB	623	196.032447	7592.677857
Maximum	900-4500	2: Kuhio NB	466	172.279461	7602.991261
Maximum	900-4500	3: Kapaa Bypass Rd SB	756	218.781408	7623.331236
Maximum	900-4500	4: Kapaa Bypass Rd NB	105	179.591159	7840.158071
95% percentile	900-4500	1: Kuhio SB	623	196.032447	7592.677857
95% percentile	900-4500	2: Kuhio NB	466	172.279461	7602.991261
95% percentile	900-4500	3: Kapaa Bypass Rd SB	756	218.781408	7623.331236
95% percentile	900-4500	4: Kapaa Bypass Rd NB	105	179.591159	7840.158071

Alternative 1: Double-Lane Roundabout AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
1	900-4500	1: Kuhio-Aleka N SBLT	0.340726	74.845454	3
1	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
1	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
1	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
1	900-4500	5: Kuhio-Aleka N WBLT	0.07092	35.153272	3
1	900-4500	6: Kuhio-Aleka N WBRT	0.338076	52.740329	9
1	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
1	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
1	900-4500	9: Kuhio-Aleka S NBTH	0.039981	53.105106	1
1	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
1	900-4500	11: Kuhio-Aleka S WBLT	0.524039	63.251878	65
1	900-4500	12: Kuhio-Aleka S WBRT	0.171453	38.339561	31
1	900-4500	23: Kuhio-Lanikai SBTH	0.402229	127.700795	12
1	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
1	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
1	900-4500	26: Kuhio-Lanikai WBRT	0.260153	26.623374	10
1	900-4500	27: Kuhio-Haleilio SBTH	64.139871	524.973783	582
1	900-4500	28: Kuhio-Haleilio NBLT	0.531275	45.026154	5
1	900-4500	29: Kuhio-Haleilio NBTH	7.572272	183.875815	107
1	900-4500	30: Kuhio-Haleilio EBLT	68.091579	366.90311	159
1	900-4500	31: Kuhio-Haleilio EBRT	7.786905	187.511414	60
1	900-4500	33: Kuhio-Papaloa S NBRT	0.013099	38.807569	1
1	900-4500	34: Kuhio-Papaloa S WBRT	0.790325	72.86903	10
1	900-4500	35: Kuhio-Kuamoo SBTH	149.393687	1105.827332	887
1	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
1	900-4500	37: Kuhio-Kuamoo NBLT	12.969772	236.932786	66
1	900-4500	38: Kuhio-Kuamoo NBTH	16.740747	266.124976	208
1	900-4500	39: Kuhio-Kuamoo EBLT	1212.806493	1713.567746	2791
1	900-4500	40: Kuhio-Kuamoo EBRT	1307.161678	1713.551368	3401
1	900-4500	140: Kuhio-KBR WB	0.159228	35.688709	7
1	900-4500	141: Kuhio-KBR EBRT	174.106706	1040.887712	849
1	900-4500	142: Kuhio-KBR NB	0.292938	62.996329	6
1	900-4500	143: Kuhio-KBR SB	4.837855	216.069467	72
1	900-4500	144: Kuhio-KBR EB	0.826782	71.696781	8
2	900-4500	1: Kuhio-Aleka N SBLT	0.494096	76.312182	5
2	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
2	900-4500	3: Kuhio-Aleka N NBTH	0.120444	122.520916	3
2	900-4500	4: Kuhio-Aleka N NBRT	0.084303	127.750839	0
2	900-4500	5: Kuhio-Aleka N WBLT	0.100482	56.479716	6
2	900-4500	6: Kuhio-Aleka N WBRT	0.309821	70.734349	9
2	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
2	900-4500	8: Kuhio-Aleka S SBTH	0	0	0

Alternative 1: Double-Lane Roundabout AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
2	900-4500	9: Kuhio-Aleka S NBTH	0	0	0
2	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
2	900-4500	11: Kuhio-Aleka S WBLT	0.551056	63.34405	58
2	900-4500	12: Kuhio-Aleka S WBRT	0.393218	72.629778	49
2	900-4500	23: Kuhio-Lanikai SBTH	0.038469	40.352752	3
2	900-4500	24: Kuhio-Lanikai NBTH	0.076584	73.825689	2
2	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
2	900-4500	26: Kuhio-Lanikai WBRT	0.381526	27.344643	16
2	900-4500	27: Kuhio-Haleilio SBTH	61.19492	524.006707	567
2	900-4500	28: Kuhio-Haleilio NBLT	1.523229	83.403105	11
2	900-4500	29: Kuhio-Haleilio NBTH	5.764689	292.110717	99
2	900-4500	30: Kuhio-Haleilio EBLT	40.414145	234.007522	113
2	900-4500	31: Kuhio-Haleilio EBRT	10.619532	204.030368	66
2	900-4500	33: Kuhio-Papaloa S NBRT	0.376896	213.609946	3
2	900-4500	34: Kuhio-Papaloa S WBRT	0.563164	53.230533	8
2	900-4500	35: Kuhio-Kuamoo SBTH	118.455827	974.070774	758
2	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
2	900-4500	37: Kuhio-Kuamoo NBLT	13.25313	125.877967	59
2	900-4500	38: Kuhio-Kuamoo NBTH	20.692746	265.585071	222
2	900-4500	39: Kuhio-Kuamoo EBLT	608.361823	1713.65548	1093
2	900-4500	40: Kuhio-Kuamoo EBRT	913.487434	1713.627216	2220
2	900-4500	140: Kuhio-KBR WB	0.181096	38.546502	5
2	900-4500	141: Kuhio-KBR EBRT	97.036811	1055.477484	499
2	900-4500	142: Kuhio-KBR NB	0.121135	56.414208	3
2	900-4500	143: Kuhio-KBR SB	5.405692	167.429747	56
2	900-4500	144: Kuhio-KBR EB	2.106936	114.951978	17
3	900-4500	1: Kuhio-Aleka N SBLT	0.186508	72.897146	2
3	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
3	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
3	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
3	900-4500	5: Kuhio-Aleka N WBLT	0.000872	15.766559	2
3	900-4500	6: Kuhio-Aleka N WBRT	0.269145	51.889508	9
3	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
3	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
3	900-4500	9: Kuhio-Aleka S NBTH	0	0	0
3	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
3	900-4500	11: Kuhio-Aleka S WBLT	0.598663	84.822568	55
3	900-4500	12: Kuhio-Aleka S WBRT	0.084392	69.153907	35
3	900-4500	23: Kuhio-Lanikai SBTH	1.124098	239.83437	14
3	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
3	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
3	900-4500	26: Kuhio-Lanikai WBRT	0.364003	26.393496	14

Alternative 1: Double-Lane Roundabout AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
3	900-4500	27: Kuhio-Haleilio SBTH	62.978229	517.559886	574
3	900-4500	28: Kuhio-Haleilio NBLT	1.808172	67.630266	13
3	900-4500	29: Kuhio-Haleilio NBTH	6.001027	197.778442	99
3	900-4500	30: Kuhio-Haleilio EBLT	35.248597	278.924483	97
3	900-4500	31: Kuhio-Haleilio EBRT	8.35047	188.694421	61
3	900-4500	33: Kuhio-Papaloa S NBRT	0.168642	140.362549	0
3	900-4500	34: Kuhio-Papaloa S WBRT	0.820068	73.709073	10
3	900-4500	35: Kuhio-Kuamoo SBTH	148.922548	1167.46902	881
3	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
3	900-4500	37: Kuhio-Kuamoo NBLT	11.568175	210.323618	66
3	900-4500	38: Kuhio-Kuamoo NBTH	20.564519	307.182521	219
3	900-4500	39: Kuhio-Kuamoo EBLT	56.251763	1061.051839	111
3	900-4500	40: Kuhio-Kuamoo EBRT	524.790447	1207.357619	1433
3	900-4500	140: Kuhio-KBR WB	0.046858	38.317731	6
3	900-4500	141: Kuhio-KBR EBRT	162.983104	1511.129045	744
3	900-4500	142: Kuhio-KBR NB	0.045006	36.353971	2
3	900-4500	143: Kuhio-KBR SB	2.157223	121.707737	58
3	900-4500	144: Kuhio-KBR EB	1.643537	135.772304	16
4	900-4500	1: Kuhio-Aleka N SBLT	0.086763	32.734597	2
4	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
4	900-4500	3: Kuhio-Aleka N NBTH	0.002673	17.090081	1
4	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
4	900-4500	5: Kuhio-Aleka N WBLT	0.136521	36.743381	3
4	900-4500	6: Kuhio-Aleka N WBRT	0.280971	51.353896	7
4	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
4	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
4	900-4500	9: Kuhio-Aleka S NBTH	0	0	0
4	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
4	900-4500	11: Kuhio-Aleka S WBLT	0.86967	85.157381	71
4	900-4500	12: Kuhio-Aleka S WBRT	0.167063	39.570863	34
4	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
4	900-4500	24: Kuhio-Lanikai NBTH	0.016103	45.2559	1
4	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
4	900-4500	26: Kuhio-Lanikai WBRT	0.301873	26.328302	12
4	900-4500	27: Kuhio-Haleilio SBTH	63.698896	464.934679	608
4	900-4500	28: Kuhio-Haleilio NBLT	1.227835	90.309119	10
4	900-4500	29: Kuhio-Haleilio NBTH	4.262585	171.301206	80
4	900-4500	30: Kuhio-Haleilio EBLT	34.527064	292.951211	120
4	900-4500	31: Kuhio-Haleilio EBRT	6.60565	106.102414	58
4	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
4	900-4500	34: Kuhio-Papaloa S WBRT	0.691029	52.102219	11
4	900-4500	35: Kuhio-Kuamoo SBTH	138.824676	956.966062	868

Alternative 1: Double-Lane Roundabout AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
4	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
4	900-4500	37: Kuhio-Kuamoo NBLT	7.733953	83.934192	60
4	900-4500	38: Kuhio-Kuamoo NBTH	18.013739	294.971927	214
4	900-4500	39: Kuhio-Kuamoo EBLT	52.62088	782.578607	111
4	900-4500	40: Kuhio-Kuamoo EBRT	817.305686	1695.319595	2012
4	900-4500	140: Kuhio-KBR WB	0.193755	77.78136	6
4	900-4500	141: Kuhio-KBR EBRT	41.284308	561.178358	312
4	900-4500	142: Kuhio-KBR NB	0.107619	77.061702	3
4	900-4500	143: Kuhio-KBR SB	2.596643	99.453771	58
4	900-4500	144: Kuhio-KBR EB	0.105114	34.040439	2
5	900-4500	1: Kuhio-Aleka N SBLT	0.399581	53.538725	4
5	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
5	900-4500	3: Kuhio-Aleka N NBTH	0.019284	27.954694	2
5	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
5	900-4500	5: Kuhio-Aleka N WBLT	0.179631	39.780955	5
5	900-4500	6: Kuhio-Aleka N WBRT	0.039047	50.204415	2
5	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
5	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
5	900-4500	9: Kuhio-Aleka S NBTH	0.002705	97.382592	0
5	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
5	900-4500	11: Kuhio-Aleka S WBLT	0.64735	105.784929	57
5	900-4500	12: Kuhio-Aleka S WBRT	0.111139	80.573474	35
5	900-4500	23: Kuhio-Lanikai SBTH	0.306084	81.182189	5
5	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
5	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
5	900-4500	26: Kuhio-Lanikai WBRT	0.4608	26.196699	15
5	900-4500	27: Kuhio-Haleilio SBTH	62.09495	524.436086	611
5	900-4500	28: Kuhio-Haleilio NBLT	4.592131	136.003348	14
5	900-4500	29: Kuhio-Haleilio NBTH	7.68936	370.459939	113
5	900-4500	30: Kuhio-Haleilio EBLT	39.339344	404.040651	138
5	900-4500	31: Kuhio-Haleilio EBRT	7.428156	173.184132	60
5	900-4500	33: Kuhio-Papaloa S NBRT	0.479895	165.139947	1
5	900-4500	34: Kuhio-Papaloa S WBRT	0.721627	53.066155	12
5	900-4500	35: Kuhio-Kuamoo SBTH	136.329677	935.282995	823
5	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
5	900-4500	37: Kuhio-Kuamoo NBLT	15.733658	197.190714	77
5	900-4500	38: Kuhio-Kuamoo NBTH	19.438658	274.980792	219
5	900-4500	39: Kuhio-Kuamoo EBLT	904.463186	1697.718491	1728
5	900-4500	40: Kuhio-Kuamoo EBRT	1271.869057	1699.633608	2916
5	900-4500	140: Kuhio-KBR WB	0.004832	17.021229	3
5	900-4500	141: Kuhio-KBR EBRT	61.063593	689.376298	394
5	900-4500	142: Kuhio-KBR NB	0.319577	83.398259	7

Alternative 1: Double-Lane Roundabout AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
5	900-4500	143: Kuhio-KBR SB	3.931779	112.360544	71
5	900-4500	144: Kuhio-KBR EB	1.216605	94.263091	7
Avg	900-4500	1: Kuhio-Aleka N SBLT	0.301535	62.065621	3
Avg	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Avg	900-4500	3: Kuhio-Aleka N NBTH	0.02848	33.513138	1
Avg	900-4500	4: Kuhio-Aleka N NBRT	0.016861	25.550168	0
Avg	900-4500	5: Kuhio-Aleka N WBLT	0.097685	36.784776	4
Avg	900-4500	6: Kuhio-Aleka N WBRT	0.247412	55.384499	7
Avg	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
Avg	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Avg	900-4500	9: Kuhio-Aleka S NBTH	0.008537	30.09754	0
Avg	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Avg	900-4500	11: Kuhio-Aleka S WBLT	0.638155	80.472161	61
Avg	900-4500	12: Kuhio-Aleka S WBRT	0.185453	60.053517	37
Avg	900-4500	23: Kuhio-Lanikai SBTH	0.374176	97.814021	7
Avg	900-4500	24: Kuhio-Lanikai NBTH	0.018537	23.816318	1
Avg	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Avg	900-4500	26: Kuhio-Lanikai WBRT	0.353671	26.577303	13
Avg	900-4500	27: Kuhio-Haleilio SBTH	62.821373	511.182228	588
Avg	900-4500	28: Kuhio-Haleilio NBLT	1.936528	84.474398	11
Avg	900-4500	29: Kuhio-Haleilio NBTH	6.257987	243.105224	100
Avg	900-4500	30: Kuhio-Haleilio EBLT	43.524146	315.365395	125
Avg	900-4500	31: Kuhio-Haleilio EBRT	8.158143	171.90455	61
Avg	900-4500	33: Kuhio-Papaloa S NBRT	0.207707	111.584002	1
Avg	900-4500	34: Kuhio-Papaloa S WBRT	0.717243	60.995402	10
Avg	900-4500	35: Kuhio-Kuamoo SBTH	138.385283	1027.923236	843
Avg	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Avg	900-4500	37: Kuhio-Kuamoo NBLT	12.251738	170.851856	66
Avg	900-4500	38: Kuhio-Kuamoo NBTH	19.090082	281.769057	216
Avg	900-4500	39: Kuhio-Kuamoo EBLT	566.900829	1393.714432	1167
Avg	900-4500	40: Kuhio-Kuamoo EBRT	966.92286	1605.897881	2396
Avg	900-4500	140: Kuhio-KBR WB	0.117154	41.471106	5
Avg	900-4500	141: Kuhio-KBR EBRT	107.294904	971.60978	560
Avg	900-4500	142: Kuhio-KBR NB	0.177255	63.244894	4
Avg	900-4500	143: Kuhio-KBR SB	3.785839	143.404253	63
Avg	900-4500	144: Kuhio-KBR EB	1.179795	90.144919	10
Standard deviation	900-4500	1: Kuhio-Aleka N SBLT	0.164002	18.819056	1
Standard deviation	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Standard deviation	900-4500	3: Kuhio-Aleka N NBTH	0.052034	51.159697	1
Standard deviation	900-4500	4: Kuhio-Aleka N NBRT	0.037702	57.131912	0
Standard deviation	900-4500	5: Kuhio-Aleka N WBLT	0.067676	14.502558	2
Standard deviation	900-4500	6: Kuhio-Aleka N WBRT	0.119509	8.629941	3

Alternative 1: Double-Lane Roundabout AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Standard deviation	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
Standard deviation	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Standard deviation	900-4500	9: Kuhio-Aleka S NBTH	0.017616	44.085746	0
Standard deviation	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Standard deviation	900-4500	11: Kuhio-Aleka S WBLT	0.137706	17.829216	7
Standard deviation	900-4500	12: Kuhio-Aleka S WBRT	0.121898	19.704588	7
Standard deviation	900-4500	23: Kuhio-Lanikai SBTH	0.452911	92.478371	6
Standard deviation	900-4500	24: Kuhio-Lanikai NBTH	0.03319	34.140313	1
Standard deviation	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Standard deviation	900-4500	26: Kuhio-Lanikai WBRT	0.077117	0.455955	2
Standard deviation	900-4500	27: Kuhio-Haleilio SBTH	1.194375	26.028107	20
Standard deviation	900-4500	28: Kuhio-Haleilio NBLT	1.558565	33.6538	4
Standard deviation	900-4500	29: Kuhio-Haleilio NBTH	1.420139	85.643475	12
Standard deviation	900-4500	30: Kuhio-Haleilio EBLT	13.965812	68.863772	24
Standard deviation	900-4500	31: Kuhio-Haleilio EBRT	1.514625	38.370238	3
Standard deviation	900-4500	33: Kuhio-Papaloa S NBRT	0.215204	89.237234	1
Standard deviation	900-4500	34: Kuhio-Papaloa S WBRT	0.10045	11.234715	1
Standard deviation	900-4500	35: Kuhio-Kuamoo SBTH	12.587898	102.541817	54
Standard deviation	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Standard deviation	900-4500	37: Kuhio-Kuamoo NBLT	2.937676	63.631312	7
Standard deviation	900-4500	38: Kuhio-Kuamoo NBTH	1.698668	18.526327	6
Standard deviation	900-4500	39: Kuhio-Kuamoo EBLT	514.32184	441.938424	1139
Standard deviation	900-4500	40: Kuhio-Kuamoo EBRT	327.672226	222.941614	772
Standard deviation	900-4500	140: Kuhio-KBR WB	0.085563	22.181998	2
Standard deviation	900-4500	141: Kuhio-KBR EBRT	59.508306	371.154938	229
Standard deviation	900-4500	142: Kuhio-KBR NB	0.12158	18.485833	2
Standard deviation	900-4500	143: Kuhio-KBR SB	1.398082	48.019666	8
Standard deviation	900-4500	144: Kuhio-KBR EB	0.767392	39.377196	6
Minimum	900-4500	1: Kuhio-Aleka N SBLT	0.086763	32.734597	2
Minimum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Minimum	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
Minimum	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
Minimum	900-4500	5: Kuhio-Aleka N WBLT	0.000872	15.766559	2
Minimum	900-4500	6: Kuhio-Aleka N WBRT	0.039047	50.204415	2
Minimum	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
Minimum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Minimum	900-4500	9: Kuhio-Aleka S NBTH	0	0	0
Minimum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Minimum	900-4500	11: Kuhio-Aleka S WBLT	0.524039	63.251878	55
Minimum	900-4500	12: Kuhio-Aleka S WBRT	0.084392	38.339561	31
Minimum	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
Minimum	900-4500	24: Kuhio-Lanikai NBTH	0	0	0

Alternative 1: Double-Lane Roundabout AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Minimum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Minimum	900-4500	26: Kuhio-Lanikai WBRT	0.260153	26.196699	10
Minimum	900-4500	27: Kuhio-Haleilio SBTH	61.19492	464.934679	567
Minimum	900-4500	28: Kuhio-Haleilio NBLT	0.531275	45.026154	5
Minimum	900-4500	29: Kuhio-Haleilio NBTH	4.262585	171.301206	80
Minimum	900-4500	30: Kuhio-Haleilio EBLT	34.527064	234.007522	97
Minimum	900-4500	31: Kuhio-Haleilio EBRT	6.60565	106.102414	58
Minimum	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
Minimum	900-4500	34: Kuhio-Papaloa S WBRT	0.563164	52.102219	8
Minimum	900-4500	35: Kuhio-Kuamoo SBTH	118.455827	935.282995	758
Minimum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Minimum	900-4500	37: Kuhio-Kuamoo NBLT	7.733953	83.934192	59
Minimum	900-4500	38: Kuhio-Kuamoo NBTH	16.740747	265.585071	208
Minimum	900-4500	39: Kuhio-Kuamoo EBLT	52.62088	782.578607	111
Minimum	900-4500	40: Kuhio-Kuamoo EBRT	524.790447	1207.357619	1433
Minimum	900-4500	140: Kuhio-KBR WB	0.004832	17.021229	3
Minimum	900-4500	141: Kuhio-KBR EBRT	41.284308	561.178358	312
Minimum	900-4500	142: Kuhio-KBR NB	0.045006	36.353971	2
Minimum	900-4500	143: Kuhio-KBR SB	2.157223	99.453771	56
Minimum	900-4500	144: Kuhio-KBR EB	0.105114	34.040439	2
Maximum	900-4500	1: Kuhio-Aleka N SBLT	0.494096	76.312182	5
Maximum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Maximum	900-4500	3: Kuhio-Aleka N NBTH	0.120444	122.520916	3
Maximum	900-4500	4: Kuhio-Aleka N NBRT	0.084303	127.750839	0
Maximum	900-4500	5: Kuhio-Aleka N WBLT	0.179631	56.479716	6
Maximum	900-4500	6: Kuhio-Aleka N WBRT	0.338076	70.734349	9
Maximum	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
Maximum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Maximum	900-4500	9: Kuhio-Aleka S NBTH	0.039981	97.382592	1
Maximum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Maximum	900-4500	11: Kuhio-Aleka S WBLT	0.86967	105.784929	71
Maximum	900-4500	12: Kuhio-Aleka S WBRT	0.393218	80.573474	49
Maximum	900-4500	23: Kuhio-Lanikai SBTH	1.124098	239.83437	14
Maximum	900-4500	24: Kuhio-Lanikai NBTH	0.076584	73.825689	2
Maximum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Maximum	900-4500	26: Kuhio-Lanikai WBRT	0.4608	27.344643	16
Maximum	900-4500	27: Kuhio-Haleilio SBTH	64.139871	524.973783	611
Maximum	900-4500	28: Kuhio-Haleilio NBLT	4.592131	136.003348	14
Maximum	900-4500	29: Kuhio-Haleilio NBTH	7.68936	370.459939	113
Maximum	900-4500	30: Kuhio-Haleilio EBLT	68.091579	404.040651	159
Maximum	900-4500	31: Kuhio-Haleilio EBRT	10.619532	204.030368	66
Maximum	900-4500	33: Kuhio-Papaloa S NBRT	0.479895	213.609946	3

Alternative 1: Double-Lane Roundabout AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Maximum	900-4500	34: Kuhio-Papaloa S WBRT	0.820068	73.709073	12
Maximum	900-4500	35: Kuhio-Kuamoo SBTH	149.393687	1167.46902	887
Maximum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Maximum	900-4500	37: Kuhio-Kuamoo NBLT	15.733658	236.932786	77
Maximum	900-4500	38: Kuhio-Kuamoo NBTH	20.692746	307.182521	222
Maximum	900-4500	39: Kuhio-Kuamoo EBLT	1212.806493	1713.65548	2791
Maximum	900-4500	40: Kuhio-Kuamoo EBRT	1307.161678	1713.627216	3401
Maximum	900-4500	140: Kuhio-KBR WB	0.193755	77.78136	7
Maximum	900-4500	141: Kuhio-KBR EBRT	174.106706	1511.129045	849
Maximum	900-4500	142: Kuhio-KBR NB	0.319577	83.398259	7
Maximum	900-4500	143: Kuhio-KBR SB	5.405692	216.069467	72
Maximum	900-4500	144: Kuhio-KBR EB	2.106936	135.772304	17
95% percentile	900-4500	1: Kuhio-Aleka N SBLT	0.494096	76.312182	5
95% percentile	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
95% percentile	900-4500	3: Kuhio-Aleka N NBTH	0.120444	122.520916	3
95% percentile	900-4500	4: Kuhio-Aleka N NBRT	0.084303	127.750839	0
95% percentile	900-4500	5: Kuhio-Aleka N WBLT	0.179631	56.479716	6
95% percentile	900-4500	6: Kuhio-Aleka N WBRT	0.338076	70.734349	9
95% percentile	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
95% percentile	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
95% percentile	900-4500	9: Kuhio-Aleka S NBTH	0.039981	97.382592	1
95% percentile	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
95% percentile	900-4500	11: Kuhio-Aleka S WBLT	0.86967	105.784929	71
95% percentile	900-4500	12: Kuhio-Aleka S WBRT	0.393218	80.573474	49
95% percentile	900-4500	23: Kuhio-Lanikai SBTH	1.124098	239.83437	14
95% percentile	900-4500	24: Kuhio-Lanikai NBTH	0.076584	73.825689	2
95% percentile	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
95% percentile	900-4500	26: Kuhio-Lanikai WBRT	0.4608	27.344643	16
95% percentile	900-4500	27: Kuhio-Haleilio SBTH	64.139871	524.973783	611
95% percentile	900-4500	28: Kuhio-Haleilio NBLT	4.592131	136.003348	14
95% percentile	900-4500	29: Kuhio-Haleilio NBTH	7.68936	370.459939	113
95% percentile	900-4500	30: Kuhio-Haleilio EBLT	68.091579	404.040651	159
95% percentile	900-4500	31: Kuhio-Haleilio EBRT	10.619532	204.030368	66
95% percentile	900-4500	33: Kuhio-Papaloa S NBRT	0.479895	213.609946	3
95% percentile	900-4500	34: Kuhio-Papaloa S WBRT	0.820068	73.709073	12
95% percentile	900-4500	35: Kuhio-Kuamoo SBTH	149.393687	1167.46902	887
95% percentile	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
95% percentile	900-4500	37: Kuhio-Kuamoo NBLT	15.733658	236.932786	77
95% percentile	900-4500	38: Kuhio-Kuamoo NBTH	20.692746	307.182521	222
95% percentile	900-4500	39: Kuhio-Kuamoo EBLT	1212.806493	1713.65548	2791
95% percentile	900-4500	40: Kuhio-Kuamoo EBRT	1307.161678	1713.627216	3401
95% percentile	900-4500	140: Kuhio-KBR WB	0.193755	77.78136	7

Alternative 1: Double-Lane Roundabout AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
95% percentile	900-4500	141: Kuhio-KBR EBRT	174.106706	1511.129045	849
95% percentile	900-4500	142: Kuhio-KBR NB	0.319577	83.398259	7
95% percentile	900-4500	143: Kuhio-KBR SB	5.405692	216.069467	72
95% percentile	900-4500	144: Kuhio-KBR EB	2.106936	135.772304	17

Alternative 1: Double-Lane Roundabout PM - Travel Time Results

SimRun	TimeInt	VehicleTravelTimeMeasurement	Vehs(All)	TravTm(All)	DistTrav(All)
1	900-4500	1: Kuhio SB	342	528.42081	7592.677857
1	900-4500	2: Kuhio NB	543	183.76335	7602.991261
1	900-4500	3: Kapaa Bypass Rd SB	475	228.903447	7623.211287
1	900-4500	4: Kapaa Bypass Rd NB	460	194.742862	7840.158071
2	900-4500	1: Kuhio SB	309	541.226495	7592.677857
2	900-4500	2: Kuhio NB	556	184.05251	7602.991261
2	900-4500	3: Kapaa Bypass Rd SB	432	231.842776	7623.229319
2	900-4500	4: Kapaa Bypass Rd NB	456	195.261481	7840.158071
3	900-4500	1: Kuhio SB	290	595.487775	7592.677857
3	900-4500	2: Kuhio NB	539	177.542164	7602.991261
3	900-4500	3: Kapaa Bypass Rd SB	429	224.595705	7623.187077
3	900-4500	4: Kapaa Bypass Rd NB	493	187.750296	7840.158071
4	900-4500	1: Kuhio SB	306	502.859413	7592.677857
4	900-4500	2: Kuhio NB	545	182.363874	7602.991261
4	900-4500	3: Kapaa Bypass Rd SB	429	230.106133	7623.005501
4	900-4500	4: Kapaa Bypass Rd NB	507	193.597975	7840.158071
5	900-4500	1: Kuhio SB	338	606.076814	7592.677857
5	900-4500	2: Kuhio NB	535	179.162818	7602.991261
5	900-4500	3: Kapaa Bypass Rd SB	435	225.164181	7623.241132
5	900-4500	4: Kapaa Bypass Rd NB	495	187.857891	7840.158071
Avg	900-4500	1: Kuhio SB	317	554.814262	7592.677857
Avg	900-4500	2: Kuhio NB	544	181.376943	7602.991261
Avg	900-4500	3: Kapaa Bypass Rd SB	440	228.122448	7623.174863
Avg	900-4500	4: Kapaa Bypass Rd NB	482	191.842101	7840.158071
Standard deviation	900-4500	1: Kuhio SB	22	44.336023	0
Standard deviation	900-4500	2: Kuhio NB	8	2.891172	0
Standard deviation	900-4500	3: Kapaa Bypass Rd SB	20	3.145436	0.096846
Standard deviation	900-4500	4: Kapaa Bypass Rd NB	23	3.735186	0
Minimum	900-4500	1: Kuhio SB	290	502.859413	7592.677857
Minimum	900-4500	2: Kuhio NB	535	177.542164	7602.991261
Minimum	900-4500	3: Kapaa Bypass Rd SB	429	224.595705	7623.005501
Minimum	900-4500	4: Kapaa Bypass Rd NB	456	187.750296	7840.158071
Maximum	900-4500	1: Kuhio SB	342	606.076814	7592.677857
Maximum	900-4500	2: Kuhio NB	556	184.05251	7602.991261
Maximum	900-4500	3: Kapaa Bypass Rd SB	475	231.842776	7623.241132
Maximum	900-4500	4: Kapaa Bypass Rd NB	507	195.261481	7840.158071
95% percentile	900-4500	1: Kuhio SB	342	606.076814	7592.677857
95% percentile	900-4500	2: Kuhio NB	556	184.05251	7602.991261
95% percentile	900-4500	3: Kapaa Bypass Rd SB	475	231.842776	7623.241132
95% percentile	900-4500	4: Kapaa Bypass Rd NB	507	195.261481	7840.158071

Alternative 1: Double-Lane Roundabout PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
1	900-4500	1: Kuhio-Aleka N SBLT	0.784211	77.550511	8
1	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
1	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
1	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
1	900-4500	5: Kuhio-Aleka N WBLT	0.09221	35.621136	3
1	900-4500	6: Kuhio-Aleka N WBRT	1.113522	110.203139	25
1	900-4500	7: Kuhio-Aleka S SBLT	87.166705	853.092874	353
1	900-4500	8: Kuhio-Aleka S SBTH	363.229901	1048.200775	1734
1	900-4500	9: Kuhio-Aleka S NBTH	0.107521	146.035193	0
1	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
1	900-4500	11: Kuhio-Aleka S WBLT	181.728626	217.085767	227
1	900-4500	12: Kuhio-Aleka S WBRT	88.73478	225.935781	129
1	900-4500	23: Kuhio-Lanikai SBTH	0.136779	58.70383	5
1	900-4500	24: Kuhio-Lanikai NBTH	0.44826	97.33883	14
1	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
1	900-4500	26: Kuhio-Lanikai WBRT	1.329386	49.481896	34
1	900-4500	27: Kuhio-Haleilio SBTH	53.324301	527.736499	519
1	900-4500	28: Kuhio-Haleilio NBLT	35.506328	478.20713	168
1	900-4500	29: Kuhio-Haleilio NBTH	28.142053	566.089061	296
1	900-4500	30: Kuhio-Haleilio EBLT	27.934683	233.399502	84
1	900-4500	31: Kuhio-Haleilio EBRT	0.825367	62.348528	6
1	900-4500	33: Kuhio-Papaloa S NBRT	5.27627	308.788648	43
1	900-4500	34: Kuhio-Papaloa S WBRT	0	0	0
1	900-4500	35: Kuhio-Kuamoo SBTH	50.130382	625.250624	347
1	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
1	900-4500	37: Kuhio-Kuamoo NBLT	111.392866	1123.577753	517
1	900-4500	38: Kuhio-Kuamoo NBTH	96.543403	1124.401884	572
1	900-4500	39: Kuhio-Kuamoo EBLT	106.226997	870.910549	165
1	900-4500	40: Kuhio-Kuamoo EBRT	11.001498	181.863976	106
1	900-4500	140: Kuhio-KBR WB	6.428375	102.848118	39
1	900-4500	141: Kuhio-KBR EBRT	19.655762	555.450626	112
1	900-4500	142: Kuhio-KBR NB	29.728464	454.20883	335
1	900-4500	143: Kuhio-KBR SB	440.81162	495.540355	1945
1	900-4500	144: Kuhio-KBR EB	0.643874	67.698396	5
2	900-4500	1: Kuhio-Aleka N SBLT	1.896175	113.771073	12
2	900-4500	2: Kuhio-Aleka N SBTH	4.049846	433.716256	15
2	900-4500	3: Kuhio-Aleka N NBTH	0.051879	74.905901	1
2	900-4500	4: Kuhio-Aleka N NBRT	0.035356	80.961409	0
2	900-4500	5: Kuhio-Aleka N WBLT	0.35309	76.483647	11
2	900-4500	6: Kuhio-Aleka N WBRT	0.598937	74.577177	18
2	900-4500	7: Kuhio-Aleka S SBLT	326.976621	1655.19178	1139
2	900-4500	8: Kuhio-Aleka S SBTH	482.592736	1655.175489	1939

Alternative 1: Double-Lane Roundabout PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
2	900-4500	9: Kuhio-Aleka S NBTH	0.002251	81.032488	0
2	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
2	900-4500	11: Kuhio-Aleka S WBLT	188.617062	218.257395	266
2	900-4500	12: Kuhio-Aleka S WBRT	101.286109	227.92267	167
2	900-4500	23: Kuhio-Lanikai SBTH	0.052212	30.272263	1
2	900-4500	24: Kuhio-Lanikai NBTH	0.320539	123.301796	4
2	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
2	900-4500	26: Kuhio-Lanikai WBRT	1.503908	64.364344	33
2	900-4500	27: Kuhio-Haleilio SBTH	67.012705	550.500676	574
2	900-4500	28: Kuhio-Haleilio NBLT	8.726514	117.563062	68
2	900-4500	29: Kuhio-Haleilio NBTH	13.246897	392.270399	217
2	900-4500	30: Kuhio-Haleilio EBLT	27.645755	168.594623	72
2	900-4500	31: Kuhio-Haleilio EBRT	0.496534	60.647101	6
2	900-4500	33: Kuhio-Papaloa S NBRT	0.961263	193.230158	14
2	900-4500	34: Kuhio-Papaloa S WBRT	0.179495	51.041757	2
2	900-4500	35: Kuhio-Kuamoo SBTH	68.539811	834.869418	425
2	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
2	900-4500	37: Kuhio-Kuamoo NBLT	135.500861	1137.911887	665
2	900-4500	38: Kuhio-Kuamoo NBTH	72.065804	1118.077687	473
2	900-4500	39: Kuhio-Kuamoo EBLT	79.442576	376.145609	161
2	900-4500	40: Kuhio-Kuamoo EBRT	10.971146	195.335947	101
2	900-4500	140: Kuhio-KBR WB	1.000312	40.098514	24
2	900-4500	141: Kuhio-KBR EBRT	5.442669	169.560764	54
2	900-4500	142: Kuhio-KBR NB	32.583755	570.055226	311
2	900-4500	143: Kuhio-KBR SB	440.600678	502.542946	1802
2	900-4500	144: Kuhio-KBR EB	2.035268	128.675427	12
3	900-4500	1: Kuhio-Aleka N SBLT	1.040798	97.920694	6
3	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
3	900-4500	3: Kuhio-Aleka N NBTH	0.007395	22.02745	1
3	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
3	900-4500	5: Kuhio-Aleka N WBLT	0.04673	55.887612	1
3	900-4500	6: Kuhio-Aleka N WBRT	0.362356	51.149903	10
3	900-4500	7: Kuhio-Aleka S SBLT	1.039732	62.68088	10
3	900-4500	8: Kuhio-Aleka S SBTH	583.274925	1316.611232	2837
3	900-4500	9: Kuhio-Aleka S NBTH	0.455107	196.870734	2
3	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
3	900-4500	11: Kuhio-Aleka S WBLT	171.793785	233.934263	234
3	900-4500	12: Kuhio-Aleka S WBRT	62.451094	237.51224	114
3	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
3	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
3	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
3	900-4500	26: Kuhio-Lanikai WBRT	0.988018	47.965299	31

Alternative 1: Double-Lane Roundabout PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
3	900-4500	27: Kuhio-Haleilio SBTH	53.072707	512.24177	467
3	900-4500	28: Kuhio-Haleilio NBLT	18.079515	422.055973	104
3	900-4500	29: Kuhio-Haleilio NBTH	14.497161	311.497363	204
3	900-4500	30: Kuhio-Haleilio EBLT	32.818212	241.727458	85
3	900-4500	31: Kuhio-Haleilio EBRT	0.614412	84.51703	10
3	900-4500	33: Kuhio-Papaloa S NBRT	3.482495	287.219243	32
3	900-4500	34: Kuhio-Papaloa S WBRT	0.046792	51.091239	1
3	900-4500	35: Kuhio-Kuamoo SBTH	44.697201	688.526022	322
3	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
3	900-4500	37: Kuhio-Kuamoo NBLT	47.028506	490.107078	300
3	900-4500	38: Kuhio-Kuamoo NBTH	43.095409	792.093055	407
3	900-4500	39: Kuhio-Kuamoo EBLT	94.515995	728.923678	145
3	900-4500	40: Kuhio-Kuamoo EBRT	8.507584	209.073152	93
3	900-4500	140: Kuhio-KBR WB	6.164603	126.073332	49
3	900-4500	141: Kuhio-KBR EBRT	4.79304	283.247595	51
3	900-4500	142: Kuhio-KBR NB	23.57871	415.326347	235
3	900-4500	143: Kuhio-KBR SB	427.151477	502.893071	2113
3	900-4500	144: Kuhio-KBR EB	0	0	0
4	900-4500	1: Kuhio-Aleka N SBLT	1.802917	91.592319	13
4	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
4	900-4500	3: Kuhio-Aleka N NBTH	0.015522	71.597496	1
4	900-4500	4: Kuhio-Aleka N NBRT	0.004373	78.910881	1
4	900-4500	5: Kuhio-Aleka N WBLT	0.118498	36.741384	7
4	900-4500	6: Kuhio-Aleka N WBRT	0.770414	76.117912	17
4	900-4500	7: Kuhio-Aleka S SBLT	0.953977	177.203298	11
4	900-4500	8: Kuhio-Aleka S SBTH	387.627207	1499.134643	1579
4	900-4500	9: Kuhio-Aleka S NBTH	0	0	0
4	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
4	900-4500	11: Kuhio-Aleka S WBLT	121.747956	218.306195	207
4	900-4500	12: Kuhio-Aleka S WBRT	43.342895	226.771792	115
4	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
4	900-4500	24: Kuhio-Lanikai NBTH	0.96004	220.276225	10
4	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
4	900-4500	26: Kuhio-Lanikai WBRT	1.906477	67.606097	33
4	900-4500	27: Kuhio-Haleilio SBTH	52.640196	451.496474	485
4	900-4500	28: Kuhio-Haleilio NBLT	12.686156	177.159844	88
4	900-4500	29: Kuhio-Haleilio NBTH	13.308615	506.58371	185
4	900-4500	30: Kuhio-Haleilio EBLT	28.114006	273.031874	74
4	900-4500	31: Kuhio-Haleilio EBRT	0.176583	61.137079	2
4	900-4500	33: Kuhio-Papaloa S NBRT	3.36568	355.068633	29
4	900-4500	34: Kuhio-Papaloa S WBRT	0.275775	52.142494	4
4	900-4500	35: Kuhio-Kuamoo SBTH	44.79295	500.549903	349

Alternative 1: Double-Lane Roundabout PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
4	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
4	900-4500	37: Kuhio-Kuamoo NBLT	78.372969	981.335801	435
4	900-4500	38: Kuhio-Kuamoo NBTH	82.818359	1022.625121	565
4	900-4500	39: Kuhio-Kuamoo EBLT	69.722853	505.315227	132
4	900-4500	40: Kuhio-Kuamoo EBRT	15.305881	195.851551	117
4	900-4500	140: Kuhio-KBR WB	2.436733	125.285724	30
4	900-4500	141: Kuhio-KBR EBRT	23.532061	416.606689	135
4	900-4500	142: Kuhio-KBR NB	25.371065	688.547489	225
4	900-4500	143: Kuhio-KBR SB	374.676509	502.88681	1611
4	900-4500	144: Kuhio-KBR EB	0.22432	47.536383	2
5	900-4500	1: Kuhio-Aleka N SBLT	0.103323	51.116665	3
5	900-4500	2: Kuhio-Aleka N SBTH	2.283743	252.017051	13
5	900-4500	3: Kuhio-Aleka N NBTH	0.114581	121.844557	3
5	900-4500	4: Kuhio-Aleka N NBRT	0.098069	129.157943	1
5	900-4500	5: Kuhio-Aleka N WBLT	0.257875	38.896243	6
5	900-4500	6: Kuhio-Aleka N WBRT	0.563886	52.880741	17
5	900-4500	7: Kuhio-Aleka S SBLT	296.433814	1621.25932	1142
5	900-4500	8: Kuhio-Aleka S SBTH	628.779796	1654.371555	2675
5	900-4500	9: Kuhio-Aleka S NBTH	0.192947	192.947457	0
5	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
5	900-4500	11: Kuhio-Aleka S WBLT	153.036906	218.150193	234
5	900-4500	12: Kuhio-Aleka S WBRT	134.953563	227.888978	147
5	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
5	900-4500	24: Kuhio-Lanikai NBTH	0.013781	26.362002	1
5	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
5	900-4500	26: Kuhio-Lanikai WBRT	1.575249	49.203296	30
5	900-4500	27: Kuhio-Haleilio SBTH	50.672972	445.831027	514
5	900-4500	28: Kuhio-Haleilio NBLT	18.322005	309.436951	94
5	900-4500	29: Kuhio-Haleilio NBTH	14.530191	452.240977	236
5	900-4500	30: Kuhio-Haleilio EBLT	26.139607	278.504988	71
5	900-4500	31: Kuhio-Haleilio EBRT	0.760096	61.648569	9
5	900-4500	33: Kuhio-Papaloa S NBRT	1.734005	194.940563	18
5	900-4500	34: Kuhio-Papaloa S WBRT	0.074724	51.794258	1
5	900-4500	35: Kuhio-Kuamoo SBTH	43.979394	376.843577	374
5	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
5	900-4500	37: Kuhio-Kuamoo NBLT	63.494274	615.351969	347
5	900-4500	38: Kuhio-Kuamoo NBTH	76.465976	842.740717	581
5	900-4500	39: Kuhio-Kuamoo EBLT	105.372144	907.885242	185
5	900-4500	40: Kuhio-Kuamoo EBRT	14.698356	253.470504	126
5	900-4500	140: Kuhio-KBR WB	1.714128	84.17747	28
5	900-4500	141: Kuhio-KBR EBRT	3.204313	195.847978	38
5	900-4500	142: Kuhio-KBR NB	18.287465	545.285337	191

Alternative 1: Double-Lane Roundabout PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
5	900-4500	143: Kuhio-KBR SB	409.568931	502.54818	1838
5	900-4500	144: Kuhio-KBR EB	0.539424	91.894638	5
Avg	900-4500	1: Kuhio-Aleka N SBLT	1.125485	86.390252	8
Avg	900-4500	2: Kuhio-Aleka N SBTH	1.266718	137.146661	6
Avg	900-4500	3: Kuhio-Aleka N NBTH	0.037875	58.075081	1
Avg	900-4500	4: Kuhio-Aleka N NBRT	0.02756	57.806047	0
Avg	900-4500	5: Kuhio-Aleka N WBLT	0.173681	48.726004	6
Avg	900-4500	6: Kuhio-Aleka N WBRT	0.681823	72.985774	17
Avg	900-4500	7: Kuhio-Aleka S SBLT	142.51417	873.88563	531
Avg	900-4500	8: Kuhio-Aleka S SBTH	489.100913	1434.698739	2153
Avg	900-4500	9: Kuhio-Aleka S NBTH	0.151565	123.377174	0
Avg	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Avg	900-4500	11: Kuhio-Aleka S WBLT	163.384867	221.146762	234
Avg	900-4500	12: Kuhio-Aleka S WBRT	86.153688	229.206292	134
Avg	900-4500	23: Kuhio-Lanikai SBTH	0.037798	17.795219	1
Avg	900-4500	24: Kuhio-Lanikai NBTH	0.348524	93.455771	6
Avg	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Avg	900-4500	26: Kuhio-Lanikai WBRT	1.460608	55.724186	32
Avg	900-4500	27: Kuhio-Haleilio SBTH	55.344576	497.561289	512
Avg	900-4500	28: Kuhio-Haleilio NBLT	18.664103	300.884592	104
Avg	900-4500	29: Kuhio-Haleilio NBTH	16.744983	445.736302	228
Avg	900-4500	30: Kuhio-Haleilio EBLT	28.530453	239.051689	77
Avg	900-4500	31: Kuhio-Haleilio EBRT	0.574599	66.059661	7
Avg	900-4500	33: Kuhio-Papaloa S NBRT	2.963943	267.849449	27
Avg	900-4500	34: Kuhio-Papaloa S WBRT	0.115357	41.213949	2
Avg	900-4500	35: Kuhio-Kuamoo SBTH	50.427948	605.207909	363
Avg	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Avg	900-4500	37: Kuhio-Kuamoo NBLT	87.157895	869.656898	453
Avg	900-4500	38: Kuhio-Kuamoo NBTH	74.19779	979.987693	520
Avg	900-4500	39: Kuhio-Kuamoo EBLT	91.056113	677.836061	158
Avg	900-4500	40: Kuhio-Kuamoo EBRT	12.096893	207.119026	109
Avg	900-4500	140: Kuhio-KBR WB	3.54883	95.696632	34
Avg	900-4500	141: Kuhio-KBR EBRT	11.325569	324.14273	78
Avg	900-4500	142: Kuhio-KBR NB	25.909892	534.684646	259
Avg	900-4500	143: Kuhio-KBR SB	418.561843	501.282272	1862
Avg	900-4500	144: Kuhio-KBR EB	0.688577	67.160969	5
Standard deviation	900-4500	1: Kuhio-Aleka N SBLT	0.745207	23.622494	4
Standard deviation	900-4500	2: Kuhio-Aleka N SBTH	1.843493	198.479439	8
Standard deviation	900-4500	3: Kuhio-Aleka N NBTH	0.047284	47.97089	1
Standard deviation	900-4500	4: Kuhio-Aleka N NBRT	0.042098	56.470691	1
Standard deviation	900-4500	5: Kuhio-Aleka N WBLT	0.127549	17.562519	4
Standard deviation	900-4500	6: Kuhio-Aleka N WBRT	0.281536	23.86678	5

Alternative 1: Double-Lane Roundabout PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Standard deviation	900-4500	7: Kuhio-Aleka S SBLT	158.772872	760.40425	574
Standard deviation	900-4500	8: Kuhio-Aleka S SBTH	116.792247	257.071714	568
Standard deviation	900-4500	9: Kuhio-Aleka S NBTH	0.187788	83.321235	1
Standard deviation	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Standard deviation	900-4500	11: Kuhio-Aleka S WBLT	26.854142	7.166041	21
Standard deviation	900-4500	12: Kuhio-Aleka S WBRT	35.396529	4.716853	23
Standard deviation	900-4500	23: Kuhio-Lanikai SBTH	0.059773	26.359062	2
Standard deviation	900-4500	24: Kuhio-Lanikai NBTH	0.39313	86.926472	6
Standard deviation	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Standard deviation	900-4500	26: Kuhio-Lanikai WBRT	0.337038	9.454108	2
Standard deviation	900-4500	27: Kuhio-Haleilio SBTH	6.605408	46.708205	41
Standard deviation	900-4500	28: Kuhio-Haleilio NBLT	10.229991	154.202404	38
Standard deviation	900-4500	29: Kuhio-Haleilio NBTH	6.401102	98.878967	43
Standard deviation	900-4500	30: Kuhio-Haleilio EBLT	2.52052	43.916173	7
Standard deviation	900-4500	31: Kuhio-Haleilio EBRT	0.256608	10.337219	3
Standard deviation	900-4500	33: Kuhio-Papaloa S NBRT	1.68082	71.662642	12
Standard deviation	900-4500	34: Kuhio-Papaloa S WBRT	0.111251	23.044046	2
Standard deviation	900-4500	35: Kuhio-Kuamoo SBTH	10.420013	175.4933	39
Standard deviation	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Standard deviation	900-4500	37: Kuhio-Kuamoo NBLT	35.957913	299.014122	145
Standard deviation	900-4500	38: Kuhio-Kuamoo NBTH	19.689393	154.82521	77
Standard deviation	900-4500	39: Kuhio-Kuamoo EBLT	16.101689	231.079475	20
Standard deviation	900-4500	40: Kuhio-Kuamoo EBRT	2.846733	27.640064	13
Standard deviation	900-4500	140: Kuhio-KBR WB	2.560853	35.613354	10
Standard deviation	900-4500	141: Kuhio-KBR EBRT	9.508257	161.307521	43
Standard deviation	900-4500	142: Kuhio-KBR NB	5.544097	106.957921	61
Standard deviation	900-4500	143: Kuhio-KBR SB	27.664687	3.214446	185
Standard deviation	900-4500	144: Kuhio-KBR EB	0.794905	48.19697	5
Minimum	900-4500	1: Kuhio-Aleka N SBLT	0.103323	51.116665	3
Minimum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Minimum	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
Minimum	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
Minimum	900-4500	5: Kuhio-Aleka N WBLT	0.04673	35.621136	1
Minimum	900-4500	6: Kuhio-Aleka N WBRT	0.362356	51.149903	10
Minimum	900-4500	7: Kuhio-Aleka S SBLT	0.953977	62.68088	10
Minimum	900-4500	8: Kuhio-Aleka S SBTH	363.229901	1048.200775	1579
Minimum	900-4500	9: Kuhio-Aleka S NBTH	0	0	0
Minimum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Minimum	900-4500	11: Kuhio-Aleka S WBLT	121.747956	217.085767	207
Minimum	900-4500	12: Kuhio-Aleka S WBRT	43.342895	225.935781	114
Minimum	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
Minimum	900-4500	24: Kuhio-Lanikai NBTH	0	0	0

Alternative 1: Double-Lane Roundabout PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Minimum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Minimum	900-4500	26: Kuhio-Lanikai WBRT	0.988018	47.965299	30
Minimum	900-4500	27: Kuhio-Haleilio SBTH	50.672972	445.831027	467
Minimum	900-4500	28: Kuhio-Haleilio NBLT	8.726514	117.563062	68
Minimum	900-4500	29: Kuhio-Haleilio NBTH	13.246897	311.497363	185
Minimum	900-4500	30: Kuhio-Haleilio EBLT	26.139607	168.594623	71
Minimum	900-4500	31: Kuhio-Haleilio EBRT	0.176583	60.647101	2
Minimum	900-4500	33: Kuhio-Papaloa S NBRT	0.961263	193.230158	14
Minimum	900-4500	34: Kuhio-Papaloa S WBRT	0	0	0
Minimum	900-4500	35: Kuhio-Kuamoo SBTH	43.979394	376.843577	322
Minimum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Minimum	900-4500	37: Kuhio-Kuamoo NBLT	47.028506	490.107078	300
Minimum	900-4500	38: Kuhio-Kuamoo NBTH	43.095409	792.093055	407
Minimum	900-4500	39: Kuhio-Kuamoo EBLT	69.722853	376.145609	132
Minimum	900-4500	40: Kuhio-Kuamoo EBRT	8.507584	181.863976	93
Minimum	900-4500	140: Kuhio-KBR WB	1.000312	40.098514	24
Minimum	900-4500	141: Kuhio-KBR EBRT	3.204313	169.560764	38
Minimum	900-4500	142: Kuhio-KBR NB	18.287465	415.326347	191
Minimum	900-4500	143: Kuhio-KBR SB	374.676509	495.540355	1611
Minimum	900-4500	144: Kuhio-KBR EB	0	0	0
Maximum	900-4500	1: Kuhio-Aleka N SBLT	1.896175	113.771073	13
Maximum	900-4500	2: Kuhio-Aleka N SBTH	4.049846	433.716256	15
Maximum	900-4500	3: Kuhio-Aleka N NBTH	0.114581	121.844557	3
Maximum	900-4500	4: Kuhio-Aleka N NBRT	0.098069	129.157943	1
Maximum	900-4500	5: Kuhio-Aleka N WBLT	0.35309	76.483647	11
Maximum	900-4500	6: Kuhio-Aleka N WBRT	1.113522	110.203139	25
Maximum	900-4500	7: Kuhio-Aleka S SBLT	326.976621	1655.19178	1142
Maximum	900-4500	8: Kuhio-Aleka S SBTH	628.779796	1655.175489	2837
Maximum	900-4500	9: Kuhio-Aleka S NBTH	0.455107	196.870734	2
Maximum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Maximum	900-4500	11: Kuhio-Aleka S WBLT	188.617062	233.934263	266
Maximum	900-4500	12: Kuhio-Aleka S WBRT	134.953563	237.51224	167
Maximum	900-4500	23: Kuhio-Lanikai SBTH	0.136779	58.70383	5
Maximum	900-4500	24: Kuhio-Lanikai NBTH	0.96004	220.276225	14
Maximum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Maximum	900-4500	26: Kuhio-Lanikai WBRT	1.906477	67.606097	34
Maximum	900-4500	27: Kuhio-Haleilio SBTH	67.012705	550.500676	574
Maximum	900-4500	28: Kuhio-Haleilio NBLT	35.506328	478.20713	168
Maximum	900-4500	29: Kuhio-Haleilio NBTH	28.142053	566.089061	296
Maximum	900-4500	30: Kuhio-Haleilio EBLT	32.818212	278.504988	85
Maximum	900-4500	31: Kuhio-Haleilio EBRT	0.825367	84.51703	10
Maximum	900-4500	33: Kuhio-Papaloa S NBRT	5.27627	355.068633	43

Alternative 1: Double-Lane Roundabout PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Maximum	900-4500	34: Kuhio-Papaloa S WBRT	0.275775	52.142494	4
Maximum	900-4500	35: Kuhio-Kuamoo SBTH	68.539811	834.869418	425
Maximum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Maximum	900-4500	37: Kuhio-Kuamoo NBLT	135.500861	1137.911887	665
Maximum	900-4500	38: Kuhio-Kuamoo NBTH	96.543403	1124.401884	581
Maximum	900-4500	39: Kuhio-Kuamoo EBLT	106.226997	907.885242	185
Maximum	900-4500	40: Kuhio-Kuamoo EBRT	15.305881	253.470504	126
Maximum	900-4500	140: Kuhio-KBR WB	6.428375	126.073332	49
Maximum	900-4500	141: Kuhio-KBR EBRT	23.532061	555.450626	135
Maximum	900-4500	142: Kuhio-KBR NB	32.583755	688.547489	335
Maximum	900-4500	143: Kuhio-KBR SB	440.81162	502.893071	2113
Maximum	900-4500	144: Kuhio-KBR EB	2.035268	128.675427	12
95% percentile	900-4500	1: Kuhio-Aleka N SBLT	1.896175	113.771073	13
95% percentile	900-4500	2: Kuhio-Aleka N SBTH	4.049846	433.716256	15
95% percentile	900-4500	3: Kuhio-Aleka N NBTH	0.114581	121.844557	3
95% percentile	900-4500	4: Kuhio-Aleka N NBRT	0.098069	129.157943	1
95% percentile	900-4500	5: Kuhio-Aleka N WBLT	0.35309	76.483647	11
95% percentile	900-4500	6: Kuhio-Aleka N WBRT	1.113522	110.203139	25
95% percentile	900-4500	7: Kuhio-Aleka S SBLT	326.976621	1655.19178	1142
95% percentile	900-4500	8: Kuhio-Aleka S SBTH	628.779796	1655.175489	2837
95% percentile	900-4500	9: Kuhio-Aleka S NBTH	0.455107	196.870734	2
95% percentile	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
95% percentile	900-4500	11: Kuhio-Aleka S WBLT	188.617062	233.934263	266
95% percentile	900-4500	12: Kuhio-Aleka S WBRT	134.953563	237.51224	167
95% percentile	900-4500	23: Kuhio-Lanikai SBTH	0.136779	58.70383	5
95% percentile	900-4500	24: Kuhio-Lanikai NBTH	0.96004	220.276225	14
95% percentile	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
95% percentile	900-4500	26: Kuhio-Lanikai WBRT	1.906477	67.606097	34
95% percentile	900-4500	27: Kuhio-Haleilio SBTH	67.012705	550.500676	574
95% percentile	900-4500	28: Kuhio-Haleilio NBLT	35.506328	478.20713	168
95% percentile	900-4500	29: Kuhio-Haleilio NBTH	28.142053	566.089061	296
95% percentile	900-4500	30: Kuhio-Haleilio EBLT	32.818212	278.504988	85
95% percentile	900-4500	31: Kuhio-Haleilio EBRT	0.825367	84.51703	10
95% percentile	900-4500	33: Kuhio-Papaloa S NBRT	5.27627	355.068633	43
95% percentile	900-4500	34: Kuhio-Papaloa S WBRT	0.275775	52.142494	4
95% percentile	900-4500	35: Kuhio-Kuamoo SBTH	68.539811	834.869418	425
95% percentile	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
95% percentile	900-4500	37: Kuhio-Kuamoo NBLT	135.500861	1137.911887	665
95% percentile	900-4500	38: Kuhio-Kuamoo NBTH	96.543403	1124.401884	581
95% percentile	900-4500	39: Kuhio-Kuamoo EBLT	106.226997	907.885242	185
95% percentile	900-4500	40: Kuhio-Kuamoo EBRT	15.305881	253.470504	126
95% percentile	900-4500	140: Kuhio-KBR WB	6.428375	126.073332	49

Alternative 1: Double-Lane Roundabout PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
95% percentile	900-4500	141: Kuhio-KBR EBRT	23.532061	555.450626	135
95% percentile	900-4500	142: Kuhio-KBR NB	32.583755	688.547489	335
95% percentile	900-4500	143: Kuhio-KBR SB	440.81162	502.893071	2113
95% percentile	900-4500	144: Kuhio-KBR EB	2.035268	128.675427	12

APPENDIX B

VISSIM SIMULATION RESULTS

- Alternative 2: Turbo Roundabout

Alternative 2: Turbo Roundabout AM - Travel Time Results

SimRun	TimeInt	VehicleTravelTimeMeasurement	Vehs(All)	TravTm(All)	DistTrav(All)
1	900-4500	1: Kuhio SB	623	194.322867	7603.37984
1	900-4500	2: Kuhio NB	447	179.547149	7613.865945
1	900-4500	3: Kapaa Bypass Rd SB	759	232.683869	7612.715957
1	900-4500	4: Kapaa Bypass Rd NB	113	193.391935	7865.344921
2	900-4500	1: Kuhio SB	600	193.746474	7603.444209
2	900-4500	2: Kuhio NB	451	180.171843	7613.640965
2	900-4500	3: Kapaa Bypass Rd SB	709	212.008914	7612.930367
2	900-4500	4: Kapaa Bypass Rd NB	93	189.834564	7865.344921
3	900-4500	1: Kuhio SB	600	195.333106	7603.419949
3	900-4500	2: Kuhio NB	448	181.499445	7613.954504
3	900-4500	3: Kapaa Bypass Rd SB	728	233.353846	7612.961644
3	900-4500	4: Kapaa Bypass Rd NB	88	190.703924	7865.344921
4	900-4500	1: Kuhio SB	585	191.948129	7603.491485
4	900-4500	2: Kuhio NB	456	181.651989	7613.755156
4	900-4500	3: Kapaa Bypass Rd SB	691	216.100181	7612.862671
4	900-4500	4: Kapaa Bypass Rd NB	91	191.013748	7865.344921
5	900-4500	1: Kuhio SB	588	194.643073	7603.465127
5	900-4500	2: Kuhio NB	468	181.022724	7614.015554
5	900-4500	3: Kapaa Bypass Rd SB	700	207.893459	7612.811432
5	900-4500	4: Kapaa Bypass Rd NB	103	186.725824	7865.344921
Avg	900-4500	1: Kuhio SB	599	193.99873	7603.440122
Avg	900-4500	2: Kuhio NB	454	180.77863	7613.846425
Avg	900-4500	3: Kapaa Bypass Rd SB	717	220.408054	7612.856414
Avg	900-4500	4: Kapaa Bypass Rd NB	98	190.333999	7865.344921
Standard deviation	900-4500	1: Kuhio SB	15	1.281542	0.042782
Standard deviation	900-4500	2: Kuhio NB	9	0.898144	0.151005
Standard deviation	900-4500	3: Kapaa Bypass Rd SB	27	11.874422	0.097894
Standard deviation	900-4500	4: Kapaa Bypass Rd NB	10	2.409266	0
Minimum	900-4500	1: Kuhio SB	585	191.948129	7603.37984
Minimum	900-4500	2: Kuhio NB	447	179.547149	7613.640965
Minimum	900-4500	3: Kapaa Bypass Rd SB	691	207.893459	7612.715957
Minimum	900-4500	4: Kapaa Bypass Rd NB	88	186.725824	7865.344921
Maximum	900-4500	1: Kuhio SB	623	195.333106	7603.491485
Maximum	900-4500	2: Kuhio NB	468	181.651989	7614.015554
Maximum	900-4500	3: Kapaa Bypass Rd SB	759	233.353846	7612.961644
Maximum	900-4500	4: Kapaa Bypass Rd NB	113	193.391935	7865.344921
95% percentile	900-4500	1: Kuhio SB	623	195.333106	7603.491485
95% percentile	900-4500	2: Kuhio NB	468	181.651989	7614.015554
95% percentile	900-4500	3: Kapaa Bypass Rd SB	759	233.353846	7612.961644
95% percentile	900-4500	4: Kapaa Bypass Rd NB	113	193.391935	7865.344921

Alternative 2: Turbo Roundabout AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
1	900-4500	1: Kuhio-Aleka N SBLT	0	0	0
1	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
1	900-4500	3: Kuhio-Aleka N NBTH	0.021472	72.450435	1
1	900-4500	4: Kuhio-Aleka N NBRT	0.013139	79.76382	1
1	900-4500	5: Kuhio-Aleka N WBLT	0.07092	35.153272	3
1	900-4500	6: Kuhio-Aleka N WBRT	0.401961	51.697446	10
1	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
1	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
1	900-4500	9: Kuhio-Aleka S NBTH	0.003842	138.312936	0
1	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
1	900-4500	11: Kuhio-Aleka S WBLT	2.138237	82.84846	15
1	900-4500	12: Kuhio-Aleka S WBRT	0.063905	19.685098	31
1	900-4500	23: Kuhio-Lanikai SBTH	0.399838	75.259671	11
1	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
1	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
1	900-4500	26: Kuhio-Lanikai WBRT	0.355849	26.623374	10
1	900-4500	27: Kuhio-Haleilio SBTH	74.212778	527.67365	671
1	900-4500	28: Kuhio-Haleilio NBLT	1.82622	65.096282	4
1	900-4500	29: Kuhio-Haleilio NBTH	8.059976	202.563891	131
1	900-4500	30: Kuhio-Haleilio EBLT	55.66154	410.614737	142
1	900-4500	31: Kuhio-Haleilio EBRT	6.358592	123.751703	46
1	900-4500	33: Kuhio-Papaloa S NBRT	0.230489	189.67144	0
1	900-4500	34: Kuhio-Papaloa S WBRT	0.75157	72.86903	10
1	900-4500	35: Kuhio-Kuamoo SBTH	132.629297	818.593767	800
1	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
1	900-4500	37: Kuhio-Kuamoo NBLT	12.305218	195.892842	69
1	900-4500	38: Kuhio-Kuamoo NBTH	18.556334	291.393162	207
1	900-4500	39: Kuhio-Kuamoo EBLT	906.001855	1686.272266	1782
1	900-4500	40: Kuhio-Kuamoo EBRT	1301.940143	1688.187384	3104
1	900-4500	140: Kuhio-KBR WB	0.220919	40.809744	9
1	900-4500	141: Kuhio-KBR EBRT	317.964669	1426.744339	1328
1	900-4500	142: Kuhio-KBR NB	9.981093	322.68905	109
1	900-4500	143: Kuhio-KBR SB	11.709035	227.721212	141
1	900-4500	144: Kuhio-KBR EB	2.538553	85.212664	28
2	900-4500	1: Kuhio-Aleka N SBLT	0.021167	30.326777	1
2	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
2	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
2	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
2	900-4500	5: Kuhio-Aleka N WBLT	0.100481	56.479716	6
2	900-4500	6: Kuhio-Aleka N WBRT	0.205069	49.878918	3
2	900-4500	7: Kuhio-Aleka S SBLT	0.050863	21.056185	1
2	900-4500	8: Kuhio-Aleka S SBTH	0	0	0

Alternative 2: Turbo Roundabout AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
2	900-4500	9: Kuhio-Aleka S NBTH	0	0	0
2	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
2	900-4500	11: Kuhio-Aleka S WBLT	1.371384	85.409379	9
2	900-4500	12: Kuhio-Aleka S WBRT	0.144331	79.585175	48
2	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
2	900-4500	24: Kuhio-Lanikai NBTH	0.010237	26.807069	1
2	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
2	900-4500	26: Kuhio-Lanikai WBRT	0.543711	27.344643	16
2	900-4500	27: Kuhio-Haleilio SBTH	65.142669	500.246929	632
2	900-4500	28: Kuhio-Haleilio NBLT	2.329552	120.94184	12
2	900-4500	29: Kuhio-Haleilio NBTH	7.081392	246.336155	138
2	900-4500	30: Kuhio-Haleilio EBLT	29.081445	169.198237	104
2	900-4500	31: Kuhio-Haleilio EBRT	7.537335	187.565545	56
2	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
2	900-4500	34: Kuhio-Papaloa S WBRT	0.495551	53.230533	8
2	900-4500	35: Kuhio-Kuamoo SBTH	129.305858	767.793397	807
2	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
2	900-4500	37: Kuhio-Kuamoo NBLT	10.440493	166.326087	56
2	900-4500	38: Kuhio-Kuamoo NBTH	18.34782	218.400814	203
2	900-4500	39: Kuhio-Kuamoo EBLT	309.033572	1649.388223	651
2	900-4500	40: Kuhio-Kuamoo EBRT	988.753519	1713.369421	2391
2	900-4500	140: Kuhio-KBR WB	0.158227	40.0616	7
2	900-4500	141: Kuhio-KBR EBRT	119.909053	907.201602	630
2	900-4500	142: Kuhio-KBR NB	7.938176	253.993865	113
2	900-4500	143: Kuhio-KBR SB	5.921722	204.842225	99
2	900-4500	144: Kuhio-KBR EB	7.715896	139.130513	40
3	900-4500	1: Kuhio-Aleka N SBLT	0.214908	73.00893	2
3	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
3	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
3	900-4500	4: Kuhio-Aleka N NBRT	0.001215	43.728777	1
3	900-4500	5: Kuhio-Aleka N WBLT	0.000434	15.624752	1
3	900-4500	6: Kuhio-Aleka N WBRT	0.21041	51.524419	5
3	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
3	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
3	900-4500	9: Kuhio-Aleka S NBTH	0	0	0
3	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
3	900-4500	11: Kuhio-Aleka S WBLT	0.767336	84.403788	6
3	900-4500	12: Kuhio-Aleka S WBRT	0.083965	69.153907	35
3	900-4500	23: Kuhio-Lanikai SBTH	0.038179	26.633091	1
3	900-4500	24: Kuhio-Lanikai NBTH	0.094837	76.949695	2
3	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
3	900-4500	26: Kuhio-Lanikai WBRT	0.38446	26.393496	14

Alternative 2: Turbo Roundabout AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
3	900-4500	27: Kuhio-Haleilio SBTH	64.633312	520.831095	593
3	900-4500	28: Kuhio-Haleilio NBLT	3.225341	129.824282	18
3	900-4500	29: Kuhio-Haleilio NBTH	6.055332	314.986787	98
3	900-4500	30: Kuhio-Haleilio EBLT	29.09751	192.568484	104
3	900-4500	31: Kuhio-Haleilio EBRT	8.42892	139.576498	68
3	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
3	900-4500	34: Kuhio-Papaloa S WBRT	0.746845	73.709073	10
3	900-4500	35: Kuhio-Kuamoo SBTH	153.185608	920.597718	930
3	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
3	900-4500	37: Kuhio-Kuamoo NBLT	13.072559	210.323618	69
3	900-4500	38: Kuhio-Kuamoo NBTH	21.968539	290.096897	243
3	900-4500	39: Kuhio-Kuamoo EBLT	23.664786	186.708389	61
3	900-4500	40: Kuhio-Kuamoo EBRT	467.463736	1378.543783	1277
3	900-4500	140: Kuhio-KBR WB	0.478833	39.008978	15
3	900-4500	141: Kuhio-KBR EBRT	337.730108	1713.265628	1287
3	900-4500	142: Kuhio-KBR NB	12.517405	267.842454	142
3	900-4500	143: Kuhio-KBR SB	7.885787	194.438126	103
3	900-4500	144: Kuhio-KBR EB	6.010915	151.891545	43
4	900-4500	1: Kuhio-Aleka N SBLT	0.209847	50.182629	3
4	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
4	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
4	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
4	900-4500	5: Kuhio-Aleka N WBLT	0.136517	36.703885	3
4	900-4500	6: Kuhio-Aleka N WBRT	0.378376	51.192344	8
4	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
4	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
4	900-4500	9: Kuhio-Aleka S NBTH	0	0	0
4	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
4	900-4500	11: Kuhio-Aleka S WBLT	0.971748	85.123222	10
4	900-4500	12: Kuhio-Aleka S WBRT	0.394817	70.906294	35
4	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
4	900-4500	24: Kuhio-Lanikai NBTH	0.085493	59.97176	2
4	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
4	900-4500	26: Kuhio-Lanikai WBRT	0.306294	26.313158	12
4	900-4500	27: Kuhio-Haleilio SBTH	68.922161	458.604257	658
4	900-4500	28: Kuhio-Haleilio NBLT	1.392463	86.858816	5
4	900-4500	29: Kuhio-Haleilio NBTH	6.612655	278.05879	118
4	900-4500	30: Kuhio-Haleilio EBLT	31.557566	258.782211	113
4	900-4500	31: Kuhio-Haleilio EBRT	4.424501	103.469856	37
4	900-4500	33: Kuhio-Papaloa S NBRT	0.926898	299.084499	2
4	900-4500	34: Kuhio-Papaloa S WBRT	0.97374	52.102219	11
4	900-4500	35: Kuhio-Kuamoo SBTH	119.868784	843.055622	818

Alternative 2: Turbo Roundabout AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
4	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
4	900-4500	37: Kuhio-Kuamoo NBLT	5.438952	98.165743	44
4	900-4500	38: Kuhio-Kuamoo NBTH	22.900978	337.69744	257
4	900-4500	39: Kuhio-Kuamoo EBLT	795.475749	1713.628305	1603
4	900-4500	40: Kuhio-Kuamoo EBRT	1314.040152	1713.681819	3192
4	900-4500	140: Kuhio-KBR WB	0.061136	40.630931	9
4	900-4500	141: Kuhio-KBR EBRT	135.696726	1049.262116	635
4	900-4500	142: Kuhio-KBR NB	8.122594	347.797127	80
4	900-4500	143: Kuhio-KBR SB	7.296806	170.592267	87
4	900-4500	144: Kuhio-KBR EB	1.59968	81.175763	19
5	900-4500	1: Kuhio-Aleka N SBLT	0.405006	57.688692	6
5	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
5	900-4500	3: Kuhio-Aleka N NBTH	0.027512	72.487672	1
5	900-4500	4: Kuhio-Aleka N NBRT	0.019718	79.801058	1
5	900-4500	5: Kuhio-Aleka N WBLT	0.18007	39.780955	6
5	900-4500	6: Kuhio-Aleka N WBRT	0.219471	52.891623	7
5	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
5	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
5	900-4500	9: Kuhio-Aleka S NBTH	0	0	0
5	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
5	900-4500	11: Kuhio-Aleka S WBLT	1.240978	105.691504	11
5	900-4500	12: Kuhio-Aleka S WBRT	0.113698	80.682615	35
5	900-4500	23: Kuhio-Lanikai SBTH	0.359565	165.358759	6
5	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
5	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
5	900-4500	26: Kuhio-Lanikai WBRT	0.382443	26.196699	15
5	900-4500	27: Kuhio-Haleilio SBTH	59.548155	440.282243	565
5	900-4500	28: Kuhio-Haleilio NBLT	0.570519	92.825967	7
5	900-4500	29: Kuhio-Haleilio NBTH	8.497816	233.683102	134
5	900-4500	30: Kuhio-Haleilio EBLT	37.480232	302.141579	140
5	900-4500	31: Kuhio-Haleilio EBRT	8.0379	173.9041	65
5	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
5	900-4500	34: Kuhio-Papaloa S WBRT	0.872917	59.776021	13
5	900-4500	35: Kuhio-Kuamoo SBTH	147.830465	921.204367	861
5	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
5	900-4500	37: Kuhio-Kuamoo NBLT	15.567128	214.498015	75
5	900-4500	38: Kuhio-Kuamoo NBTH	20.56688	204.866297	215
5	900-4500	39: Kuhio-Kuamoo EBLT	1062.266352	1713.846774	2179
5	900-4500	40: Kuhio-Kuamoo EBRT	1350.295401	1713.93822	3247
5	900-4500	140: Kuhio-KBR WB	0.404106	38.266227	11
5	900-4500	141: Kuhio-KBR EBRT	65.039999	618.725796	445
5	900-4500	142: Kuhio-KBR NB	10.549609	260.859146	125

Alternative 2: Turbo Roundabout AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
5	900-4500	143: Kuhio-KBR SB	8.491774	218.437015	117
5	900-4500	144: Kuhio-KBR EB	3.816004	133.11044	28
Avg	900-4500	1: Kuhio-Aleka N SBLT	0.170185	42.241406	2
Avg	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Avg	900-4500	3: Kuhio-Aleka N NBTH	0.009797	28.987621	0
Avg	900-4500	4: Kuhio-Aleka N NBRT	0.006814	40.658731	1
Avg	900-4500	5: Kuhio-Aleka N WBLT	0.097684	36.748516	4
Avg	900-4500	6: Kuhio-Aleka N WBRT	0.283057	51.43695	7
Avg	900-4500	7: Kuhio-Aleka S SBLT	0.010173	4.211237	0
Avg	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Avg	900-4500	9: Kuhio-Aleka S NBTH	0.000768	27.662587	0
Avg	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Avg	900-4500	11: Kuhio-Aleka S WBLT	1.297937	88.695271	10
Avg	900-4500	12: Kuhio-Aleka S WBRT	0.160143	64.002618	37
Avg	900-4500	23: Kuhio-Lanikai SBTH	0.159516	53.450304	4
Avg	900-4500	24: Kuhio-Lanikai NBTH	0.038113	32.745705	1
Avg	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Avg	900-4500	26: Kuhio-Lanikai WBRT	0.394551	26.574274	13
Avg	900-4500	27: Kuhio-Haleilio SBTH	66.491815	489.527635	624
Avg	900-4500	28: Kuhio-Haleilio NBLT	1.868819	99.109437	9
Avg	900-4500	29: Kuhio-Haleilio NBTH	7.261434	255.125745	124
Avg	900-4500	30: Kuhio-Haleilio EBLT	36.575659	266.66105	121
Avg	900-4500	31: Kuhio-Haleilio EBRT	6.957449	145.65354	54
Avg	900-4500	33: Kuhio-Papaloa S NBRT	0.231477	97.751188	0
Avg	900-4500	34: Kuhio-Papaloa S WBRT	0.768125	62.337375	10
Avg	900-4500	35: Kuhio-Kuamoo SBTH	136.564002	854.248974	843
Avg	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Avg	900-4500	37: Kuhio-Kuamoo NBLT	11.36487	177.041261	63
Avg	900-4500	38: Kuhio-Kuamoo NBTH	20.46811	268.490922	225
Avg	900-4500	39: Kuhio-Kuamoo EBLT	619.288463	1389.968792	1255
Avg	900-4500	40: Kuhio-Kuamoo EBRT	1084.49859	1641.544125	2642
Avg	900-4500	140: Kuhio-KBR WB	0.264644	39.755496	10
Avg	900-4500	141: Kuhio-KBR EBRT	195.268111	1143.039896	865
Avg	900-4500	142: Kuhio-KBR NB	9.821775	290.636328	114
Avg	900-4500	143: Kuhio-KBR SB	8.261025	203.206169	109
Avg	900-4500	144: Kuhio-KBR EB	4.33621	118.104185	32
Standard deviation	900-4500	1: Kuhio-Aleka N SBLT	0.165743	28.17187	2
Standard deviation	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Standard deviation	900-4500	3: Kuhio-Aleka N NBTH	0.013584	39.692937	1
Standard deviation	900-4500	4: Kuhio-Aleka N NBRT	0.009093	39.928122	1
Standard deviation	900-4500	5: Kuhio-Aleka N WBLT	0.067965	14.554004	2
Standard deviation	900-4500	6: Kuhio-Aleka N WBRT	0.098268	1.081536	3

Alternative 2: Turbo Roundabout AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Standard deviation	900-4500	7: Kuhio-Aleka S SBLT	0.022747	9.416612	0
Standard deviation	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Standard deviation	900-4500	9: Kuhio-Aleka S NBTH	0.001718	61.855426	0
Standard deviation	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Standard deviation	900-4500	11: Kuhio-Aleka S WBLT	0.525043	9.552887	3
Standard deviation	900-4500	12: Kuhio-Aleka S WBRT	0.13467	25.294651	6
Standard deviation	900-4500	23: Kuhio-Lanikai SBTH	0.202106	69.699684	5
Standard deviation	900-4500	24: Kuhio-Lanikai NBTH	0.047814	34.910889	1
Standard deviation	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Standard deviation	900-4500	26: Kuhio-Lanikai WBRT	0.089141	0.458068	2
Standard deviation	900-4500	27: Kuhio-Haleilio SBTH	5.45455	38.507442	44
Standard deviation	900-4500	28: Kuhio-Haleilio NBLT	0.995834	26.298811	6
Standard deviation	900-4500	29: Kuhio-Haleilio NBTH	1.009248	43.037952	16
Standard deviation	900-4500	30: Kuhio-Haleilio EBLT	11.206653	96.218912	19
Standard deviation	900-4500	31: Kuhio-Haleilio EBRT	1.615807	34.823822	13
Standard deviation	900-4500	33: Kuhio-Papaloa S NBRT	0.401359	139.329034	1
Standard deviation	900-4500	34: Kuhio-Papaloa S WBRT	0.179082	10.422149	2
Standard deviation	900-4500	35: Kuhio-Kuamoo SBTH	13.694012	66.626444	54
Standard deviation	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Standard deviation	900-4500	37: Kuhio-Kuamoo NBLT	3.789142	47.964227	13
Standard deviation	900-4500	38: Kuhio-Kuamoo NBTH	2.020545	55.538241	24
Standard deviation	900-4500	39: Kuhio-Kuamoo EBLT	436.033714	673.160868	872
Standard deviation	900-4500	40: Kuhio-Kuamoo EBRT	374.338494	147.435069	838
Standard deviation	900-4500	140: Kuhio-KBR WB	0.173189	1.08935	3
Standard deviation	900-4500	141: Kuhio-KBR EBRT	124.033226	431.55673	411
Standard deviation	900-4500	142: Kuhio-KBR NB	1.887903	41.963214	23
Standard deviation	900-4500	143: Kuhio-KBR SB	2.149702	22.227167	21
Standard deviation	900-4500	144: Kuhio-KBR EB	2.510861	32.613035	10
Minimum	900-4500	1: Kuhio-Aleka N SBLT	0	0	0
Minimum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Minimum	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
Minimum	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
Minimum	900-4500	5: Kuhio-Aleka N WBLT	0.000434	15.624752	1
Minimum	900-4500	6: Kuhio-Aleka N WBRT	0.205069	49.878918	3
Minimum	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
Minimum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Minimum	900-4500	9: Kuhio-Aleka S NBTH	0	0	0
Minimum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Minimum	900-4500	11: Kuhio-Aleka S WBLT	0.767336	82.84846	6
Minimum	900-4500	12: Kuhio-Aleka S WBRT	0.063905	19.685098	31
Minimum	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
Minimum	900-4500	24: Kuhio-Lanikai NBTH	0	0	0

Alternative 2: Turbo Roundabout AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Minimum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Minimum	900-4500	26: Kuhio-Lanikai WBRT	0.306294	26.196699	10
Minimum	900-4500	27: Kuhio-Haleilio SBTH	59.548155	440.282243	565
Minimum	900-4500	28: Kuhio-Haleilio NBLT	0.570519	65.096282	4
Minimum	900-4500	29: Kuhio-Haleilio NBTH	6.055332	202.563891	98
Minimum	900-4500	30: Kuhio-Haleilio EBLT	29.081445	169.198237	104
Minimum	900-4500	31: Kuhio-Haleilio EBRT	4.424501	103.469856	37
Minimum	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
Minimum	900-4500	34: Kuhio-Papaloa S WBRT	0.495551	52.102219	8
Minimum	900-4500	35: Kuhio-Kuamoo SBTH	119.868784	767.793397	800
Minimum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Minimum	900-4500	37: Kuhio-Kuamoo NBLT	5.438952	98.165743	44
Minimum	900-4500	38: Kuhio-Kuamoo NBTH	18.34782	204.866297	203
Minimum	900-4500	39: Kuhio-Kuamoo EBLT	23.664786	186.708389	61
Minimum	900-4500	40: Kuhio-Kuamoo EBRT	467.463736	1378.543783	1277
Minimum	900-4500	140: Kuhio-KBR WB	0.061136	38.266227	7
Minimum	900-4500	141: Kuhio-KBR EBRT	65.039999	618.725796	445
Minimum	900-4500	142: Kuhio-KBR NB	7.938176	253.993865	80
Minimum	900-4500	143: Kuhio-KBR SB	5.921722	170.592267	87
Minimum	900-4500	144: Kuhio-KBR EB	1.59968	81.175763	19
Maximum	900-4500	1: Kuhio-Aleka N SBLT	0.405006	73.00893	6
Maximum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Maximum	900-4500	3: Kuhio-Aleka N NBTH	0.027512	72.487672	1
Maximum	900-4500	4: Kuhio-Aleka N NBRT	0.019718	79.801058	1
Maximum	900-4500	5: Kuhio-Aleka N WBLT	0.18007	56.479716	6
Maximum	900-4500	6: Kuhio-Aleka N WBRT	0.401961	52.891623	10
Maximum	900-4500	7: Kuhio-Aleka S SBLT	0.050863	21.056185	1
Maximum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Maximum	900-4500	9: Kuhio-Aleka S NBTH	0.003842	138.312936	0
Maximum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Maximum	900-4500	11: Kuhio-Aleka S WBLT	2.138237	105.691504	15
Maximum	900-4500	12: Kuhio-Aleka S WBRT	0.394817	80.682615	48
Maximum	900-4500	23: Kuhio-Lanikai SBTH	0.399838	165.358759	11
Maximum	900-4500	24: Kuhio-Lanikai NBTH	0.094837	76.949695	2
Maximum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Maximum	900-4500	26: Kuhio-Lanikai WBRT	0.543711	27.344643	16
Maximum	900-4500	27: Kuhio-Haleilio SBTH	74.212778	527.67365	671
Maximum	900-4500	28: Kuhio-Haleilio NBLT	3.225341	129.824282	18
Maximum	900-4500	29: Kuhio-Haleilio NBTH	8.497816	314.986787	138
Maximum	900-4500	30: Kuhio-Haleilio EBLT	55.66154	410.614737	142
Maximum	900-4500	31: Kuhio-Haleilio EBRT	8.42892	187.565545	68
Maximum	900-4500	33: Kuhio-Papaloa S NBRT	0.926898	299.084499	2

Alternative 2: Turbo Roundabout AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Maximum	900-4500	34: Kuhio-Papaloa S WBRT	0.97374	73.709073	13
Maximum	900-4500	35: Kuhio-Kuamoo SBTH	153.185608	921.204367	930
Maximum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Maximum	900-4500	37: Kuhio-Kuamoo NBLT	15.567128	214.498015	75
Maximum	900-4500	38: Kuhio-Kuamoo NBTH	22.900978	337.69744	257
Maximum	900-4500	39: Kuhio-Kuamoo EBLT	1062.266352	1713.846774	2179
Maximum	900-4500	40: Kuhio-Kuamoo EBRT	1350.295401	1713.93822	3247
Maximum	900-4500	140: Kuhio-KBR WB	0.478833	40.809744	15
Maximum	900-4500	141: Kuhio-KBR EBRT	337.730108	1713.265628	1328
Maximum	900-4500	142: Kuhio-KBR NB	12.517405	347.797127	142
Maximum	900-4500	143: Kuhio-KBR SB	11.709035	227.721212	141
Maximum	900-4500	144: Kuhio-KBR EB	7.715896	151.891545	43
95% percentile	900-4500	1: Kuhio-Aleka N SBLT	0.405006	73.00893	6
95% percentile	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
95% percentile	900-4500	3: Kuhio-Aleka N NBTH	0.027512	72.487672	1
95% percentile	900-4500	4: Kuhio-Aleka N NBRT	0.019718	79.801058	1
95% percentile	900-4500	5: Kuhio-Aleka N WBLT	0.18007	56.479716	6
95% percentile	900-4500	6: Kuhio-Aleka N WBRT	0.401961	52.891623	10
95% percentile	900-4500	7: Kuhio-Aleka S SBLT	0.050863	21.056185	1
95% percentile	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
95% percentile	900-4500	9: Kuhio-Aleka S NBTH	0.003842	138.312936	0
95% percentile	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
95% percentile	900-4500	11: Kuhio-Aleka S WBLT	2.138237	105.691504	15
95% percentile	900-4500	12: Kuhio-Aleka S WBRT	0.394817	80.682615	48
95% percentile	900-4500	23: Kuhio-Lanikai SBTH	0.399838	165.358759	11
95% percentile	900-4500	24: Kuhio-Lanikai NBTH	0.094837	76.949695	2
95% percentile	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
95% percentile	900-4500	26: Kuhio-Lanikai WBRT	0.543711	27.344643	16
95% percentile	900-4500	27: Kuhio-Haleilio SBTH	74.212778	527.67365	671
95% percentile	900-4500	28: Kuhio-Haleilio NBLT	3.225341	129.824282	18
95% percentile	900-4500	29: Kuhio-Haleilio NBTH	8.497816	314.986787	138
95% percentile	900-4500	30: Kuhio-Haleilio EBLT	55.66154	410.614737	142
95% percentile	900-4500	31: Kuhio-Haleilio EBRT	8.42892	187.565545	68
95% percentile	900-4500	33: Kuhio-Papaloa S NBRT	0.926898	299.084499	2
95% percentile	900-4500	34: Kuhio-Papaloa S WBRT	0.97374	73.709073	13
95% percentile	900-4500	35: Kuhio-Kuamoo SBTH	153.185608	921.204367	930
95% percentile	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
95% percentile	900-4500	37: Kuhio-Kuamoo NBLT	15.567128	214.498015	75
95% percentile	900-4500	38: Kuhio-Kuamoo NBTH	22.900978	337.69744	257
95% percentile	900-4500	39: Kuhio-Kuamoo EBLT	1062.266352	1713.846774	2179
95% percentile	900-4500	40: Kuhio-Kuamoo EBRT	1350.295401	1713.93822	3247
95% percentile	900-4500	140: Kuhio-KBR WB	0.478833	40.809744	15

Alternative 2: Turbo Roundabout AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
95% percentile	900-4500	141: Kuhio-KBR EBRT	337.730108	1713.265628	1328
95% percentile	900-4500	142: Kuhio-KBR NB	12.517405	347.797127	142
95% percentile	900-4500	143: Kuhio-KBR SB	11.709035	227.721212	141
95% percentile	900-4500	144: Kuhio-KBR EB	7.715896	151.891545	43

Alternative 2: Turbo Roundabout PM - Travel Time Results

SimRun	TimeInt	VehicleTravelTimeMeasurement	Vehs(All)	TravTm(All)	DistTrav(All)
1	900-4500	1: Kuhio SB	359	412.136015	7603.412178
1	900-4500	2: Kuhio NB	547	214.500473	7611.765203
1	900-4500	3: Kapaa Bypass Rd SB	432	233.812901	7617.099662
1	900-4500	4: Kapaa Bypass Rd NB	475	227.936606	7865.344921
2	900-4500	1: Kuhio SB	336	349.086029	7603.464354
2	900-4500	2: Kuhio NB	529	205.874928	7611.769968
2	900-4500	3: Kapaa Bypass Rd SB	440	231.17498	7616.6327
2	900-4500	4: Kapaa Bypass Rd NB	462	218.824582	7865.344921
3	900-4500	1: Kuhio SB	335	373.683281	7603.532198
3	900-4500	2: Kuhio NB	512	199.293906	7611.602576
3	900-4500	3: Kapaa Bypass Rd SB	417	227.33362	7617.44328
3	900-4500	4: Kapaa Bypass Rd NB	500	210.036897	7865.344921
4	900-4500	1: Kuhio SB	312	323.101553	7603.533085
4	900-4500	2: Kuhio NB	549	218.151555	7612.012167
4	900-4500	3: Kapaa Bypass Rd SB	388	223.634034	7617.363482
4	900-4500	4: Kapaa Bypass Rd NB	484	230.602136	7865.344921
5	900-4500	1: Kuhio SB	338	484.500829	7603.46445
5	900-4500	2: Kuhio NB	514	201.176274	7611.900733
5	900-4500	3: Kapaa Bypass Rd SB	419	226.746113	7617.64052
5	900-4500	4: Kapaa Bypass Rd NB	502	209.709396	7865.344921
Avg	900-4500	1: Kuhio SB	336	388.501542	7603.481253
Avg	900-4500	2: Kuhio NB	530	207.799427	7611.81013
Avg	900-4500	3: Kapaa Bypass Rd SB	419	228.540329	7617.235929
Avg	900-4500	4: Kapaa Bypass Rd NB	485	219.421923	7865.344921
Standard deviation	900-4500	1: Kuhio SB	17	62.898278	0.05153
Standard deviation	900-4500	2: Kuhio NB	18	8.245973	0.154708
Standard deviation	900-4500	3: Kapaa Bypass Rd SB	20	3.983983	0.389041
Standard deviation	900-4500	4: Kapaa Bypass Rd NB	17	9.750201	0
Minimum	900-4500	1: Kuhio SB	312	323.101553	7603.412178
Minimum	900-4500	2: Kuhio NB	512	199.293906	7611.602576
Minimum	900-4500	3: Kapaa Bypass Rd SB	388	223.634034	7616.6327
Minimum	900-4500	4: Kapaa Bypass Rd NB	462	209.709396	7865.344921
Maximum	900-4500	1: Kuhio SB	359	484.500829	7603.533085
Maximum	900-4500	2: Kuhio NB	549	218.151555	7612.012167
Maximum	900-4500	3: Kapaa Bypass Rd SB	440	233.812901	7617.64052
Maximum	900-4500	4: Kapaa Bypass Rd NB	502	230.602136	7865.344921
95% percentile	900-4500	1: Kuhio SB	359	484.500829	7603.533085
95% percentile	900-4500	2: Kuhio NB	549	218.151555	7612.012167
95% percentile	900-4500	3: Kapaa Bypass Rd SB	440	233.812901	7617.64052
95% percentile	900-4500	4: Kapaa Bypass Rd NB	502	230.602136	7865.344921

Alternative 2: Turbo Roundabout PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
1	900-4500	1: Kuhio-Aleka N SBLT	0.955255	95.948854	7
1	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
1	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
1	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
1	900-4500	5: Kuhio-Aleka N WBLT	0.093562	35.621136	4
1	900-4500	6: Kuhio-Aleka N WBRT	1.145284	71.812582	27
1	900-4500	7: Kuhio-Aleka S SBLT	0.27742	49.724361	3
1	900-4500	8: Kuhio-Aleka S SBTH	101.746935	398.763818	693
1	900-4500	9: Kuhio-Aleka S NBTH	0	0	0
1	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
1	900-4500	11: Kuhio-Aleka S WBLT	113.986674	218.259902	247
1	900-4500	12: Kuhio-Aleka S WBRT	81.566259	227.998687	199
1	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
1	900-4500	24: Kuhio-Lanikai NBTH	9.920491	346.89718	88
1	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
1	900-4500	26: Kuhio-Lanikai WBRT	1.701883	62.932458	34
1	900-4500	27: Kuhio-Haleilio SBTH	61.03346	475.000422	571
1	900-4500	28: Kuhio-Haleilio NBLT	30.942583	794.859789	165
1	900-4500	29: Kuhio-Haleilio NBTH	26.911872	784.555323	245
1	900-4500	30: Kuhio-Haleilio EBLT	26.561895	233.001845	85
1	900-4500	31: Kuhio-Haleilio EBRT	0.693411	91.245495	7
1	900-4500	33: Kuhio-Papaloa S NBRT	8.601237	527.25491	64
1	900-4500	34: Kuhio-Papaloa S WBRT	0	0	0
1	900-4500	35: Kuhio-Kuamoo SBTH	63.425099	601.816689	409
1	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
1	900-4500	37: Kuhio-Kuamoo NBLT	125.774159	1113.871095	586
1	900-4500	38: Kuhio-Kuamoo NBTH	104.739878	1114.695225	591
1	900-4500	39: Kuhio-Kuamoo EBLT	119.577133	870.910549	174
1	900-4500	40: Kuhio-Kuamoo EBRT	11.848627	164.968771	112
1	900-4500	140: Kuhio-KBR WB	17.472226	260.971067	74
1	900-4500	141: Kuhio-KBR EBRT	9.088449	274.407614	67
1	900-4500	142: Kuhio-KBR NB	224.561793	1248.558655	1664
1	900-4500	143: Kuhio-KBR SB	401.665092	498.652957	2449
1	900-4500	144: Kuhio-KBR EB	9.8125	167.342683	77
2	900-4500	1: Kuhio-Aleka N SBLT	0.479238	101.733231	5
2	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
2	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
2	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
2	900-4500	5: Kuhio-Aleka N WBLT	0.214231	56.941231	9
2	900-4500	6: Kuhio-Aleka N WBRT	0.96563	54.410511	26
2	900-4500	7: Kuhio-Aleka S SBLT	2.318296	101.972815	10
2	900-4500	8: Kuhio-Aleka S SBTH	15.538554	262.862977	113

Alternative 2: Turbo Roundabout PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
2	900-4500	9: Kuhio-Aleka S NBTH	0	0	0
2	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
2	900-4500	11: Kuhio-Aleka S WBLT	74.249605	218.247159	216
2	900-4500	12: Kuhio-Aleka S WBRT	20.748885	226.765349	126
2	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
2	900-4500	24: Kuhio-Lanikai NBTH	0.43249	178.477031	6
2	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
2	900-4500	26: Kuhio-Lanikai WBRT	1.446364	65.014629	33
2	900-4500	27: Kuhio-Haleilio SBTH	60.030653	487.634466	520
2	900-4500	28: Kuhio-Haleilio NBLT	17.534797	256.052842	98
2	900-4500	29: Kuhio-Haleilio NBTH	17.430127	366.346425	243
2	900-4500	30: Kuhio-Haleilio EBLT	25.910758	170.98358	78
2	900-4500	31: Kuhio-Haleilio EBRT	0.27231	62.751739	5
2	900-4500	33: Kuhio-Papaloa S NBRT	2.300711	332.225216	16
2	900-4500	34: Kuhio-Papaloa S WBRT	0.288623	51.041757	2
2	900-4500	35: Kuhio-Kuamoo SBTH	51.575528	614.331503	405
2	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
2	900-4500	37: Kuhio-Kuamoo NBLT	137.303895	1120.836659	676
2	900-4500	38: Kuhio-Kuamoo NBTH	112.969421	1121.08139	629
2	900-4500	39: Kuhio-Kuamoo EBLT	86.411016	568.935489	157
2	900-4500	40: Kuhio-Kuamoo EBRT	10.688764	157.682624	105
2	900-4500	140: Kuhio-KBR WB	7.072073	164.513221	54
2	900-4500	141: Kuhio-KBR EBRT	7.933262	460.266922	56
2	900-4500	142: Kuhio-KBR NB	152.236841	761.709459	1333
2	900-4500	143: Kuhio-KBR SB	278.98891	498.879737	1786
2	900-4500	144: Kuhio-KBR EB	15.009081	361.438989	90
3	900-4500	1: Kuhio-Aleka N SBLT	0.477253	97.802357	3
3	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
3	900-4500	3: Kuhio-Aleka N NBTH	0.039743	104.824337	1
3	900-4500	4: Kuhio-Aleka N NBRT	0.034407	111.097039	1
3	900-4500	5: Kuhio-Aleka N WBLT	0.000438	15.781131	1
3	900-4500	6: Kuhio-Aleka N WBRT	0.488784	75.631578	15
3	900-4500	7: Kuhio-Aleka S SBLT	0.40858	56.411869	4
3	900-4500	8: Kuhio-Aleka S SBTH	42.86334	367.313398	364
3	900-4500	9: Kuhio-Aleka S NBTH	0	0	0
3	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
3	900-4500	11: Kuhio-Aleka S WBLT	29.581575	215.248691	89
3	900-4500	12: Kuhio-Aleka S WBRT	4.035817	197.086668	68
3	900-4500	23: Kuhio-Lanikai SBTH	0.03195	26.980011	1
3	900-4500	24: Kuhio-Lanikai NBTH	0.102661	73.682024	1
3	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
3	900-4500	26: Kuhio-Lanikai WBRT	1.169564	47.965299	31

Alternative 2: Turbo Roundabout PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
3	900-4500	27: Kuhio-Haleilio SBTH	61.570823	513.188646	548
3	900-4500	28: Kuhio-Haleilio NBLT	13.879911	172.438536	88
3	900-4500	29: Kuhio-Haleilio NBTH	10.536124	323.50573	178
3	900-4500	30: Kuhio-Haleilio EBLT	31.036863	214.74593	87
3	900-4500	31: Kuhio-Haleilio EBRT	1.341476	83.500507	10
3	900-4500	33: Kuhio-Papaloa S NBRT	2.684389	314.939903	19
3	900-4500	34: Kuhio-Papaloa S WBRT	0.04417	51.091239	1
3	900-4500	35: Kuhio-Kuamoo SBTH	36.426107	352.496156	291
3	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
3	900-4500	37: Kuhio-Kuamoo NBLT	61.173925	926.992391	334
3	900-4500	38: Kuhio-Kuamoo NBTH	44.324952	927.816522	376
3	900-4500	39: Kuhio-Kuamoo EBLT	78.432056	661.485345	141
3	900-4500	40: Kuhio-Kuamoo EBRT	8.254823	193.998207	96
3	900-4500	140: Kuhio-KBR WB	23.769602	235.39041	91
3	900-4500	141: Kuhio-KBR EBRT	2.829811	172.225557	32
3	900-4500	142: Kuhio-KBR NB	171.553314	1130.868318	1466
3	900-4500	143: Kuhio-KBR SB	346.900168	498.910076	2267
3	900-4500	144: Kuhio-KBR EB	14.098681	415.944999	98
4	900-4500	1: Kuhio-Aleka N SBLT	1.057682	90.17133	11
4	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
4	900-4500	3: Kuhio-Aleka N NBTH	0.00834	34.87116	1
4	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
4	900-4500	5: Kuhio-Aleka N WBLT	0.226371	76.788898	7
4	900-4500	6: Kuhio-Aleka N WBRT	0.999512	76.303288	20
4	900-4500	7: Kuhio-Aleka S SBLT	0.364511	41.494139	3
4	900-4500	8: Kuhio-Aleka S SBTH	34.032226	455.065057	229
4	900-4500	9: Kuhio-Aleka S NBTH	0.032422	118.383958	0
4	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
4	900-4500	11: Kuhio-Aleka S WBLT	44.075373	218.251063	130
4	900-4500	12: Kuhio-Aleka S WBRT	7.23814	227.989848	78
4	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
4	900-4500	24: Kuhio-Lanikai NBTH	0.188261	65.536205	4
4	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
4	900-4500	26: Kuhio-Lanikai WBRT	1.462603	48.725783	33
4	900-4500	27: Kuhio-Haleilio SBTH	54.378355	469.218797	506
4	900-4500	28: Kuhio-Haleilio NBLT	10.409548	285.466766	85
4	900-4500	29: Kuhio-Haleilio NBTH	15.600315	403.694329	209
4	900-4500	30: Kuhio-Haleilio EBLT	28.216079	272.953532	77
4	900-4500	31: Kuhio-Haleilio EBRT	0.402025	120.046134	7
4	900-4500	33: Kuhio-Papaloa S NBRT	3.603062	319.349283	26
4	900-4500	34: Kuhio-Papaloa S WBRT	0.274726	52.142494	4
4	900-4500	35: Kuhio-Kuamoo SBTH	32.770187	470.157713	287

Alternative 2: Turbo Roundabout PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
4	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
4	900-4500	37: Kuhio-Kuamoo NBLT	80.474238	810.87078	423
4	900-4500	38: Kuhio-Kuamoo NBTH	69.66523	1009.647281	490
4	900-4500	39: Kuhio-Kuamoo EBLT	102.792488	712.25852	158
4	900-4500	40: Kuhio-Kuamoo EBRT	23.707075	494.344936	152
4	900-4500	140: Kuhio-KBR WB	11.900657	147.048536	61
4	900-4500	141: Kuhio-KBR EBRT	5.190304	336.273542	38
4	900-4500	142: Kuhio-KBR NB	321.891203	1130.623053	2434
4	900-4500	143: Kuhio-KBR SB	255.870614	498.968204	1663
4	900-4500	144: Kuhio-KBR EB	6.379254	155.483153	50
5	900-4500	1: Kuhio-Aleka N SBLT	0.077392	35.123034	1
5	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
5	900-4500	3: Kuhio-Aleka N NBTH	0.025065	71.907777	2
5	900-4500	4: Kuhio-Aleka N NBRT	0.008745	79.221162	1
5	900-4500	5: Kuhio-Aleka N WBLT	0.257875	38.896243	6
5	900-4500	6: Kuhio-Aleka N WBRT	0.952878	74.118295	21
5	900-4500	7: Kuhio-Aleka S SBLT	196.086779	989.815816	869
5	900-4500	8: Kuhio-Aleka S SBTH	317.170067	989.881639	1826
5	900-4500	9: Kuhio-Aleka S NBTH	0	0	0
5	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
5	900-4500	11: Kuhio-Aleka S WBLT	160.002894	233.008798	323
5	900-4500	12: Kuhio-Aleka S WBRT	99.134338	242.747583	217
5	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
5	900-4500	24: Kuhio-Lanikai NBTH	0.001515	18.557456	1
5	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
5	900-4500	26: Kuhio-Lanikai WBRT	1.197077	49.11743	30
5	900-4500	27: Kuhio-Haleilio SBTH	44.746786	371.311477	456
5	900-4500	28: Kuhio-Haleilio NBLT	14.688444	254.508963	87
5	900-4500	29: Kuhio-Haleilio NBTH	18.076726	384.317984	263
5	900-4500	30: Kuhio-Haleilio EBLT	27.915776	257.712469	66
5	900-4500	31: Kuhio-Haleilio EBRT	0.375233	61.580286	6
5	900-4500	33: Kuhio-Papaloa S NBRT	3.407595	297.160386	24
5	900-4500	34: Kuhio-Papaloa S WBRT	0.088675	51.794258	1
5	900-4500	35: Kuhio-Kuamoo SBTH	43.368357	425.731226	378
5	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
5	900-4500	37: Kuhio-Kuamoo NBLT	73.993506	944.560697	428
5	900-4500	38: Kuhio-Kuamoo NBTH	79.594495	945.384827	597
5	900-4500	39: Kuhio-Kuamoo EBLT	74.67815	626.405291	158
5	900-4500	40: Kuhio-Kuamoo EBRT	15.644288	255.816147	128
5	900-4500	140: Kuhio-KBR WB	7.866159	104.78003	42
5	900-4500	141: Kuhio-KBR EBRT	4.431743	373.150258	30
5	900-4500	142: Kuhio-KBR NB	136.022979	627.882712	1263

Alternative 2: Turbo Roundabout PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
5	900-4500	143: Kuhio-KBR SB	383.554447	480.55618	2290
5	900-4500	144: Kuhio-KBR EB	16.921465	372.102563	139
Avg	900-4500	1: Kuhio-Aleka N SBLT	0.609364	84.155761	5
Avg	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Avg	900-4500	3: Kuhio-Aleka N NBTH	0.01463	42.320655	1
Avg	900-4500	4: Kuhio-Aleka N NBRT	0.00863	38.06364	0
Avg	900-4500	5: Kuhio-Aleka N WBLT	0.158495	44.805728	5
Avg	900-4500	6: Kuhio-Aleka N WBRT	0.910418	70.455251	22
Avg	900-4500	7: Kuhio-Aleka S SBLT	39.891117	247.8838	178
Avg	900-4500	8: Kuhio-Aleka S SBTH	102.270224	494.777378	645
Avg	900-4500	9: Kuhio-Aleka S NBTH	0.006484	23.676792	0
Avg	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Avg	900-4500	11: Kuhio-Aleka S WBLT	84.379224	220.603123	201
Avg	900-4500	12: Kuhio-Aleka S WBRT	42.544688	224.517627	138
Avg	900-4500	23: Kuhio-Lanikai SBTH	0.00639	5.396002	0
Avg	900-4500	24: Kuhio-Lanikai NBTH	2.129084	136.629979	20
Avg	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Avg	900-4500	26: Kuhio-Lanikai WBRT	1.395498	54.75112	32
Avg	900-4500	27: Kuhio-Haleilio SBTH	56.352015	463.270761	520
Avg	900-4500	28: Kuhio-Haleilio NBLT	17.491057	352.66538	105
Avg	900-4500	29: Kuhio-Haleilio NBTH	17.711033	452.483958	228
Avg	900-4500	30: Kuhio-Haleilio EBLT	27.928274	229.879471	79
Avg	900-4500	31: Kuhio-Haleilio EBRT	0.616891	83.824832	7
Avg	900-4500	33: Kuhio-Papaloa S NBRT	4.119399	358.18594	30
Avg	900-4500	34: Kuhio-Papaloa S WBRT	0.139239	41.213949	2
Avg	900-4500	35: Kuhio-Kuamoo SBTH	45.513056	492.906657	354
Avg	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Avg	900-4500	37: Kuhio-Kuamoo NBLT	95.743945	983.426324	489
Avg	900-4500	38: Kuhio-Kuamoo NBTH	82.258795	1023.725049	537
Avg	900-4500	39: Kuhio-Kuamoo EBLT	92.378169	687.999039	158
Avg	900-4500	40: Kuhio-Kuamoo EBRT	14.028715	253.362137	119
Avg	900-4500	140: Kuhio-KBR WB	13.616143	182.540653	64
Avg	900-4500	141: Kuhio-KBR EBRT	5.894714	323.264779	45
Avg	900-4500	142: Kuhio-KBR NB	201.253226	979.928439	1632
Avg	900-4500	143: Kuhio-KBR SB	333.395846	495.193431	2091
Avg	900-4500	144: Kuhio-KBR EB	12.444196	294.462478	91
Standard deviation	900-4500	1: Kuhio-Aleka N SBLT	0.399378	27.724851	4
Standard deviation	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Standard deviation	900-4500	3: Kuhio-Aleka N NBTH	0.017372	45.879403	1
Standard deviation	900-4500	4: Kuhio-Aleka N NBRT	0.014899	53.325278	1
Standard deviation	900-4500	5: Kuhio-Aleka N WBLT	0.108153	23.086249	3
Standard deviation	900-4500	6: Kuhio-Aleka N WBRT	0.247854	9.133562	5

Alternative 2: Turbo Roundabout PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Standard deviation	900-4500	7: Kuhio-Aleka S SBLT	87.320201	415.415	386
Standard deviation	900-4500	8: Kuhio-Aleka S SBTH	124.388707	285.462457	695
Standard deviation	900-4500	9: Kuhio-Aleka S NBTH	0.014499	52.942916	0
Standard deviation	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Standard deviation	900-4500	11: Kuhio-Aleka S WBLT	53.210273	7.055922	93
Standard deviation	900-4500	12: Kuhio-Aleka S WBRT	44.52419	16.688433	68
Standard deviation	900-4500	23: Kuhio-Lanikai SBTH	0.014289	12.065828	0
Standard deviation	900-4500	24: Kuhio-Lanikai NBTH	4.358446	131.264392	38
Standard deviation	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Standard deviation	900-4500	26: Kuhio-Lanikai WBRT	0.218734	8.461153	2
Standard deviation	900-4500	27: Kuhio-Haleilio SBTH	7.093323	54.117602	44
Standard deviation	900-4500	28: Kuhio-Haleilio NBLT	7.937069	250.74984	34
Standard deviation	900-4500	29: Kuhio-Haleilio NBTH	5.933012	187.985024	34
Standard deviation	900-4500	30: Kuhio-Haleilio EBLT	1.980131	39.804365	8
Standard deviation	900-4500	31: Kuhio-Haleilio EBRT	0.434218	24.010671	2
Standard deviation	900-4500	33: Kuhio-Papaloa S NBRT	2.560616	95.342671	20
Standard deviation	900-4500	34: Kuhio-Papaloa S WBRT	0.133842	23.044046	2
Standard deviation	900-4500	35: Kuhio-Kuamoo SBTH	12.320186	113.303299	61
Standard deviation	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Standard deviation	900-4500	37: Kuhio-Kuamoo NBLT	33.65403	132.635007	138
Standard deviation	900-4500	38: Kuhio-Kuamoo NBTH	27.62795	91.224517	104
Standard deviation	900-4500	39: Kuhio-Kuamoo EBLT	18.652301	114.802044	12
Standard deviation	900-4500	40: Kuhio-Kuamoo EBRT	6.031721	140.152385	22
Standard deviation	900-4500	140: Kuhio-KBR WB	7.014132	64.373558	19
Standard deviation	900-4500	141: Kuhio-KBR EBRT	2.568352	107.966714	16
Standard deviation	900-4500	142: Kuhio-KBR NB	75.227134	268.891067	474
Standard deviation	900-4500	143: Kuhio-KBR SB	63.892915	8.183346	345
Standard deviation	900-4500	144: Kuhio-KBR EB	4.274086	123.234059	33
Minimum	900-4500	1: Kuhio-Aleka N SBLT	0.077392	35.123034	1
Minimum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Minimum	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
Minimum	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
Minimum	900-4500	5: Kuhio-Aleka N WBLT	0.000438	15.781131	1
Minimum	900-4500	6: Kuhio-Aleka N WBRT	0.488784	54.410511	15
Minimum	900-4500	7: Kuhio-Aleka S SBLT	0.27742	41.494139	3
Minimum	900-4500	8: Kuhio-Aleka S SBTH	15.538554	262.862977	113
Minimum	900-4500	9: Kuhio-Aleka S NBTH	0	0	0
Minimum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Minimum	900-4500	11: Kuhio-Aleka S WBLT	29.581575	215.248691	89
Minimum	900-4500	12: Kuhio-Aleka S WBRT	4.035817	197.086668	68
Minimum	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
Minimum	900-4500	24: Kuhio-Lanikai NBTH	0.001515	18.557456	1

Alternative 2: Turbo Roundabout PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Minimum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Minimum	900-4500	26: Kuhio-Lanikai WBRT	1.169564	47.965299	30
Minimum	900-4500	27: Kuhio-Haleilio SBTH	44.746786	371.311477	456
Minimum	900-4500	28: Kuhio-Haleilio NBLT	10.409548	172.438536	85
Minimum	900-4500	29: Kuhio-Haleilio NBTH	10.536124	323.50573	178
Minimum	900-4500	30: Kuhio-Haleilio EBLT	25.910758	170.98358	66
Minimum	900-4500	31: Kuhio-Haleilio EBRT	0.27231	61.580286	5
Minimum	900-4500	33: Kuhio-Papaloa S NBRT	2.300711	297.160386	16
Minimum	900-4500	34: Kuhio-Papaloa S WBRT	0	0	0
Minimum	900-4500	35: Kuhio-Kuamoo SBTH	32.770187	352.496156	287
Minimum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Minimum	900-4500	37: Kuhio-Kuamoo NBLT	61.173925	810.87078	334
Minimum	900-4500	38: Kuhio-Kuamoo NBTH	44.324952	927.816522	376
Minimum	900-4500	39: Kuhio-Kuamoo EBLT	74.67815	568.935489	141
Minimum	900-4500	40: Kuhio-Kuamoo EBRT	8.254823	157.682624	96
Minimum	900-4500	140: Kuhio-KBR WB	7.072073	104.78003	42
Minimum	900-4500	141: Kuhio-KBR EBRT	2.829811	172.225557	30
Minimum	900-4500	142: Kuhio-KBR NB	136.022979	627.882712	1263
Minimum	900-4500	143: Kuhio-KBR SB	255.870614	480.55618	1663
Minimum	900-4500	144: Kuhio-KBR EB	6.379254	155.483153	50
Maximum	900-4500	1: Kuhio-Aleka N SBLT	1.057682	101.733231	11
Maximum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Maximum	900-4500	3: Kuhio-Aleka N NBTH	0.039743	104.824337	2
Maximum	900-4500	4: Kuhio-Aleka N NBRT	0.034407	111.097039	1
Maximum	900-4500	5: Kuhio-Aleka N WBLT	0.257875	76.788898	9
Maximum	900-4500	6: Kuhio-Aleka N WBRT	1.145284	76.303288	27
Maximum	900-4500	7: Kuhio-Aleka S SBLT	196.086779	989.815816	869
Maximum	900-4500	8: Kuhio-Aleka S SBTH	317.170067	989.881639	1826
Maximum	900-4500	9: Kuhio-Aleka S NBTH	0.032422	118.383958	0
Maximum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Maximum	900-4500	11: Kuhio-Aleka S WBLT	160.002894	233.008798	323
Maximum	900-4500	12: Kuhio-Aleka S WBRT	99.134338	242.747583	217
Maximum	900-4500	23: Kuhio-Lanikai SBTH	0.03195	26.980011	1
Maximum	900-4500	24: Kuhio-Lanikai NBTH	9.920491	346.89718	88
Maximum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Maximum	900-4500	26: Kuhio-Lanikai WBRT	1.701883	65.014629	34
Maximum	900-4500	27: Kuhio-Haleilio SBTH	61.570823	513.188646	571
Maximum	900-4500	28: Kuhio-Haleilio NBLT	30.942583	794.859789	165
Maximum	900-4500	29: Kuhio-Haleilio NBTH	26.911872	784.555323	263
Maximum	900-4500	30: Kuhio-Haleilio EBLT	31.036863	272.953532	87
Maximum	900-4500	31: Kuhio-Haleilio EBRT	1.341476	120.046134	10
Maximum	900-4500	33: Kuhio-Papaloa S NBRT	8.601237	527.25491	64

Alternative 2: Turbo Roundabout PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Maximum	900-4500	34: Kuhio-Papaloa S WBRT	0.288623	52.142494	4
Maximum	900-4500	35: Kuhio-Kuamoo SBTH	63.425099	614.331503	409
Maximum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Maximum	900-4500	37: Kuhio-Kuamoo NBLT	137.303895	1120.836659	676
Maximum	900-4500	38: Kuhio-Kuamoo NBTH	112.969421	1121.08139	629
Maximum	900-4500	39: Kuhio-Kuamoo EBLT	119.577133	870.910549	174
Maximum	900-4500	40: Kuhio-Kuamoo EBRT	23.707075	494.344936	152
Maximum	900-4500	140: Kuhio-KBR WB	23.769602	260.971067	91
Maximum	900-4500	141: Kuhio-KBR EBRT	9.088449	460.266922	67
Maximum	900-4500	142: Kuhio-KBR NB	321.891203	1248.558655	2434
Maximum	900-4500	143: Kuhio-KBR SB	401.665092	498.968204	2449
Maximum	900-4500	144: Kuhio-KBR EB	16.921465	415.944999	139
95% percentile	900-4500	1: Kuhio-Aleka N SBLT	1.057682	101.733231	11
95% percentile	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
95% percentile	900-4500	3: Kuhio-Aleka N NBTH	0.039743	104.824337	2
95% percentile	900-4500	4: Kuhio-Aleka N NBRT	0.034407	111.097039	1
95% percentile	900-4500	5: Kuhio-Aleka N WBLT	0.257875	76.788898	9
95% percentile	900-4500	6: Kuhio-Aleka N WBRT	1.145284	76.303288	27
95% percentile	900-4500	7: Kuhio-Aleka S SBLT	196.086779	989.815816	869
95% percentile	900-4500	8: Kuhio-Aleka S SBTH	317.170067	989.881639	1826
95% percentile	900-4500	9: Kuhio-Aleka S NBTH	0.032422	118.383958	0
95% percentile	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
95% percentile	900-4500	11: Kuhio-Aleka S WBLT	160.002894	233.008798	323
95% percentile	900-4500	12: Kuhio-Aleka S WBRT	99.134338	242.747583	217
95% percentile	900-4500	23: Kuhio-Lanikai SBTH	0.03195	26.980011	1
95% percentile	900-4500	24: Kuhio-Lanikai NBTH	9.920491	346.89718	88
95% percentile	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
95% percentile	900-4500	26: Kuhio-Lanikai WBRT	1.701883	65.014629	34
95% percentile	900-4500	27: Kuhio-Haleilio SBTH	61.570823	513.188646	571
95% percentile	900-4500	28: Kuhio-Haleilio NBLT	30.942583	794.859789	165
95% percentile	900-4500	29: Kuhio-Haleilio NBTH	26.911872	784.555323	263
95% percentile	900-4500	30: Kuhio-Haleilio EBLT	31.036863	272.953532	87
95% percentile	900-4500	31: Kuhio-Haleilio EBRT	1.341476	120.046134	10
95% percentile	900-4500	33: Kuhio-Papaloa S NBRT	8.601237	527.25491	64
95% percentile	900-4500	34: Kuhio-Papaloa S WBRT	0.288623	52.142494	4
95% percentile	900-4500	35: Kuhio-Kuamoo SBTH	63.425099	614.331503	409
95% percentile	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
95% percentile	900-4500	37: Kuhio-Kuamoo NBLT	137.303895	1120.836659	676
95% percentile	900-4500	38: Kuhio-Kuamoo NBTH	112.969421	1121.08139	629
95% percentile	900-4500	39: Kuhio-Kuamoo EBLT	119.577133	870.910549	174
95% percentile	900-4500	40: Kuhio-Kuamoo EBRT	23.707075	494.344936	152
95% percentile	900-4500	140: Kuhio-KBR WB	23.769602	260.971067	91

Alternative 2: Turbo Roundabout PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
95% percentile	900-4500	141: Kuhio-KBR EBRT	9.088449	460.266922	67
95% percentile	900-4500	142: Kuhio-KBR NB	321.891203	1248.558655	2434
95% percentile	900-4500	143: Kuhio-KBR SB	401.665092	498.968204	2449
95% percentile	900-4500	144: Kuhio-KBR EB	16.921465	415.944999	139

APPENDIX B

VISSIM SIMULATION RESULTS

- Alternative 3A: Traffic Signal (Protected Only Left-Turns)

Alternative 3A: Traffic Signal (Protected Left-Turns) AM - Travel Time Results

SimRun	TimeInt	VehicleTravelTimeMeasurement	Vehs(All)	TravTm(All)	DistTrav(All)
1	900-4500	1: Kuhio SB	626	225.594102	7553.405653
1	900-4500	2: Kuhio NB	448	197.45416	7587.931168
1	900-4500	3: Kapaa Bypass Rd SB	705	369.091754	7667.549231
1	900-4500	4: Kapaa Bypass Rd NB	97	224.467726	7726.112565
2	900-4500	1: Kuhio SB	589	221.354484	7553.405653
2	900-4500	2: Kuhio NB	443	197.1792	7587.931168
2	900-4500	3: Kapaa Bypass Rd SB	728	264.293993	7667.549231
2	900-4500	4: Kapaa Bypass Rd NB	105	223.779708	7726.112565
3	900-4500	1: Kuhio SB	591	224.079988	7553.405653
3	900-4500	2: Kuhio NB	460	195.349885	7587.931168
3	900-4500	3: Kapaa Bypass Rd SB	730	266.31942	7667.549231
3	900-4500	4: Kapaa Bypass Rd NB	103	224.7853	7726.112565
4	900-4500	1: Kuhio SB	583	219.835079	7553.405653
4	900-4500	2: Kuhio NB	438	199.911944	7587.931168
4	900-4500	3: Kapaa Bypass Rd SB	679	238.130076	7667.549231
4	900-4500	4: Kapaa Bypass Rd NB	96	231.159774	7726.112565
5	900-4500	1: Kuhio SB	588	215.813205	7553.405653
5	900-4500	2: Kuhio NB	453	195.051826	7587.931168
5	900-4500	3: Kapaa Bypass Rd SB	700	233.248048	7667.549231
5	900-4500	4: Kapaa Bypass Rd NB	114	221.292658	7726.112565
Avg	900-4500	1: Kuhio SB	595	221.335372	7553.405653
Avg	900-4500	2: Kuhio NB	448	196.989403	7587.931168
Avg	900-4500	3: Kapaa Bypass Rd SB	708	274.216658	7667.549231
Avg	900-4500	4: Kapaa Bypass Rd NB	103	225.097033	7726.112565
Standard deviation	900-4500	1: Kuhio SB	17	3.821494	0
Standard deviation	900-4500	2: Kuhio NB	9	1.951633	0
Standard deviation	900-4500	3: Kapaa Bypass Rd SB	21	55.097137	0
Standard deviation	900-4500	4: Kapaa Bypass Rd NB	7	3.655771	0
Minimum	900-4500	1: Kuhio SB	583	215.813205	7553.405653
Minimum	900-4500	2: Kuhio NB	438	195.051826	7587.931168
Minimum	900-4500	3: Kapaa Bypass Rd SB	679	233.248048	7667.549231
Minimum	900-4500	4: Kapaa Bypass Rd NB	96	221.292658	7726.112565
Maximum	900-4500	1: Kuhio SB	626	225.594102	7553.405653
Maximum	900-4500	2: Kuhio NB	460	199.911944	7587.931168
Maximum	900-4500	3: Kapaa Bypass Rd SB	730	369.091754	7667.549231
Maximum	900-4500	4: Kapaa Bypass Rd NB	114	231.159774	7726.112565
95% percentile	900-4500	1: Kuhio SB	626	225.594102	7553.405653
95% percentile	900-4500	2: Kuhio NB	460	199.911944	7587.931168
95% percentile	900-4500	3: Kapaa Bypass Rd SB	730	369.091754	7667.549231
95% percentile	900-4500	4: Kapaa Bypass Rd NB	114	231.159774	7726.112565

Alternative 3A: Traffic Signal (Protected Left-Turns) AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
1	900-4500	1: Kuhio-Aleka N SBLT	0.644272	74.845454	2
1	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
1	900-4500	3: Kuhio-Aleka N NBTH	0.301365	158.447139	3
1	900-4500	4: Kuhio-Aleka N NBRT	0.31389	165.760524	2
1	900-4500	5: Kuhio-Aleka N WBLT	0.070054	35.316087	3
1	900-4500	6: Kuhio-Aleka N WBRT	1.040671	72.583242	10
1	900-4500	7: Kuhio-Aleka S SBLT	0.134877	24.324348	2
1	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
1	900-4500	9: Kuhio-Aleka S NBTH	0.541454	258.304338	2
1	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
1	900-4500	11: Kuhio-Aleka S WBLT	1.47734	83.554104	69
1	900-4500	12: Kuhio-Aleka S WBRT	0.063005	19.685098	31
1	900-4500	13: Kuhio-KBR SBLT	36.40534	410.875167	116
1	900-4500	17: Kuhio-KBR SBTH	101.480203	474.490418	598
1	900-4500	19: Kuhio-KBR NBLT	49.770472	301.591929	127
1	900-4500	20: Kuhio-KBR NBTH	80.579152	450.354746	532
1	900-4500	21: Kuhio-KBR EBLT	0.580464	40.109679	3
1	900-4500	23: Kuhio-Lanikai SBTH	0.929348	84.644155	20
1	900-4500	24: Kuhio-Lanikai NBTH	0.008798	18.863783	1
1	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
1	900-4500	26: Kuhio-Lanikai WBRT	0.303823	26.623374	10
1	900-4500	27: Kuhio-Haleilio SBTH	82.376096	541.941562	713
1	900-4500	28: Kuhio-Haleilio NBLT	0.158439	58.598277	2
1	900-4500	29: Kuhio-Haleilio NBTH	6.404442	261.435431	100
1	900-4500	30: Kuhio-Haleilio EBLT	39.770626	299.514724	131
1	900-4500	31: Kuhio-Haleilio EBRT	5.696122	116.192784	47
1	900-4500	33: Kuhio-Papaloa S NBRT	0.219125	135.976968	2
1	900-4500	34: Kuhio-Papaloa S WBRT	0.793003	72.86903	10
1	900-4500	35: Kuhio-Kuamoo SBTH	163.039841	1031.805111	950
1	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
1	900-4500	37: Kuhio-Kuamoo NBLT	15.27814	236.964383	74
1	900-4500	38: Kuhio-Kuamoo NBTH	16.562192	189.711322	187
1	900-4500	39: Kuhio-Kuamoo EBLT	875.37762	1713.578208	1847
1	900-4500	40: Kuhio-Kuamoo EBRT	1149.020972	1713.647474	2847
1	900-4500	140: Kuhio-KBR WB	3.721527	99.98442	39
1	900-4500	141: Kuhio-KBR EBRT	1262.179523	1713.654983	3364
2	900-4500	1: Kuhio-Aleka N SBLT	0.588082	104.560482	5
2	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
2	900-4500	3: Kuhio-Aleka N NBTH	0.115882	99.306739	5
2	900-4500	4: Kuhio-Aleka N NBRT	0.024018	79.877519	1
2	900-4500	5: Kuhio-Aleka N WBLT	0.103614	56.953304	6
2	900-4500	6: Kuhio-Aleka N WBRT	0.333288	53.269442	5

Alternative 3A: Traffic Signal (Protected Left-Turns) AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
2	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
2	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
2	900-4500	9: Kuhio-Aleka S NBTH	0.224426	169.55388	1
2	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
2	900-4500	11: Kuhio-Aleka S WBLT	3.648858	127.932724	68
2	900-4500	12: Kuhio-Aleka S WBRT	0.305473	113.595254	48
2	900-4500	13: Kuhio-KBR SBLT	20.164068	288.559466	48
2	900-4500	17: Kuhio-KBR SBTH	113.89343	411.5782	608
2	900-4500	19: Kuhio-KBR NBLT	49.894978	326.575299	138
2	900-4500	20: Kuhio-KBR NBTH	69.966789	421.627756	514
2	900-4500	21: Kuhio-KBR EBLT	1.066506	22.790152	8
2	900-4500	23: Kuhio-Lanikai SBTH	1.006779	117.403993	19
2	900-4500	24: Kuhio-Lanikai NBTH	0.102523	58.897169	2
2	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
2	900-4500	26: Kuhio-Lanikai WBRT	0.427019	27.344643	16
2	900-4500	27: Kuhio-Haleilio SBTH	74.161469	528.20245	666
2	900-4500	28: Kuhio-Haleilio NBLT	1.826166	84.81803	11
2	900-4500	29: Kuhio-Haleilio NBTH	8.141019	309.639525	148
2	900-4500	30: Kuhio-Haleilio EBLT	46.935735	603.976979	138
2	900-4500	31: Kuhio-Haleilio EBRT	10.946566	213.987275	70
2	900-4500	33: Kuhio-Papaloa S NBRT	0.151416	166.116847	0
2	900-4500	34: Kuhio-Papaloa S WBRT	0.655175	53.230533	8
2	900-4500	35: Kuhio-Kuamoo SBTH	128.223503	769.124621	874
2	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
2	900-4500	37: Kuhio-Kuamoo NBLT	10.243884	168.433604	55
2	900-4500	38: Kuhio-Kuamoo NBTH	18.21148	218.400814	211
2	900-4500	39: Kuhio-Kuamoo EBLT	48.556584	418.63743	106
2	900-4500	40: Kuhio-Kuamoo EBRT	712.88356	1695.242331	1872
2	900-4500	140: Kuhio-KBR WB	2.750359	82.726121	28
2	900-4500	141: Kuhio-KBR EBRT	632.293852	1653.735809	1860
3	900-4500	1: Kuhio-Aleka N SBLT	0	0	0
3	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
3	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
3	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
3	900-4500	5: Kuhio-Aleka N WBLT	0.000434	15.624752	1
3	900-4500	6: Kuhio-Aleka N WBRT	0.41951	71.610743	8
3	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
3	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
3	900-4500	9: Kuhio-Aleka S NBTH	0.517429	186.523598	1
3	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
3	900-4500	11: Kuhio-Aleka S WBLT	1.144139	84.822568	57
3	900-4500	12: Kuhio-Aleka S WBRT	0.106534	69.153907	35

Alternative 3A: Traffic Signal (Protected Left-Turns) AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
3	900-4500	13: Kuhio-KBR SBLT	29.938273	395.839499	84
3	900-4500	17: Kuhio-KBR SBTH	107.923715	446.200517	633
3	900-4500	19: Kuhio-KBR NBLT	47.283898	276.086043	124
3	900-4500	20: Kuhio-KBR NBTH	77.457185	396.059316	512
3	900-4500	21: Kuhio-KBR EBLT	0.882548	40.258404	2
3	900-4500	23: Kuhio-Lanikai SBTH	2.582761	273.457358	31
3	900-4500	24: Kuhio-Lanikai NBTH	0.045071	35.917294	1
3	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
3	900-4500	26: Kuhio-Lanikai WBRT	0.298625	26.393496	14
3	900-4500	27: Kuhio-Haleilio SBTH	80.663608	534.802432	663
3	900-4500	28: Kuhio-Haleilio NBLT	1.73187	57.597556	10
3	900-4500	29: Kuhio-Haleilio NBTH	4.197337	166.40892	72
3	900-4500	30: Kuhio-Haleilio EBLT	25.873549	257.259728	85
3	900-4500	31: Kuhio-Haleilio EBRT	4.544236	104.654343	41
3	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
3	900-4500	34: Kuhio-Papaloa S WBRT	0.619469	73.709073	10
3	900-4500	35: Kuhio-Kuamoo SBTH	146.889077	950.895176	878
3	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
3	900-4500	37: Kuhio-Kuamoo NBLT	13.452457	232.259927	71
3	900-4500	38: Kuhio-Kuamoo NBTH	18.171628	328.356963	200
3	900-4500	39: Kuhio-Kuamoo EBLT	38.251205	697.74093	77
3	900-4500	40: Kuhio-Kuamoo EBRT	590.032335	1594.474024	1718
3	900-4500	140: Kuhio-KBR WB	3.475418	107.908725	42
3	900-4500	141: Kuhio-KBR EBRT	647.768689	1693.493376	1914
4	900-4500	1: Kuhio-Aleka N SBLT	0.335097	31.567333	2
4	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
4	900-4500	3: Kuhio-Aleka N NBTH	0.321506	179.705895	4
4	900-4500	4: Kuhio-Aleka N NBRT	0.168466	187.019281	1
4	900-4500	5: Kuhio-Aleka N WBLT	0.136521	36.743381	3
4	900-4500	6: Kuhio-Aleka N WBRT	0.774762	72.959347	8
4	900-4500	7: Kuhio-Aleka S SBLT	0.034573	22.146547	1
4	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
4	900-4500	9: Kuhio-Aleka S NBTH	0.169015	147.100209	0
4	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
4	900-4500	11: Kuhio-Aleka S WBLT	2.985527	128.482244	76
4	900-4500	12: Kuhio-Aleka S WBRT	0.63129	135.153002	35
4	900-4500	13: Kuhio-KBR SBLT	23.574315	389.999467	76
4	900-4500	17: Kuhio-KBR SBTH	92.554291	401.650489	578
4	900-4500	19: Kuhio-KBR NBLT	48.54197	261.762971	124
4	900-4500	20: Kuhio-KBR NBTH	74.946868	422.57696	494
4	900-4500	21: Kuhio-KBR EBLT	2.308595	39.045624	7
4	900-4500	23: Kuhio-Lanikai SBTH	0.197378	98.300841	7

Alternative 3A: Traffic Signal (Protected Left-Turns) AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
4	900-4500	24: Kuhio-Lanikai NBTH	0.000915	16.672355	1
4	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
4	900-4500	26: Kuhio-Lanikai WBRT	0.353358	26.328302	12
4	900-4500	27: Kuhio-Haleilio SBTH	52.949973	538.720162	566
4	900-4500	28: Kuhio-Haleilio NBLT	1.588356	54.978352	9
4	900-4500	29: Kuhio-Haleilio NBTH	6.842408	259.972022	124
4	900-4500	30: Kuhio-Haleilio EBLT	35.722747	398.756451	123
4	900-4500	31: Kuhio-Haleilio EBRT	7.013487	162.212761	54
4	900-4500	33: Kuhio-Papaloa S NBRT	0.403128	175.333192	4
4	900-4500	34: Kuhio-Papaloa S WBRT	0.826131	52.102219	11
4	900-4500	35: Kuhio-Kuamoo SBTH	164.055386	953.575674	1018
4	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
4	900-4500	37: Kuhio-Kuamoo NBLT	5.752399	94.453041	49
4	900-4500	38: Kuhio-Kuamoo NBTH	21.583384	236.4194	251
4	900-4500	39: Kuhio-Kuamoo EBLT	305.842228	1640.26258	578
4	900-4500	40: Kuhio-Kuamoo EBRT	862.356615	1693.911426	2038
4	900-4500	140: Kuhio-KBR WB	2.827846	104.344172	35
4	900-4500	141: Kuhio-KBR EBRT	286.308962	1317.694992	1120
5	900-4500	1: Kuhio-Aleka N SBLT	0.13282	30.785968	3
5	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
5	900-4500	3: Kuhio-Aleka N NBTH	0.102362	75.147872	3
5	900-4500	4: Kuhio-Aleka N NBRT	0.050122	82.461257	1
5	900-4500	5: Kuhio-Aleka N WBLT	0.179631	39.780955	5
5	900-4500	6: Kuhio-Aleka N WBRT	0.142666	51.518126	4
5	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
5	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
5	900-4500	9: Kuhio-Aleka S NBTH	0.174854	181.171896	0
5	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
5	900-4500	11: Kuhio-Aleka S WBLT	3.010613	105.726077	62
5	900-4500	12: Kuhio-Aleka S WBRT	0.209098	90.219208	37
5	900-4500	13: Kuhio-KBR SBLT	31.891612	317.480517	97
5	900-4500	17: Kuhio-KBR SBTH	107.480591	421.07577	602
5	900-4500	19: Kuhio-KBR NBLT	54.072019	239.067396	148
5	900-4500	20: Kuhio-KBR NBTH	71.458476	501.874012	504
5	900-4500	21: Kuhio-KBR EBLT	6.15104	291.844256	17
5	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
5	900-4500	24: Kuhio-Lanikai NBTH	0.276081	90.570099	6
5	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
5	900-4500	26: Kuhio-Lanikai WBRT	0.358936	26.196699	15
5	900-4500	27: Kuhio-Haleilio SBTH	51.07687	492.453237	542
5	900-4500	28: Kuhio-Haleilio NBLT	1.009554	80.905306	9
5	900-4500	29: Kuhio-Haleilio NBTH	8.05318	241.715061	123

Alternative 3A: Traffic Signal (Protected Left-Turns) AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
5	900-4500	30: Kuhio-Haleilio EBLT	45.903427	525.217451	164
5	900-4500	31: Kuhio-Haleilio EBRT	8.435342	173.186288	60
5	900-4500	33: Kuhio-Papaloa S NBRT	0.08981	78.084954	1
5	900-4500	34: Kuhio-Papaloa S WBRT	0.796674	53.066155	13
5	900-4500	35: Kuhio-Kuamoo SBTH	124.467501	881.369754	775
5	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
5	900-4500	37: Kuhio-Kuamoo NBLT	13.835957	139.518045	72
5	900-4500	38: Kuhio-Kuamoo NBTH	18.306357	282.656322	208
5	900-4500	39: Kuhio-Kuamoo EBLT	882.318112	1713.623891	1937
5	900-4500	40: Kuhio-Kuamoo EBRT	1335.095983	1713.953762	3312
5	900-4500	140: Kuhio-KBR WB	2.069415	104.374012	36
5	900-4500	141: Kuhio-KBR EBRT	293.352134	1167.637237	1215
Avg	900-4500	1: Kuhio-Aleka N SBLT	0.340054	48.351847	2
Avg	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Avg	900-4500	3: Kuhio-Aleka N NBTH	0.168223	102.521529	3
Avg	900-4500	4: Kuhio-Aleka N NBRT	0.111299	103.023716	1
Avg	900-4500	5: Kuhio-Aleka N WBLT	0.098051	36.883696	4
Avg	900-4500	6: Kuhio-Aleka N WBRT	0.542179	64.38818	7
Avg	900-4500	7: Kuhio-Aleka S SBLT	0.03389	9.294179	1
Avg	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Avg	900-4500	9: Kuhio-Aleka S NBTH	0.325436	188.530784	1
Avg	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Avg	900-4500	11: Kuhio-Aleka S WBLT	2.453295	106.103543	66
Avg	900-4500	12: Kuhio-Aleka S WBRT	0.26308	85.561294	37
Avg	900-4500	13: Kuhio-KBR SBLT	28.394722	360.550823	84
Avg	900-4500	17: Kuhio-KBR SBTH	104.666446	430.999079	604
Avg	900-4500	19: Kuhio-KBR NBLT	49.912667	281.016728	132
Avg	900-4500	20: Kuhio-KBR NBTH	74.881694	438.498558	511
Avg	900-4500	21: Kuhio-KBR EBLT	2.19783	86.809623	7
Avg	900-4500	23: Kuhio-Lanikai SBTH	0.943253	114.76127	15
Avg	900-4500	24: Kuhio-Lanikai NBTH	0.086677	44.18414	2
Avg	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Avg	900-4500	26: Kuhio-Lanikai WBRT	0.348352	26.577303	13
Avg	900-4500	27: Kuhio-Haleilio SBTH	68.245603	527.223968	630
Avg	900-4500	28: Kuhio-Haleilio NBLT	1.262877	67.379504	8
Avg	900-4500	29: Kuhio-Haleilio NBTH	6.727677	247.834192	113
Avg	900-4500	30: Kuhio-Haleilio EBLT	38.841217	416.945067	128
Avg	900-4500	31: Kuhio-Haleilio EBRT	7.32715	154.04669	54
Avg	900-4500	33: Kuhio-Papaloa S NBRT	0.172696	111.102392	1
Avg	900-4500	34: Kuhio-Papaloa S WBRT	0.73809	60.995402	10
Avg	900-4500	35: Kuhio-Kuamoo SBTH	145.335061	917.354067	899
Avg	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0

Alternative 3A: Traffic Signal (Protected Left-Turns) AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Avg	900-4500	37: Kuhio-Kuamoo NBLT	11.712568	174.3258	64
Avg	900-4500	38: Kuhio-Kuamoo NBTH	18.567008	251.108964	211
Avg	900-4500	39: Kuhio-Kuamoo EBLT	430.06915	1236.768608	909
Avg	900-4500	40: Kuhio-Kuamoo EBRT	929.877893	1682.245803	2357
Avg	900-4500	140: Kuhio-KBR WB	2.968913	99.86749	36
Avg	900-4500	141: Kuhio-KBR EBRT	624.380632	1509.243279	1895
Standard deviation	900-4500	1: Kuhio-Aleka N SBLT	0.279586	41.19922	2
Standard deviation	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Standard deviation	900-4500	3: Kuhio-Aleka N NBTH	0.138382	71.336204	2
Standard deviation	900-4500	4: Kuhio-Aleka N NBRT	0.130441	75.10594	1
Standard deviation	900-4500	5: Kuhio-Aleka N WBLT	0.067969	14.710567	2
Standard deviation	900-4500	6: Kuhio-Aleka N WBRT	0.360861	10.977864	2
Standard deviation	900-4500	7: Kuhio-Aleka S SBLT	0.058405	12.749849	1
Standard deviation	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Standard deviation	900-4500	9: Kuhio-Aleka S NBTH	0.187664	41.842401	1
Standard deviation	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Standard deviation	900-4500	11: Kuhio-Aleka S WBLT	1.082777	22.016011	7
Standard deviation	900-4500	12: Kuhio-Aleka S WBRT	0.226289	44.372886	6
Standard deviation	900-4500	13: Kuhio-KBR SBLT	6.514614	54.043639	25
Standard deviation	900-4500	17: Kuhio-KBR SBTH	8.070361	29.409023	20
Standard deviation	900-4500	19: Kuhio-KBR NBLT	2.554896	34.108971	11
Standard deviation	900-4500	20: Kuhio-KBR NBTH	4.329352	40.29959	14
Standard deviation	900-4500	21: Kuhio-KBR EBLT	2.305747	114.855337	6
Standard deviation	900-4500	23: Kuhio-Lanikai SBTH	1.017137	99.422794	12
Standard deviation	900-4500	24: Kuhio-Lanikai NBTH	0.113222	30.961629	2
Standard deviation	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Standard deviation	900-4500	26: Kuhio-Lanikai WBRT	0.051916	0.455955	2
Standard deviation	900-4500	27: Kuhio-Haleilio SBTH	15.145931	20.100773	73
Standard deviation	900-4500	28: Kuhio-Haleilio NBLT	0.694108	14.26214	4
Standard deviation	900-4500	29: Kuhio-Haleilio NBTH	1.602714	52.008986	29
Standard deviation	900-4500	30: Kuhio-Haleilio EBLT	8.575329	146.9047	29
Standard deviation	900-4500	31: Kuhio-Haleilio EBRT	2.491561	44.436485	11
Standard deviation	900-4500	33: Kuhio-Papaloa S NBRT	0.151988	72.80938	2
Standard deviation	900-4500	34: Kuhio-Papaloa S WBRT	0.093734	11.234715	2
Standard deviation	900-4500	35: Kuhio-Kuamoo SBTH	18.672073	98.492248	91
Standard deviation	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Standard deviation	900-4500	37: Kuhio-Kuamoo NBLT	3.805586	61.044882	11
Standard deviation	900-4500	38: Kuhio-Kuamoo NBTH	1.834971	54.812786	24
Standard deviation	900-4500	39: Kuhio-Kuamoo EBLT	423.477929	627.979937	920
Standard deviation	900-4500	40: Kuhio-Kuamoo EBRT	307.963495	50.000853	689
Standard deviation	900-4500	140: Kuhio-KBR WB	0.65187	9.985628	5
Standard deviation	900-4500	141: Kuhio-KBR EBRT	397.262308	249.997884	898

Alternative 3A: Traffic Signal (Protected Left-Turns) AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Minimum	900-4500	1: Kuhio-Aleka N SBLT	0	0	0
Minimum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Minimum	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
Minimum	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
Minimum	900-4500	5: Kuhio-Aleka N WBLT	0.000434	15.624752	1
Minimum	900-4500	6: Kuhio-Aleka N WBRT	0.142666	51.518126	4
Minimum	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
Minimum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Minimum	900-4500	9: Kuhio-Aleka S NBTH	0.169015	147.100209	0
Minimum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Minimum	900-4500	11: Kuhio-Aleka S WBLT	1.144139	83.554104	57
Minimum	900-4500	12: Kuhio-Aleka S WBRT	0.063005	19.685098	31
Minimum	900-4500	13: Kuhio-KBR SBLT	20.164068	288.559466	48
Minimum	900-4500	17: Kuhio-KBR SBTH	92.554291	401.650489	578
Minimum	900-4500	19: Kuhio-KBR NBLT	47.283898	239.067396	124
Minimum	900-4500	20: Kuhio-KBR NBTH	69.966789	396.059316	494
Minimum	900-4500	21: Kuhio-KBR EBLT	0.580464	22.790152	2
Minimum	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
Minimum	900-4500	24: Kuhio-Lanikai NBTH	0.000915	16.672355	1
Minimum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Minimum	900-4500	26: Kuhio-Lanikai WBRT	0.298625	26.196699	10
Minimum	900-4500	27: Kuhio-Haleilio SBTH	51.07687	492.453237	542
Minimum	900-4500	28: Kuhio-Haleilio NBLT	0.158439	54.978352	2
Minimum	900-4500	29: Kuhio-Haleilio NBTH	4.197337	166.40892	72
Minimum	900-4500	30: Kuhio-Haleilio EBLT	25.873549	257.259728	85
Minimum	900-4500	31: Kuhio-Haleilio EBRT	4.544236	104.654343	41
Minimum	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
Minimum	900-4500	34: Kuhio-Papaloa S WBRT	0.619469	52.102219	8
Minimum	900-4500	35: Kuhio-Kuamoo SBTH	124.467501	769.124621	775
Minimum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Minimum	900-4500	37: Kuhio-Kuamoo NBLT	5.752399	94.453041	49
Minimum	900-4500	38: Kuhio-Kuamoo NBTH	16.562192	189.711322	187
Minimum	900-4500	39: Kuhio-Kuamoo EBLT	38.251205	418.63743	77
Minimum	900-4500	40: Kuhio-Kuamoo EBRT	590.032335	1594.474024	1718
Minimum	900-4500	140: Kuhio-KBR WB	2.069415	82.726121	28
Minimum	900-4500	141: Kuhio-KBR EBRT	286.308962	1167.637237	1120
Maximum	900-4500	1: Kuhio-Aleka N SBLT	0.644272	104.560482	5
Maximum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Maximum	900-4500	3: Kuhio-Aleka N NBTH	0.321506	179.705895	5
Maximum	900-4500	4: Kuhio-Aleka N NBRT	0.31389	187.019281	2
Maximum	900-4500	5: Kuhio-Aleka N WBLT	0.179631	56.953304	6
Maximum	900-4500	6: Kuhio-Aleka N WBRT	1.040671	72.959347	10

Alternative 3A: Traffic Signal (Protected Left-Turns) AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Maximum	900-4500	7: Kuhio-Aleka S SBLT	0.134877	24.324348	2
Maximum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Maximum	900-4500	9: Kuhio-Aleka S NBTH	0.541454	258.304338	2
Maximum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Maximum	900-4500	11: Kuhio-Aleka S WBLT	3.648858	128.482244	76
Maximum	900-4500	12: Kuhio-Aleka S WBRT	0.63129	135.153002	48
Maximum	900-4500	13: Kuhio-KBR SBLT	36.40534	410.875167	116
Maximum	900-4500	17: Kuhio-KBR SBTH	113.89343	474.490418	633
Maximum	900-4500	19: Kuhio-KBR NBLT	54.072019	326.575299	148
Maximum	900-4500	20: Kuhio-KBR NBTH	80.579152	501.874012	532
Maximum	900-4500	21: Kuhio-KBR EBLT	6.15104	291.844256	17
Maximum	900-4500	23: Kuhio-Lanikai SBTH	2.582761	273.457358	31
Maximum	900-4500	24: Kuhio-Lanikai NBTH	0.276081	90.570099	6
Maximum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Maximum	900-4500	26: Kuhio-Lanikai WBRT	0.427019	27.344643	16
Maximum	900-4500	27: Kuhio-Haleilio SBTH	82.376096	541.941562	713
Maximum	900-4500	28: Kuhio-Haleilio NBLT	1.826166	84.81803	11
Maximum	900-4500	29: Kuhio-Haleilio NBTH	8.141019	309.639525	148
Maximum	900-4500	30: Kuhio-Haleilio EBLT	46.935735	603.976979	164
Maximum	900-4500	31: Kuhio-Haleilio EBRT	10.946566	213.987275	70
Maximum	900-4500	33: Kuhio-Papaloa S NBRT	0.403128	175.333192	4
Maximum	900-4500	34: Kuhio-Papaloa S WBRT	0.826131	73.709073	13
Maximum	900-4500	35: Kuhio-Kuamoo SBTH	164.055386	1031.805111	1018
Maximum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Maximum	900-4500	37: Kuhio-Kuamoo NBLT	15.27814	236.964383	74
Maximum	900-4500	38: Kuhio-Kuamoo NBTH	21.583384	328.356963	251
Maximum	900-4500	39: Kuhio-Kuamoo EBLT	882.318112	1713.623891	1937
Maximum	900-4500	40: Kuhio-Kuamoo EBRT	1335.095983	1713.953762	3312
Maximum	900-4500	140: Kuhio-KBR WB	3.721527	107.908725	42
Maximum	900-4500	141: Kuhio-KBR EBRT	1262.179523	1713.654983	3364
95% percentile	900-4500	1: Kuhio-Aleka N SBLT	0.644272	104.560482	5
95% percentile	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
95% percentile	900-4500	3: Kuhio-Aleka N NBTH	0.321506	179.705895	5
95% percentile	900-4500	4: Kuhio-Aleka N NBRT	0.31389	187.019281	2
95% percentile	900-4500	5: Kuhio-Aleka N WBLT	0.179631	56.953304	6
95% percentile	900-4500	6: Kuhio-Aleka N WBRT	1.040671	72.959347	10
95% percentile	900-4500	7: Kuhio-Aleka S SBLT	0.134877	24.324348	2
95% percentile	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
95% percentile	900-4500	9: Kuhio-Aleka S NBTH	0.541454	258.304338	2
95% percentile	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
95% percentile	900-4500	11: Kuhio-Aleka S WBLT	3.648858	128.482244	76
95% percentile	900-4500	12: Kuhio-Aleka S WBRT	0.63129	135.153002	48

Alternative 3A: Traffic Signal (Protected Left-Turns) AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
95% percentile	900-4500	13: Kuhio-KBR SBLT	36.40534	410.875167	116
95% percentile	900-4500	17: Kuhio-KBR SBTH	113.89343	474.490418	633
95% percentile	900-4500	19: Kuhio-KBR NBLT	54.072019	326.575299	148
95% percentile	900-4500	20: Kuhio-KBR NBTH	80.579152	501.874012	532
95% percentile	900-4500	21: Kuhio-KBR EBLT	6.15104	291.844256	17
95% percentile	900-4500	23: Kuhio-Lanikai SBTH	2.582761	273.457358	31
95% percentile	900-4500	24: Kuhio-Lanikai NBTH	0.276081	90.570099	6
95% percentile	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
95% percentile	900-4500	26: Kuhio-Lanikai WBRT	0.427019	27.344643	16
95% percentile	900-4500	27: Kuhio-Haleilio SBTH	82.376096	541.941562	713
95% percentile	900-4500	28: Kuhio-Haleilio NBLT	1.826166	84.81803	11
95% percentile	900-4500	29: Kuhio-Haleilio NBTH	8.141019	309.639525	148
95% percentile	900-4500	30: Kuhio-Haleilio EBLT	46.935735	603.976979	164
95% percentile	900-4500	31: Kuhio-Haleilio EBRT	10.946566	213.987275	70
95% percentile	900-4500	33: Kuhio-Papaloa S NBRT	0.403128	175.333192	4
95% percentile	900-4500	34: Kuhio-Papaloa S WBRT	0.826131	73.709073	13
95% percentile	900-4500	35: Kuhio-Kuamoo SBTH	164.055386	1031.805111	1018
95% percentile	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
95% percentile	900-4500	37: Kuhio-Kuamoo NBLT	15.27814	236.964383	74
95% percentile	900-4500	38: Kuhio-Kuamoo NBTH	21.583384	328.356963	251
95% percentile	900-4500	39: Kuhio-Kuamoo EBLT	882.318112	1713.623891	1937
95% percentile	900-4500	40: Kuhio-Kuamoo EBRT	1335.095983	1713.953762	3312
95% percentile	900-4500	140: Kuhio-KBR WB	3.721527	107.908725	42
95% percentile	900-4500	141: Kuhio-KBR EBRT	1262.179523	1713.654983	3364

Alternative 3A: Traffic Signal (Protected Left-Turns) PM - Travel Time Results

SimRun	TimeInt	VehicleTravelTimeMeasurement	Vehs(All)	TravTm(All)	DistTrav(All)
1	900-4500	1: Kuhio SB	355	307.181267	7553.405653
1	900-4500	2: Kuhio NB	540	220.216823	7587.931168
1	900-4500	3: Kapaa Bypass Rd SB	474	279.953209	7667.549231
1	900-4500	4: Kapaa Bypass Rd NB	452	321.764986	7726.112565
2	900-4500	1: Kuhio SB	333	287.208071	7553.405653
2	900-4500	2: Kuhio NB	545	201.798957	7587.931168
2	900-4500	3: Kapaa Bypass Rd SB	457	264.451033	7667.549231
2	900-4500	4: Kapaa Bypass Rd NB	479	266.006386	7726.112565
3	900-4500	1: Kuhio SB	358	298.030945	7553.405653
3	900-4500	2: Kuhio NB	534	215.777772	7587.931168
3	900-4500	3: Kapaa Bypass Rd SB	402	266.34117	7667.549231
3	900-4500	4: Kapaa Bypass Rd NB	486	283.401474	7726.112565
4	900-4500	1: Kuhio SB	337	299.938138	7553.405653
4	900-4500	2: Kuhio NB	528	298.192552	7587.931168
4	900-4500	3: Kapaa Bypass Rd SB	439	273.044995	7667.549231
4	900-4500	4: Kapaa Bypass Rd NB	461	402.472612	7726.112565
5	900-4500	1: Kuhio SB	372	299.560587	7553.405653
5	900-4500	2: Kuhio NB	524	214.361766	7587.931168
5	900-4500	3: Kapaa Bypass Rd SB	406	259.681713	7667.549231
5	900-4500	4: Kapaa Bypass Rd NB	479	287.39458	7726.112565
Avg	900-4500	1: Kuhio SB	351	298.383802	7553.405653
Avg	900-4500	2: Kuhio NB	534	230.069574	7587.931168
Avg	900-4500	3: Kapaa Bypass Rd SB	436	268.694424	7667.549231
Avg	900-4500	4: Kapaa Bypass Rd NB	471	312.208008	7726.112565
Standard deviation	900-4500	1: Kuhio SB	16	7.18014	0
Standard deviation	900-4500	2: Kuhio NB	9	38.691199	0
Standard deviation	900-4500	3: Kapaa Bypass Rd SB	31	7.912977	0
Standard deviation	900-4500	4: Kapaa Bypass Rd NB	14	54.35795	0
Minimum	900-4500	1: Kuhio SB	333	287.208071	7553.405653
Minimum	900-4500	2: Kuhio NB	524	201.798957	7587.931168
Minimum	900-4500	3: Kapaa Bypass Rd SB	402	259.681713	7667.549231
Minimum	900-4500	4: Kapaa Bypass Rd NB	452	266.006386	7726.112565
Maximum	900-4500	1: Kuhio SB	372	307.181267	7553.405653
Maximum	900-4500	2: Kuhio NB	545	298.192552	7587.931168
Maximum	900-4500	3: Kapaa Bypass Rd SB	474	279.953209	7667.549231
Maximum	900-4500	4: Kapaa Bypass Rd NB	486	402.472612	7726.112565
95% percentile	900-4500	1: Kuhio SB	372	307.181267	7553.405653
95% percentile	900-4500	2: Kuhio NB	545	298.192552	7587.931168
95% percentile	900-4500	3: Kapaa Bypass Rd SB	474	279.953209	7667.549231
95% percentile	900-4500	4: Kapaa Bypass Rd NB	486	402.472612	7726.112565

Alternative 3A: Traffic Signal (Protected Left-Turns) PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
1	900-4500	1: Kuhio-Aleka N SBLT	1.730408	91.134738	16
1	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
1	900-4500	3: Kuhio-Aleka N NBTH	0.038921	90.462531	1
1	900-4500	4: Kuhio-Aleka N NBRT	0.016154	97.775916	1
1	900-4500	5: Kuhio-Aleka N WBLT	0.093562	35.621136	4
1	900-4500	6: Kuhio-Aleka N WBRT	1.04779	73.629049	18
1	900-4500	7: Kuhio-Aleka S SBLT	0.3945	41.58368	3
1	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
1	900-4500	9: Kuhio-Aleka S NBTH	3.622542	361.616591	16
1	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
1	900-4500	11: Kuhio-Aleka S WBLT	13.320448	218.217489	188
1	900-4500	12: Kuhio-Aleka S WBRT	3.614533	227.956274	69
1	900-4500	13: Kuhio-KBR SBLT	142.912804	511.30773	424
1	900-4500	17: Kuhio-KBR SBTH	154.975596	511.892956	660
1	900-4500	19: Kuhio-KBR NBLT	700.865909	1337.24765	1008
1	900-4500	20: Kuhio-KBR NBTH	77.563968	601.031517	416
1	900-4500	21: Kuhio-KBR EBLT	31.696542	915.294371	90
1	900-4500	23: Kuhio-Lanikai SBTH	2.196684	192.952961	33
1	900-4500	24: Kuhio-Lanikai NBTH	85.710949	577.266967	355
1	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
1	900-4500	26: Kuhio-Lanikai WBRT	1.984119	64.237802	34
1	900-4500	27: Kuhio-Haleilio SBTH	99.67538	543.548333	820
1	900-4500	28: Kuhio-Haleilio NBLT	44.441872	851.56086	197
1	900-4500	29: Kuhio-Haleilio NBTH	52.072164	844.114255	471
1	900-4500	30: Kuhio-Haleilio EBLT	40.209604	321.113156	101
1	900-4500	31: Kuhio-Haleilio EBRT	0.514904	90.747878	7
1	900-4500	33: Kuhio-Papaloa S NBRT	22.807972	586.813842	141
1	900-4500	34: Kuhio-Papaloa S WBRT	0	0	0
1	900-4500	35: Kuhio-Kuamoo SBTH	59.893408	592.482272	436
1	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
1	900-4500	37: Kuhio-Kuamoo NBLT	98.379396	939.113985	444
1	900-4500	38: Kuhio-Kuamoo NBTH	84.548973	993.037406	559
1	900-4500	39: Kuhio-Kuamoo EBLT	81.044437	598.465924	148
1	900-4500	40: Kuhio-Kuamoo EBRT	10.392162	201.325232	119
1	900-4500	140: Kuhio-KBR WB	15.466202	141.748945	66
1	900-4500	141: Kuhio-KBR EBRT	285.497951	980.957633	1144
2	900-4500	1: Kuhio-Aleka N SBLT	1.452543	78.620743	8
2	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
2	900-4500	3: Kuhio-Aleka N NBTH	0.022926	73.784182	2
2	900-4500	4: Kuhio-Aleka N NBRT	0.01331	81.097567	1
2	900-4500	5: Kuhio-Aleka N WBLT	0.303494	56.941231	9
2	900-4500	6: Kuhio-Aleka N WBRT	0.990876	72.432801	23

Alternative 3A: Traffic Signal (Protected Left-Turns) PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
2	900-4500	7: Kuhio-Aleka S SBLT	1.014837	74.035942	8
2	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
2	900-4500	9: Kuhio-Aleka S NBTH	3.277193	433.993735	13
2	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
2	900-4500	11: Kuhio-Aleka S WBLT	22.295398	216.240774	245
2	900-4500	12: Kuhio-Aleka S WBRT	2.583557	225.979559	70
2	900-4500	13: Kuhio-KBR SBLT	97.557635	511.605425	307
2	900-4500	17: Kuhio-KBR SBTH	153.766624	512.190651	681
2	900-4500	19: Kuhio-KBR NBLT	387.009589	1308.550547	665
2	900-4500	20: Kuhio-KBR NBTH	71.588791	524.767722	460
2	900-4500	21: Kuhio-KBR EBLT	4.759694	43.904003	13
2	900-4500	23: Kuhio-Lanikai SBTH	0.053167	43.329243	2
2	900-4500	24: Kuhio-Lanikai NBTH	1.298551	197.398352	20
2	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
2	900-4500	26: Kuhio-Lanikai WBRT	1.181516	45.34938	33
2	900-4500	27: Kuhio-Haleilio SBTH	45.883839	508.737096	471
2	900-4500	28: Kuhio-Haleilio NBLT	14.760403	409.394888	92
2	900-4500	29: Kuhio-Haleilio NBTH	16.56921	484.990181	238
2	900-4500	30: Kuhio-Haleilio EBLT	25.25674	217.252171	80
2	900-4500	31: Kuhio-Haleilio EBRT	0.28854	60.436117	5
2	900-4500	33: Kuhio-Papaloa S NBRT	2.959942	227.689767	24
2	900-4500	34: Kuhio-Papaloa S WBRT	1.074149	51.041757	2
2	900-4500	35: Kuhio-Kuamoo SBTH	43.752412	471.030507	294
2	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
2	900-4500	37: Kuhio-Kuamoo NBLT	129.907017	1104.615306	564
2	900-4500	38: Kuhio-Kuamoo NBTH	76.877689	1105.439437	489
2	900-4500	39: Kuhio-Kuamoo EBLT	98.437392	543.159258	166
2	900-4500	40: Kuhio-Kuamoo EBRT	16.801365	233.787156	121
2	900-4500	140: Kuhio-KBR WB	9.355844	127.373496	71
2	900-4500	141: Kuhio-KBR EBRT	171.702583	990.223901	730
3	900-4500	1: Kuhio-Aleka N SBLT	0.63115	67.016162	5
3	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
3	900-4500	3: Kuhio-Aleka N NBTH	0.057676	74.130824	2
3	900-4500	4: Kuhio-Aleka N NBRT	0.037478	81.060267	0
3	900-4500	5: Kuhio-Aleka N WBLT	0.079625	80.489609	2
3	900-4500	6: Kuhio-Aleka N WBRT	0.955743	98.320704	18
3	900-4500	7: Kuhio-Aleka S SBLT	2.871248	122.414621	7
3	900-4500	8: Kuhio-Aleka S SBTH	0.097733	46.041024	2
3	900-4500	9: Kuhio-Aleka S NBTH	4.013973	561.771901	22
3	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
3	900-4500	11: Kuhio-Aleka S WBLT	5.882828	106.308571	150
3	900-4500	12: Kuhio-Aleka S WBRT	0.702672	109.98835	63

Alternative 3A: Traffic Signal (Protected Left-Turns) PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
3	900-4500	13: Kuhio-KBR SBLT	116.284149	541.571024	312
3	900-4500	17: Kuhio-KBR SBTH	164.667667	542.91603	658
3	900-4500	19: Kuhio-KBR NBLT	529.100375	1365.440343	844
3	900-4500	20: Kuhio-KBR NBTH	95.852444	1315.256305	510
3	900-4500	21: Kuhio-KBR EBLT	4.964462	232.413074	18
3	900-4500	23: Kuhio-Lanikai SBTH	0.995737	135.289603	13
3	900-4500	24: Kuhio-Lanikai NBTH	32.908092	546.06229	165
3	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
3	900-4500	26: Kuhio-Lanikai WBRT	1.862269	47.965299	31
3	900-4500	27: Kuhio-Haleilio SBTH	56.806996	546.378876	544
3	900-4500	28: Kuhio-Haleilio NBLT	32.884651	426.174614	166
3	900-4500	29: Kuhio-Haleilio NBTH	29.36483	568.88802	283
3	900-4500	30: Kuhio-Haleilio EBLT	37.169615	310.1458	98
3	900-4500	31: Kuhio-Haleilio EBRT	1.559078	105.788891	15
3	900-4500	33: Kuhio-Papaloa S NBRT	6.07297	311.587606	48
3	900-4500	34: Kuhio-Papaloa S WBRT	0.04417	51.091239	1
3	900-4500	35: Kuhio-Kuamoo SBTH	52.350261	618.839186	390
3	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
3	900-4500	37: Kuhio-Kuamoo NBLT	89.441636	1116.680503	456
3	900-4500	38: Kuhio-Kuamoo NBTH	63.604915	1088.871837	461
3	900-4500	39: Kuhio-Kuamoo EBLT	73.927589	424.079767	125
3	900-4500	40: Kuhio-Kuamoo EBRT	8.267603	173.148731	96
3	900-4500	140: Kuhio-KBR WB	16.679523	232.165121	67
3	900-4500	141: Kuhio-KBR EBRT	182.20003	805.345237	748
4	900-4500	1: Kuhio-Aleka N SBLT	0.829093	90.336293	9
4	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
4	900-4500	3: Kuhio-Aleka N NBTH	0.095664	75.252427	3
4	900-4500	4: Kuhio-Aleka N NBRT	0.064974	82.207996	1
4	900-4500	5: Kuhio-Aleka N WBLT	0.223206	55.455392	8
4	900-4500	6: Kuhio-Aleka N WBRT	0.784738	76.105448	15
4	900-4500	7: Kuhio-Aleka S SBLT	0.433766	50.700354	4
4	900-4500	8: Kuhio-Aleka S SBTH	0.281558	58.665807	3
4	900-4500	9: Kuhio-Aleka S NBTH	1.224052	253.33281	7
4	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
4	900-4500	11: Kuhio-Aleka S WBLT	14.459809	214.894019	191
4	900-4500	12: Kuhio-Aleka S WBRT	3.380351	141.553585	66
4	900-4500	13: Kuhio-KBR SBLT	146.752269	513.040791	477
4	900-4500	17: Kuhio-KBR SBTH	187.225956	513.626018	782
4	900-4500	19: Kuhio-KBR NBLT	854.138247	1345.652269	1309
4	900-4500	20: Kuhio-KBR NBTH	78.627673	547.83043	428
4	900-4500	21: Kuhio-KBR EBLT	31.224323	758.921869	93
4	900-4500	23: Kuhio-Lanikai SBTH	0.450176	101.919823	10

Alternative 3A: Traffic Signal (Protected Left-Turns) PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
4	900-4500	24: Kuhio-Lanikai NBTH	210.920203	559.593678	1067
4	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
4	900-4500	26: Kuhio-Lanikai WBRT	4.601081	86.489045	33
4	900-4500	27: Kuhio-Haleilio SBTH	74.753882	539.077852	635
4	900-4500	28: Kuhio-Haleilio NBLT	391.949105	1655.124735	1488
4	900-4500	29: Kuhio-Haleilio NBTH	556.076014	1671.089622	2425
4	900-4500	30: Kuhio-Haleilio EBLT	32.452208	275.778532	89
4	900-4500	31: Kuhio-Haleilio EBRT	1.066274	80.792741	5
4	900-4500	33: Kuhio-Papaloa S NBRT	431.55049	1543.558979	1779
4	900-4500	34: Kuhio-Papaloa S WBRT	0.505149	52.142494	4
4	900-4500	35: Kuhio-Kuamoo SBTH	45.37275	578.740813	353
4	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
4	900-4500	37: Kuhio-Kuamoo NBLT	105.886993	1122.302907	559
4	900-4500	38: Kuhio-Kuamoo NBTH	104.288008	1123.127037	658
4	900-4500	39: Kuhio-Kuamoo EBLT	78.949939	481.013479	130
4	900-4500	40: Kuhio-Kuamoo EBRT	19.584179	572.853071	142
4	900-4500	140: Kuhio-KBR WB	15.942821	171.237078	57
4	900-4500	141: Kuhio-KBR EBRT	200.955006	994.821309	799
5	900-4500	1: Kuhio-Aleka N SBLT	1.503988	91.641828	10
5	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
5	900-4500	3: Kuhio-Aleka N NBTH	0.009431	57.922077	1
5	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
5	900-4500	5: Kuhio-Aleka N WBLT	0.256611	38.896243	6
5	900-4500	6: Kuhio-Aleka N WBRT	0.745711	69.3489	16
5	900-4500	7: Kuhio-Aleka S SBLT	0.965277	63.140766	4
5	900-4500	8: Kuhio-Aleka S SBTH	0.071628	33.086019	1
5	900-4500	9: Kuhio-Aleka S NBTH	3.93838	544.290061	24
5	900-4500	10: Kuhio-Aleka S NBRT	0.001882	34.092658	1
5	900-4500	11: Kuhio-Aleka S WBLT	8.725024	214.954738	160
5	900-4500	12: Kuhio-Aleka S WBRT	2.09866	224.693523	81
5	900-4500	13: Kuhio-KBR SBLT	98.786189	513.542385	319
5	900-4500	17: Kuhio-KBR SBTH	160.777817	514.887391	698
5	900-4500	19: Kuhio-KBR NBLT	544.375503	1325.256358	875
5	900-4500	20: Kuhio-KBR NBTH	77.365098	701.285094	461
5	900-4500	21: Kuhio-KBR EBLT	7.954733	282.497473	19
5	900-4500	23: Kuhio-Lanikai SBTH	1.004387	113.289466	13
5	900-4500	24: Kuhio-Lanikai NBTH	36.895089	560.30831	220
5	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
5	900-4500	26: Kuhio-Lanikai WBRT	1.277128	49.11743	30
5	900-4500	27: Kuhio-Haleilio SBTH	75.319782	559.76954	674
5	900-4500	28: Kuhio-Haleilio NBLT	19.415187	308.14039	115
5	900-4500	29: Kuhio-Haleilio NBTH	27.595147	608.758267	307

Alternative 3A: Traffic Signal (Protected Left-Turns) PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
5	900-4500	30: Kuhio-Haleilio EBLT	27.279572	187.644645	71
5	900-4500	31: Kuhio-Haleilio EBRT	0.314439	83.822473	6
5	900-4500	33: Kuhio-Papaloa S NBRT	8.125911	380.646415	60
5	900-4500	34: Kuhio-Papaloa S WBRT	0.377222	51.794258	1
5	900-4500	35: Kuhio-Kuamoo SBTH	54.134554	557.43026	407
5	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
5	900-4500	37: Kuhio-Kuamoo NBLT	51.326169	495.336049	310
5	900-4500	38: Kuhio-Kuamoo NBTH	51.75757	804.984106	471
5	900-4500	39: Kuhio-Kuamoo EBLT	114.493536	949.587801	181
5	900-4500	40: Kuhio-Kuamoo EBRT	48.733923	764.436974	181
5	900-4500	140: Kuhio-KBR WB	19.793345	170.663606	70
5	900-4500	141: Kuhio-KBR EBRT	145.736216	1020.022836	630
Avg	900-4500	1: Kuhio-Aleka N SBLT	1.229436	83.749953	10
Avg	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Avg	900-4500	3: Kuhio-Aleka N NBTH	0.044924	74.310408	2
Avg	900-4500	4: Kuhio-Aleka N NBRT	0.026383	68.428349	1
Avg	900-4500	5: Kuhio-Aleka N WBLT	0.191299	53.480722	6
Avg	900-4500	6: Kuhio-Aleka N WBRT	0.904972	77.96738	18
Avg	900-4500	7: Kuhio-Aleka S SBLT	1.135926	70.375073	5
Avg	900-4500	8: Kuhio-Aleka S SBTH	0.090184	27.55857	1
Avg	900-4500	9: Kuhio-Aleka S NBTH	3.215228	431.00102	16
Avg	900-4500	10: Kuhio-Aleka S NBRT	0.000376	6.818532	0
Avg	900-4500	11: Kuhio-Aleka S WBLT	12.936702	194.123118	187
Avg	900-4500	12: Kuhio-Aleka S WBRT	2.475955	186.034258	70
Avg	900-4500	13: Kuhio-KBR SBLT	120.458609	518.213471	368
Avg	900-4500	17: Kuhio-KBR SBTH	164.282732	519.102609	696
Avg	900-4500	19: Kuhio-KBR NBLT	603.097925	1336.429433	940
Avg	900-4500	20: Kuhio-KBR NBTH	80.199595	738.034214	455
Avg	900-4500	21: Kuhio-KBR EBLT	16.119951	446.606158	47
Avg	900-4500	23: Kuhio-Lanikai SBTH	0.94003	117.356219	14
Avg	900-4500	24: Kuhio-Lanikai NBTH	73.546577	488.125919	365
Avg	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Avg	900-4500	26: Kuhio-Lanikai WBRT	2.181223	58.631791	32
Avg	900-4500	27: Kuhio-Haleilio SBTH	70.487976	539.502339	629
Avg	900-4500	28: Kuhio-Haleilio NBLT	100.690244	730.079097	412
Avg	900-4500	29: Kuhio-Haleilio NBTH	136.335473	835.568069	745
Avg	900-4500	30: Kuhio-Haleilio EBLT	32.473548	262.386861	88
Avg	900-4500	31: Kuhio-Haleilio EBRT	0.748647	84.31762	8
Avg	900-4500	33: Kuhio-Papaloa S NBRT	94.303457	610.059322	410
Avg	900-4500	34: Kuhio-Papaloa S WBRT	0.400138	41.213949	2
Avg	900-4500	35: Kuhio-Kuamoo SBTH	51.100677	563.704608	376
Avg	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0

Alternative 3A: Traffic Signal (Protected Left-Turns) PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Avg	900-4500	37: Kuhio-Kuamoo NBLT	94.988242	955.60975	467
Avg	900-4500	38: Kuhio-Kuamoo NBTH	76.215431	1023.091965	528
Avg	900-4500	39: Kuhio-Kuamoo EBLT	89.370579	599.261246	150
Avg	900-4500	40: Kuhio-Kuamoo EBRT	20.755847	389.110233	132
Avg	900-4500	140: Kuhio-KBR WB	15.447547	168.637649	66
Avg	900-4500	141: Kuhio-KBR EBRT	197.218357	958.274183	810
Standard deviation	900-4500	1: Kuhio-Aleka N SBLT	0.47285	10.799597	4
Standard deviation	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Standard deviation	900-4500	3: Kuhio-Aleka N NBTH	0.033604	11.518084	1
Standard deviation	900-4500	4: Kuhio-Aleka N NBRT	0.025416	38.902673	1
Standard deviation	900-4500	5: Kuhio-Aleka N WBLT	0.099869	17.867752	3
Standard deviation	900-4500	6: Kuhio-Aleka N WBRT	0.132452	11.634598	3
Standard deviation	900-4500	7: Kuhio-Aleka S SBLT	1.012159	31.58279	2
Standard deviation	900-4500	8: Kuhio-Aleka S SBTH	0.115425	26.733703	1
Standard deviation	900-4500	9: Kuhio-Aleka S NBTH	1.150594	128.767793	7
Standard deviation	900-4500	10: Kuhio-Aleka S NBRT	0.000842	15.2467	0
Standard deviation	900-4500	11: Kuhio-Aleka S WBLT	6.2759	49.108326	37
Standard deviation	900-4500	12: Kuhio-Aleka S WBRT	1.163266	56.145195	7
Standard deviation	900-4500	13: Kuhio-KBR SBLT	23.490008	13.091089	78
Standard deviation	900-4500	17: Kuhio-KBR SBTH	13.564987	13.365949	51
Standard deviation	900-4500	19: Kuhio-KBR NBLT	179.023707	21.385935	240
Standard deviation	900-4500	20: Kuhio-KBR NBTH	9.17346	329.75963	37
Standard deviation	900-4500	21: Kuhio-KBR EBLT	14.061858	371.54714	41
Standard deviation	900-4500	23: Kuhio-Lanikai SBTH	0.808224	54.247783	11
Standard deviation	900-4500	24: Kuhio-Lanikai NBTH	82.513757	162.898132	410
Standard deviation	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Standard deviation	900-4500	26: Kuhio-Lanikai WBRT	1.397596	17.234946	2
Standard deviation	900-4500	27: Kuhio-Haleilio SBTH	20.530353	18.848717	133
Standard deviation	900-4500	28: Kuhio-Haleilio NBLT	163.235087	557.605555	603
Standard deviation	900-4500	29: Kuhio-Haleilio NBTH	234.996575	485.704409	943
Standard deviation	900-4500	30: Kuhio-Haleilio EBLT	6.343496	58.164787	12
Standard deviation	900-4500	31: Kuhio-Haleilio EBRT	0.550581	16.4724	4
Standard deviation	900-4500	33: Kuhio-Papaloa S NBRT	188.680942	538.489574	766
Standard deviation	900-4500	34: Kuhio-Papaloa S WBRT	0.433782	23.044046	2
Standard deviation	900-4500	35: Kuhio-Kuamoo SBTH	6.612188	56.395744	55
Standard deviation	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Standard deviation	900-4500	37: Kuhio-Kuamoo NBLT	28.66507	268.354729	104
Standard deviation	900-4500	38: Kuhio-Kuamoo NBTH	20.094577	131.899041	82
Standard deviation	900-4500	39: Kuhio-Kuamoo EBLT	16.806029	206.487194	24
Standard deviation	900-4500	40: Kuhio-Kuamoo EBRT	16.302957	264.886499	32
Standard deviation	900-4500	140: Kuhio-KBR WB	3.799941	40.225408	6
Standard deviation	900-4500	141: Kuhio-KBR EBRT	53.231252	86.705211	196

Alternative 3A: Traffic Signal (Protected Left-Turns) PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Minimum	900-4500	1: Kuhio-Aleka N SBLT	0.63115	67.016162	5
Minimum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Minimum	900-4500	3: Kuhio-Aleka N NBTH	0.009431	57.922077	1
Minimum	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
Minimum	900-4500	5: Kuhio-Aleka N WBLT	0.079625	35.621136	2
Minimum	900-4500	6: Kuhio-Aleka N WBRT	0.745711	69.3489	15
Minimum	900-4500	7: Kuhio-Aleka S SBLT	0.3945	41.58368	3
Minimum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Minimum	900-4500	9: Kuhio-Aleka S NBTH	1.224052	253.33281	7
Minimum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Minimum	900-4500	11: Kuhio-Aleka S WBLT	5.882828	106.308571	150
Minimum	900-4500	12: Kuhio-Aleka S WBRT	0.702672	109.98835	63
Minimum	900-4500	13: Kuhio-KBR SBLT	97.557635	511.30773	307
Minimum	900-4500	17: Kuhio-KBR SBTH	153.766624	511.892956	658
Minimum	900-4500	19: Kuhio-KBR NBLT	387.009589	1308.550547	665
Minimum	900-4500	20: Kuhio-KBR NBTH	71.588791	524.767722	416
Minimum	900-4500	21: Kuhio-KBR EBLT	4.759694	43.904003	13
Minimum	900-4500	23: Kuhio-Lanikai SBTH	0.053167	43.329243	2
Minimum	900-4500	24: Kuhio-Lanikai NBTH	1.298551	197.398352	20
Minimum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Minimum	900-4500	26: Kuhio-Lanikai WBRT	1.181516	45.34938	30
Minimum	900-4500	27: Kuhio-Haleilio SBTH	45.883839	508.737096	471
Minimum	900-4500	28: Kuhio-Haleilio NBLT	14.760403	308.14039	92
Minimum	900-4500	29: Kuhio-Haleilio NBTH	16.56921	484.990181	238
Minimum	900-4500	30: Kuhio-Haleilio EBLT	25.25674	187.644645	71
Minimum	900-4500	31: Kuhio-Haleilio EBRT	0.28854	60.436117	5
Minimum	900-4500	33: Kuhio-Papaloa S NBRT	2.959942	227.689767	24
Minimum	900-4500	34: Kuhio-Papaloa S WBRT	0	0	0
Minimum	900-4500	35: Kuhio-Kuamoo SBTH	43.752412	471.030507	294
Minimum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Minimum	900-4500	37: Kuhio-Kuamoo NBLT	51.326169	495.336049	310
Minimum	900-4500	38: Kuhio-Kuamoo NBTH	51.75757	804.984106	461
Minimum	900-4500	39: Kuhio-Kuamoo EBLT	73.927589	424.079767	125
Minimum	900-4500	40: Kuhio-Kuamoo EBRT	8.267603	173.148731	96
Minimum	900-4500	140: Kuhio-KBR WB	9.355844	127.373496	57
Minimum	900-4500	141: Kuhio-KBR EBRT	145.736216	805.345237	630
Maximum	900-4500	1: Kuhio-Aleka N SBLT	1.730408	91.641828	16
Maximum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Maximum	900-4500	3: Kuhio-Aleka N NBTH	0.095664	90.462531	3
Maximum	900-4500	4: Kuhio-Aleka N NBRT	0.064974	97.775916	1
Maximum	900-4500	5: Kuhio-Aleka N WBLT	0.303494	80.489609	9
Maximum	900-4500	6: Kuhio-Aleka N WBRT	1.04779	98.320704	23

Alternative 3A: Traffic Signal (Protected Left-Turns) PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Maximum	900-4500	7: Kuhio-Aleka S SBLT	2.871248	122.414621	8
Maximum	900-4500	8: Kuhio-Aleka S SBTH	0.281558	58.665807	3
Maximum	900-4500	9: Kuhio-Aleka S NBTH	4.013973	561.771901	24
Maximum	900-4500	10: Kuhio-Aleka S NBRT	0.001882	34.092658	1
Maximum	900-4500	11: Kuhio-Aleka S WBLT	22.295398	218.217489	245
Maximum	900-4500	12: Kuhio-Aleka S WBRT	3.614533	227.956274	81
Maximum	900-4500	13: Kuhio-KBR SBLT	146.752269	541.571024	477
Maximum	900-4500	17: Kuhio-KBR SBTH	187.225956	542.91603	782
Maximum	900-4500	19: Kuhio-KBR NBLT	854.138247	1365.440343	1309
Maximum	900-4500	20: Kuhio-KBR NBTH	95.852444	1315.256305	510
Maximum	900-4500	21: Kuhio-KBR EBLT	31.696542	915.294371	93
Maximum	900-4500	23: Kuhio-Lanikai SBTH	2.196684	192.952961	33
Maximum	900-4500	24: Kuhio-Lanikai NBTH	210.920203	577.266967	1067
Maximum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Maximum	900-4500	26: Kuhio-Lanikai WBRT	4.601081	86.489045	34
Maximum	900-4500	27: Kuhio-Haleilio SBTH	99.67538	559.76954	820
Maximum	900-4500	28: Kuhio-Haleilio NBLT	391.949105	1655.124735	1488
Maximum	900-4500	29: Kuhio-Haleilio NBTH	556.076014	1671.089622	2425
Maximum	900-4500	30: Kuhio-Haleilio EBLT	40.209604	321.113156	101
Maximum	900-4500	31: Kuhio-Haleilio EBRT	1.559078	105.788891	15
Maximum	900-4500	33: Kuhio-Papaloa S NBRT	431.55049	1543.558979	1779
Maximum	900-4500	34: Kuhio-Papaloa S WBRT	1.074149	52.142494	4
Maximum	900-4500	35: Kuhio-Kuamoo SBTH	59.893408	618.839186	436
Maximum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Maximum	900-4500	37: Kuhio-Kuamoo NBLT	129.907017	1122.302907	564
Maximum	900-4500	38: Kuhio-Kuamoo NBTH	104.288008	1123.127037	658
Maximum	900-4500	39: Kuhio-Kuamoo EBLT	114.493536	949.587801	181
Maximum	900-4500	40: Kuhio-Kuamoo EBRT	48.733923	764.436974	181
Maximum	900-4500	140: Kuhio-KBR WB	19.793345	232.165121	71
Maximum	900-4500	141: Kuhio-KBR EBRT	285.497951	1020.022836	1144
95% percentile	900-4500	1: Kuhio-Aleka N SBLT	1.730408	91.641828	16
95% percentile	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
95% percentile	900-4500	3: Kuhio-Aleka N NBTH	0.095664	90.462531	3
95% percentile	900-4500	4: Kuhio-Aleka N NBRT	0.064974	97.775916	1
95% percentile	900-4500	5: Kuhio-Aleka N WBLT	0.303494	80.489609	9
95% percentile	900-4500	6: Kuhio-Aleka N WBRT	1.04779	98.320704	23
95% percentile	900-4500	7: Kuhio-Aleka S SBLT	2.871248	122.414621	8
95% percentile	900-4500	8: Kuhio-Aleka S SBTH	0.281558	58.665807	3
95% percentile	900-4500	9: Kuhio-Aleka S NBTH	4.013973	561.771901	24
95% percentile	900-4500	10: Kuhio-Aleka S NBRT	0.001882	34.092658	1
95% percentile	900-4500	11: Kuhio-Aleka S WBLT	22.295398	218.217489	245
95% percentile	900-4500	12: Kuhio-Aleka S WBRT	3.614533	227.956274	81

Alternative 3A: Traffic Signal (Protected Left-Turns) PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
95% percentile	900-4500	13: Kuhio-KBR SBLT	146.752269	541.571024	477
95% percentile	900-4500	17: Kuhio-KBR SBTH	187.225956	542.91603	782
95% percentile	900-4500	19: Kuhio-KBR NBLT	854.138247	1365.440343	1309
95% percentile	900-4500	20: Kuhio-KBR NBTH	95.852444	1315.256305	510
95% percentile	900-4500	21: Kuhio-KBR EBLT	31.696542	915.294371	93
95% percentile	900-4500	23: Kuhio-Lanikai SBTH	2.196684	192.952961	33
95% percentile	900-4500	24: Kuhio-Lanikai NBTH	210.920203	577.266967	1067
95% percentile	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
95% percentile	900-4500	26: Kuhio-Lanikai WBRT	4.601081	86.489045	34
95% percentile	900-4500	27: Kuhio-Haleilio SBTH	99.67538	559.76954	820
95% percentile	900-4500	28: Kuhio-Haleilio NBLT	391.949105	1655.124735	1488
95% percentile	900-4500	29: Kuhio-Haleilio NBTH	556.076014	1671.089622	2425
95% percentile	900-4500	30: Kuhio-Haleilio EBLT	40.209604	321.113156	101
95% percentile	900-4500	31: Kuhio-Haleilio EBRT	1.559078	105.788891	15
95% percentile	900-4500	33: Kuhio-Papaloa S NBRT	431.55049	1543.558979	1779
95% percentile	900-4500	34: Kuhio-Papaloa S WBRT	1.074149	52.142494	4
95% percentile	900-4500	35: Kuhio-Kuamoo SBTH	59.893408	618.839186	436
95% percentile	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
95% percentile	900-4500	37: Kuhio-Kuamoo NBLT	129.907017	1122.302907	564
95% percentile	900-4500	38: Kuhio-Kuamoo NBTH	104.288008	1123.127037	658
95% percentile	900-4500	39: Kuhio-Kuamoo EBLT	114.493536	949.587801	181
95% percentile	900-4500	40: Kuhio-Kuamoo EBRT	48.733923	764.436974	181
95% percentile	900-4500	140: Kuhio-KBR WB	19.793345	232.165121	71
95% percentile	900-4500	141: Kuhio-KBR EBRT	285.497951	1020.022836	1144

APPENDIX B

VISSIM SIMULATION RESULTS

- Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns)

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) AM - Travel Time Results

SimRun	TimeInt	VehicleTravelTimeMeasurement	Vehs(All)	TravTm(All)	DistTrav(All)
1	900-4500	1: Kuhio SB	629	226.718086	7553.405653
1	900-4500	2: Kuhio NB	469	193.853417	7587.931168
1	900-4500	3: Kapaa Bypass Rd SB	761	257.237601	7667.549231
1	900-4500	4: Kapaa Bypass Rd NB	81	206.540958	7726.112565
2	900-4500	1: Kuhio SB	589	220.465396	7553.405653
2	900-4500	2: Kuhio NB	439	194.318381	7587.931168
2	900-4500	3: Kapaa Bypass Rd SB	725	235.198713	7667.549231
2	900-4500	4: Kapaa Bypass Rd NB	104	200.948133	7726.112565
3	900-4500	1: Kuhio SB	605	219.270403	7553.405653
3	900-4500	2: Kuhio NB	455	191.826975	7587.931168
3	900-4500	3: Kapaa Bypass Rd SB	720	239.584465	7667.549231
3	900-4500	4: Kapaa Bypass Rd NB	93	199.245642	7726.112565
4	900-4500	1: Kuhio SB	591	215.328046	7553.405653
4	900-4500	2: Kuhio NB	445	190.749962	7587.931168
4	900-4500	3: Kapaa Bypass Rd SB	689	225.093865	7667.549231
4	900-4500	4: Kapaa Bypass Rd NB	98	208.333772	7726.112565
5	900-4500	1: Kuhio SB	603	220.477581	7553.405653
5	900-4500	2: Kuhio NB	467	187.210299	7587.931168
5	900-4500	3: Kapaa Bypass Rd SB	692	219.170985	7667.549231
5	900-4500	4: Kapaa Bypass Rd NB	114	197.803375	7726.112565
Avg	900-4500	1: Kuhio SB	603	220.451902	7553.405653
Avg	900-4500	2: Kuhio NB	455	191.591807	7587.931168
Avg	900-4500	3: Kapaa Bypass Rd SB	717	235.257126	7667.549231
Avg	900-4500	4: Kapaa Bypass Rd NB	98	202.574376	7726.112565
Standard deviation	900-4500	1: Kuhio SB	16	4.090102	0
Standard deviation	900-4500	2: Kuhio NB	13	2.850908	0
Standard deviation	900-4500	3: Kapaa Bypass Rd SB	29	14.696312	0
Standard deviation	900-4500	4: Kapaa Bypass Rd NB	12	4.62039	0
Minimum	900-4500	1: Kuhio SB	589	215.328046	7553.405653
Minimum	900-4500	2: Kuhio NB	439	187.210299	7587.931168
Minimum	900-4500	3: Kapaa Bypass Rd SB	689	219.170985	7667.549231
Minimum	900-4500	4: Kapaa Bypass Rd NB	81	197.803375	7726.112565
Maximum	900-4500	1: Kuhio SB	629	226.718086	7553.405653
Maximum	900-4500	2: Kuhio NB	469	194.318381	7587.931168
Maximum	900-4500	3: Kapaa Bypass Rd SB	761	257.237601	7667.549231
Maximum	900-4500	4: Kapaa Bypass Rd NB	114	208.333772	7726.112565
95% percentile	900-4500	1: Kuhio SB	629	226.718086	7553.405653
95% percentile	900-4500	2: Kuhio NB	469	194.318381	7587.931168
95% percentile	900-4500	3: Kapaa Bypass Rd SB	761	257.237601	7667.549231
95% percentile	900-4500	4: Kapaa Bypass Rd NB	114	208.333772	7726.112565

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
1	900-4500	1: Kuhio-Aleka N SBLT	0.621811	75.036751	3
1	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
1	900-4500	3: Kuhio-Aleka N NBTH	0.007105	22.18386	1
1	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
1	900-4500	5: Kuhio-Aleka N WBLT	0.106232	53.245263	4
1	900-4500	6: Kuhio-Aleka N WBRT	0.529123	51.911754	11
1	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
1	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
1	900-4500	9: Kuhio-Aleka S NBTH	1.016242	306.332097	11
1	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
1	900-4500	11: Kuhio-Aleka S WBLT	2.956434	105.387072	73
1	900-4500	12: Kuhio-Aleka S WBRT	0.120645	41.901923	31
1	900-4500	13: Kuhio-KBR SBLT	2.539641	168.754901	9
1	900-4500	17: Kuhio-KBR SBTH	103.979376	406.725805	598
1	900-4500	19: Kuhio-KBR NBLT	22.438325	167.68095	91
1	900-4500	20: Kuhio-KBR NBTH	63.554903	323.073193	433
1	900-4500	21: Kuhio-KBR EBLT	0.094751	21.029857	1
1	900-4500	23: Kuhio-Lanikai SBTH	2.537405	244.268406	32
1	900-4500	24: Kuhio-Lanikai NBTH	0.263178	149.034137	5
1	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
1	900-4500	26: Kuhio-Lanikai WBRT	0.280238	26.623374	10
1	900-4500	27: Kuhio-Haleilio SBTH	90.001902	542.373931	753
1	900-4500	28: Kuhio-Haleilio NBLT	1.369764	64.561693	5
1	900-4500	29: Kuhio-Haleilio NBTH	11.422389	457.423144	149
1	900-4500	30: Kuhio-Haleilio EBLT	42.384607	371.992122	134
1	900-4500	31: Kuhio-Haleilio EBRT	8.081939	202.337039	56
1	900-4500	33: Kuhio-Papaloa S NBRT	1.252655	200.122731	10
1	900-4500	34: Kuhio-Papaloa S WBRT	0.769883	72.86903	10
1	900-4500	35: Kuhio-Kuamoo SBTH	136.449074	775.392538	869
1	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
1	900-4500	37: Kuhio-Kuamoo NBLT	18.482477	236.932786	78
1	900-4500	38: Kuhio-Kuamoo NBTH	18.425755	333.259706	212
1	900-4500	39: Kuhio-Kuamoo EBLT	258.304908	1656.330228	580
1	900-4500	40: Kuhio-Kuamoo EBRT	1202.221575	1678.342125	2753
1	900-4500	140: Kuhio-KBR WB	3.569261	82.712331	39
1	900-4500	141: Kuhio-KBR EBRT	567.241364	1638.208341	1825
2	900-4500	1: Kuhio-Aleka N SBLT	0.187481	81.503163	1
2	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
2	900-4500	3: Kuhio-Aleka N NBTH	0.028725	68.893346	2
2	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
2	900-4500	5: Kuhio-Aleka N WBLT	0.193474	56.479716	7
2	900-4500	6: Kuhio-Aleka N WBRT	0.489557	52.616346	9

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
2	900-4500	7: Kuhio-Aleka S SBLT	0.415184	94.547371	2
2	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
2	900-4500	9: Kuhio-Aleka S NBTH	1.574513	408.629744	8
2	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
2	900-4500	11: Kuhio-Aleka S WBLT	3.054239	107.290304	65
2	900-4500	12: Kuhio-Aleka S WBRT	0.212664	83.063845	48
2	900-4500	13: Kuhio-KBR SBLT	1.615054	52.800161	5
2	900-4500	17: Kuhio-KBR SBTH	106.350797	457.547361	593
2	900-4500	19: Kuhio-KBR NBLT	25.295669	364.137704	92
2	900-4500	20: Kuhio-KBR NBTH	57.232827	332.952706	471
2	900-4500	21: Kuhio-KBR EBLT	0.200763	21.426207	1
2	900-4500	23: Kuhio-Lanikai SBTH	0.194773	85.279654	3
2	900-4500	24: Kuhio-Lanikai NBTH	0.068472	50.552698	3
2	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
2	900-4500	26: Kuhio-Lanikai WBRT	0.509566	27.344643	16
2	900-4500	27: Kuhio-Haleilio SBTH	63.384796	535.161788	633
2	900-4500	28: Kuhio-Haleilio NBLT	2.43674	101.087322	13
2	900-4500	29: Kuhio-Haleilio NBTH	7.151427	212.958691	111
2	900-4500	30: Kuhio-Haleilio EBLT	32.868443	350.845639	122
2	900-4500	31: Kuhio-Haleilio EBRT	14.640085	398.260015	80
2	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
2	900-4500	34: Kuhio-Papaloa S WBRT	0.399621	53.230533	8
2	900-4500	35: Kuhio-Kuamoo SBTH	129.76308	834.337242	847
2	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
2	900-4500	37: Kuhio-Kuamoo NBLT	11.690131	165.894048	65
2	900-4500	38: Kuhio-Kuamoo NBTH	19.663247	220.96993	224
2	900-4500	39: Kuhio-Kuamoo EBLT	51.332802	496.714592	110
2	900-4500	40: Kuhio-Kuamoo EBRT	724.097819	1713.588161	1948
2	900-4500	140: Kuhio-KBR WB	2.167618	61.294473	29
2	900-4500	141: Kuhio-KBR EBRT	344.75051	1654.713773	1211
3	900-4500	1: Kuhio-Aleka N SBLT	0.859516	94.04147	3
3	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
3	900-4500	3: Kuhio-Aleka N NBTH	0.351286	152.420491	5
3	900-4500	4: Kuhio-Aleka N NBRT	0.229742	150.499829	3
3	900-4500	5: Kuhio-Aleka N WBLT	0.000438	15.766559	1
3	900-4500	6: Kuhio-Aleka N WBRT	0.378382	50.968363	5
3	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
3	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
3	900-4500	9: Kuhio-Aleka S NBTH	0.205235	184.333366	0
3	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
3	900-4500	11: Kuhio-Aleka S WBLT	1.374875	84.822568	55
3	900-4500	12: Kuhio-Aleka S WBRT	0.083488	69.153907	35

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
3	900-4500	13: Kuhio-KBR SBLT	2.461907	271.746538	10
3	900-4500	17: Kuhio-KBR SBTH	97.949754	444.15939	579
3	900-4500	19: Kuhio-KBR NBLT	17.657886	173.405871	95
3	900-4500	20: Kuhio-KBR NBTH	64.618054	335.463101	456
3	900-4500	21: Kuhio-KBR EBLT	0.295218	21.872679	2
3	900-4500	23: Kuhio-Lanikai SBTH	0.395957	110.565909	7
3	900-4500	24: Kuhio-Lanikai NBTH	0.0478	51.070946	2
3	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
3	900-4500	26: Kuhio-Lanikai WBRT	0.364661	26.393496	14
3	900-4500	27: Kuhio-Haleilio SBTH	78.372677	547.123356	723
3	900-4500	28: Kuhio-Haleilio NBLT	1.657186	68.743879	12
3	900-4500	29: Kuhio-Haleilio NBTH	4.372886	169.57993	90
3	900-4500	30: Kuhio-Haleilio EBLT	25.812805	237.830926	94
3	900-4500	31: Kuhio-Haleilio EBRT	9.486541	169.978917	68
3	900-4500	33: Kuhio-Papaloa S NBRT	0.097388	104.610174	1
3	900-4500	34: Kuhio-Papaloa S WBRT	0.626513	73.709073	10
3	900-4500	35: Kuhio-Kuamoo SBTH	135.502764	860.074073	888
3	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
3	900-4500	37: Kuhio-Kuamoo NBLT	12.867264	214.831921	61
3	900-4500	38: Kuhio-Kuamoo NBTH	18.998889	287.998466	228
3	900-4500	39: Kuhio-Kuamoo EBLT	34.885716	246.595004	67
3	900-4500	40: Kuhio-Kuamoo EBRT	492.225509	1243.943943	1363
3	900-4500	140: Kuhio-KBR WB	3.191472	107.908725	40
3	900-4500	141: Kuhio-KBR EBRT	371.522755	1549.961085	1291
4	900-4500	1: Kuhio-Aleka N SBLT	0.740548	60.235031	4
4	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
4	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
4	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
4	900-4500	5: Kuhio-Aleka N WBLT	0.136521	36.743381	3
4	900-4500	6: Kuhio-Aleka N WBRT	0.490478	51.676731	12
4	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
4	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
4	900-4500	9: Kuhio-Aleka S NBTH	0.451003	204.465823	1
4	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
4	900-4500	11: Kuhio-Aleka S WBLT	1.86975	85.157381	70
4	900-4500	12: Kuhio-Aleka S WBRT	0.656259	73.164648	35
4	900-4500	13: Kuhio-KBR SBLT	4.971943	229.601822	17
4	900-4500	17: Kuhio-KBR SBTH	86.516415	376.21342	567
4	900-4500	19: Kuhio-KBR NBLT	22.164634	228.627064	101
4	900-4500	20: Kuhio-KBR NBTH	62.008436	430.39743	454
4	900-4500	21: Kuhio-KBR EBLT	0.432657	39.105145	3
4	900-4500	23: Kuhio-Lanikai SBTH	0.537243	148.799831	10

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
4	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
4	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
4	900-4500	26: Kuhio-Lanikai WBRT	0.346579	26.328302	12
4	900-4500	27: Kuhio-Haleilio SBTH	59.041702	526.207576	579
4	900-4500	28: Kuhio-Haleilio NBLT	2.163464	175.584577	11
4	900-4500	29: Kuhio-Haleilio NBTH	6.097501	217.218719	108
4	900-4500	30: Kuhio-Haleilio EBLT	41.953623	320.964888	124
4	900-4500	31: Kuhio-Haleilio EBRT	6.549938	105.7863	54
4	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
4	900-4500	34: Kuhio-Papaloa S WBRT	1.072053	52.102219	11
4	900-4500	35: Kuhio-Kuamoo SBTH	121.311356	880.685288	878
4	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
4	900-4500	37: Kuhio-Kuamoo NBLT	8.06668	119.53999	59
4	900-4500	38: Kuhio-Kuamoo NBTH	19.537545	194.022011	226
4	900-4500	39: Kuhio-Kuamoo EBLT	626.300226	1686.081351	1333
4	900-4500	40: Kuhio-Kuamoo EBRT	1028.401724	1686.094601	2618
4	900-4500	140: Kuhio-KBR WB	1.98269	78.209994	29
4	900-4500	141: Kuhio-KBR EBRT	219.063482	1156.803054	920
5	900-4500	1: Kuhio-Aleka N SBLT	0.216398	48.714448	2
5	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
5	900-4500	3: Kuhio-Aleka N NBTH	0.154921	121.101928	3
5	900-4500	4: Kuhio-Aleka N NBRT	0.04474	83.181759	0
5	900-4500	5: Kuhio-Aleka N WBLT	0.179631	39.780955	5
5	900-4500	6: Kuhio-Aleka N WBRT	0.146964	50.669555	5
5	900-4500	7: Kuhio-Aleka S SBLT	0.068399	21.843277	1
5	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
5	900-4500	9: Kuhio-Aleka S NBTH	0.997357	261.186794	3
5	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
5	900-4500	11: Kuhio-Aleka S WBLT	0.778031	105.784929	58
5	900-4500	12: Kuhio-Aleka S WBRT	0.163029	80.574404	35
5	900-4500	13: Kuhio-KBR SBLT	11.655568	402.233988	45
5	900-4500	17: Kuhio-KBR SBTH	94.722573	497.883425	580
5	900-4500	19: Kuhio-KBR NBLT	24.37038	296.193595	116
5	900-4500	20: Kuhio-KBR NBTH	56.903998	355.30043	461
5	900-4500	21: Kuhio-KBR EBLT	0.931592	35.86903	3
5	900-4500	23: Kuhio-Lanikai SBTH	0.693023	162.487854	13
5	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
5	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
5	900-4500	26: Kuhio-Lanikai WBRT	0.49539	26.196699	15
5	900-4500	27: Kuhio-Haleilio SBTH	84.413588	524.984742	780
5	900-4500	28: Kuhio-Haleilio NBLT	0.336394	44.730053	3
5	900-4500	29: Kuhio-Haleilio NBTH	8.74844	208.277499	152

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
5	900-4500	30: Kuhio-Haleilio EBLT	35.749511	240.030099	127
5	900-4500	31: Kuhio-Haleilio EBRT	6.992286	126.685601	57
5	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
5	900-4500	34: Kuhio-Papaloa S WBRT	0.797125	53.066155	13
5	900-4500	35: Kuhio-Kuamoo SBTH	129.553837	864.603774	817
5	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
5	900-4500	37: Kuhio-Kuamoo NBLT	15.228001	144.981459	81
5	900-4500	38: Kuhio-Kuamoo NBTH	14.361824	181.489501	182
5	900-4500	39: Kuhio-Kuamoo EBLT	1057.244665	1673.93199	2049
5	900-4500	40: Kuhio-Kuamoo EBRT	1375.19119	1672.976213	3268
5	900-4500	140: Kuhio-KBR WB	4.637552	81.738341	47
5	900-4500	141: Kuhio-KBR EBRT	163.379455	880.830387	809
Avg	900-4500	1: Kuhio-Aleka N SBLT	0.525151	71.906173	3
Avg	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Avg	900-4500	3: Kuhio-Aleka N NBTH	0.108408	72.919925	2
Avg	900-4500	4: Kuhio-Aleka N NBRT	0.054896	46.736318	1
Avg	900-4500	5: Kuhio-Aleka N WBLT	0.123259	40.403175	4
Avg	900-4500	6: Kuhio-Aleka N WBRT	0.406901	51.56855	8
Avg	900-4500	7: Kuhio-Aleka S SBLT	0.096717	23.27813	1
Avg	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Avg	900-4500	9: Kuhio-Aleka S NBTH	0.84887	272.989565	5
Avg	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Avg	900-4500	11: Kuhio-Aleka S WBLT	2.006666	97.688451	64
Avg	900-4500	12: Kuhio-Aleka S WBRT	0.247217	69.571745	37
Avg	900-4500	13: Kuhio-KBR SBLT	4.648822	225.027482	17
Avg	900-4500	17: Kuhio-KBR SBTH	97.903783	436.50588	583
Avg	900-4500	19: Kuhio-KBR NBLT	22.385379	246.009037	99
Avg	900-4500	20: Kuhio-KBR NBTH	60.863644	355.437372	455
Avg	900-4500	21: Kuhio-KBR EBLT	0.390996	27.860583	2
Avg	900-4500	23: Kuhio-Lanikai SBTH	0.87168	150.280331	13
Avg	900-4500	24: Kuhio-Lanikai NBTH	0.07589	50.131556	2
Avg	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Avg	900-4500	26: Kuhio-Lanikai WBRT	0.399287	26.577303	13
Avg	900-4500	27: Kuhio-Haleilio SBTH	75.042933	535.170279	694
Avg	900-4500	28: Kuhio-Haleilio NBLT	1.59271	90.941505	9
Avg	900-4500	29: Kuhio-Haleilio NBTH	7.558529	253.091596	122
Avg	900-4500	30: Kuhio-Haleilio EBLT	35.753798	304.332735	120
Avg	900-4500	31: Kuhio-Haleilio EBRT	9.150158	200.609574	63
Avg	900-4500	33: Kuhio-Papaloa S NBRT	0.270009	60.946581	2
Avg	900-4500	34: Kuhio-Papaloa S WBRT	0.733039	60.995402	10
Avg	900-4500	35: Kuhio-Kuamoo SBTH	130.516022	843.018583	860
Avg	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Avg	900-4500	37: Kuhio-Kuamoo NBLT	13.266911	176.436041	69
Avg	900-4500	38: Kuhio-Kuamoo NBTH	18.197452	243.547923	214
Avg	900-4500	39: Kuhio-Kuamoo EBLT	405.613663	1151.930633	828
Avg	900-4500	40: Kuhio-Kuamoo EBRT	964.427563	1598.989008	2390
Avg	900-4500	140: Kuhio-KBR WB	3.109718	82.372773	37
Avg	900-4500	141: Kuhio-KBR EBRT	333.191513	1376.103328	1211
Standard deviation	900-4500	1: Kuhio-Aleka N SBLT	0.306956	17.790066	1
Standard deviation	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Standard deviation	900-4500	3: Kuhio-Aleka N NBTH	0.149597	64.322474	2
Standard deviation	900-4500	4: Kuhio-Aleka N NBRT	0.099643	68.278816	1
Standard deviation	900-4500	5: Kuhio-Aleka N WBLT	0.076907	16.156411	2
Standard deviation	900-4500	6: Kuhio-Aleka N WBRT	0.155833	0.773916	3
Standard deviation	900-4500	7: Kuhio-Aleka S SBLT	0.180475	40.948069	1
Standard deviation	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Standard deviation	900-4500	9: Kuhio-Aleka S NBTH	0.536	89.728358	5
Standard deviation	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Standard deviation	900-4500	11: Kuhio-Aleka S WBLT	0.990823	11.614387	8
Standard deviation	900-4500	12: Kuhio-Aleka S WBRT	0.233679	16.445348	6
Standard deviation	900-4500	13: Kuhio-KBR SBLT	4.111991	128.874546	16
Standard deviation	900-4500	17: Kuhio-KBR SBTH	7.874948	46.878984	12
Standard deviation	900-4500	19: Kuhio-KBR NBLT	2.950031	83.936753	10
Standard deviation	900-4500	20: Kuhio-KBR NBTH	3.588546	43.505749	14
Standard deviation	900-4500	21: Kuhio-KBR EBLT	0.326765	8.866939	1
Standard deviation	900-4500	23: Kuhio-Lanikai SBTH	0.949068	60.801515	11
Standard deviation	900-4500	24: Kuhio-Lanikai NBTH	0.108903	60.846377	2
Standard deviation	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Standard deviation	900-4500	26: Kuhio-Lanikai WBRT	0.099432	0.455955	2
Standard deviation	900-4500	27: Kuhio-Haleilio SBTH	13.366176	9.731957	85
Standard deviation	900-4500	28: Kuhio-Haleilio NBLT	0.817058	51.457542	4
Standard deviation	900-4500	29: Kuhio-Haleilio NBTH	2.683	115.792267	27
Standard deviation	900-4500	30: Kuhio-Haleilio EBLT	6.883932	62.400302	15
Standard deviation	900-4500	31: Kuhio-Haleilio EBRT	3.271509	116.68668	11
Standard deviation	900-4500	33: Kuhio-Papaloa S NBRT	0.550932	90.027728	4
Standard deviation	900-4500	34: Kuhio-Papaloa S WBRT	0.24643	11.234715	2
Standard deviation	900-4500	35: Kuhio-Kuamoo SBTH	6.047464	41.304475	28
Standard deviation	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Standard deviation	900-4500	37: Kuhio-Kuamoo NBLT	3.896677	48.661548	10
Standard deviation	900-4500	38: Kuhio-Kuamoo NBTH	2.199481	64.880437	19
Standard deviation	900-4500	39: Kuhio-Kuamoo EBLT	435.3101	717.83738	852
Standard deviation	900-4500	40: Kuhio-Kuamoo EBRT	357.105939	199.090665	742
Standard deviation	900-4500	140: Kuhio-KBR WB	1.085113	16.690013	8
Standard deviation	900-4500	141: Kuhio-KBR EBRT	156.719152	342.759841	397

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Minimum	900-4500	1: Kuhio-Aleka N SBLT	0.187481	48.714448	1
Minimum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Minimum	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
Minimum	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
Minimum	900-4500	5: Kuhio-Aleka N WBLT	0.000438	15.766559	1
Minimum	900-4500	6: Kuhio-Aleka N WBRT	0.146964	50.669555	5
Minimum	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
Minimum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Minimum	900-4500	9: Kuhio-Aleka S NBTH	0.205235	184.333366	0
Minimum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Minimum	900-4500	11: Kuhio-Aleka S WBLT	0.778031	84.822568	55
Minimum	900-4500	12: Kuhio-Aleka S WBRT	0.083488	41.901923	31
Minimum	900-4500	13: Kuhio-KBR SBLT	1.615054	52.800161	5
Minimum	900-4500	17: Kuhio-KBR SBTH	86.516415	376.21342	567
Minimum	900-4500	19: Kuhio-KBR NBLT	17.657886	167.68095	91
Minimum	900-4500	20: Kuhio-KBR NBTH	56.903998	323.073193	433
Minimum	900-4500	21: Kuhio-KBR EBLT	0.094751	21.029857	1
Minimum	900-4500	23: Kuhio-Lanikai SBTH	0.194773	85.279654	3
Minimum	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
Minimum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Minimum	900-4500	26: Kuhio-Lanikai WBRT	0.280238	26.196699	10
Minimum	900-4500	27: Kuhio-Haleilio SBTH	59.041702	524.984742	579
Minimum	900-4500	28: Kuhio-Haleilio NBLT	0.336394	44.730053	3
Minimum	900-4500	29: Kuhio-Haleilio NBTH	4.372886	169.57993	90
Minimum	900-4500	30: Kuhio-Haleilio EBLT	25.812805	237.830926	94
Minimum	900-4500	31: Kuhio-Haleilio EBRT	6.549938	105.7863	54
Minimum	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
Minimum	900-4500	34: Kuhio-Papaloa S WBRT	0.399621	52.102219	8
Minimum	900-4500	35: Kuhio-Kuamoo SBTH	121.311356	775.392538	817
Minimum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Minimum	900-4500	37: Kuhio-Kuamoo NBLT	8.06668	119.53999	59
Minimum	900-4500	38: Kuhio-Kuamoo NBTH	14.361824	181.489501	182
Minimum	900-4500	39: Kuhio-Kuamoo EBLT	34.885716	246.595004	67
Minimum	900-4500	40: Kuhio-Kuamoo EBRT	492.225509	1243.943943	1363
Minimum	900-4500	140: Kuhio-KBR WB	1.98269	61.294473	29
Minimum	900-4500	141: Kuhio-KBR EBRT	163.379455	880.830387	809
Maximum	900-4500	1: Kuhio-Aleka N SBLT	0.859516	94.04147	4
Maximum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Maximum	900-4500	3: Kuhio-Aleka N NBTH	0.351286	152.420491	5
Maximum	900-4500	4: Kuhio-Aleka N NBRT	0.229742	150.499829	3
Maximum	900-4500	5: Kuhio-Aleka N WBLT	0.193474	56.479716	7
Maximum	900-4500	6: Kuhio-Aleka N WBRT	0.529123	52.616346	12

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Maximum	900-4500	7: Kuhio-Aleka S SBLT	0.415184	94.547371	2
Maximum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Maximum	900-4500	9: Kuhio-Aleka S NBTH	1.574513	408.629744	11
Maximum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Maximum	900-4500	11: Kuhio-Aleka S WBLT	3.054239	107.290304	73
Maximum	900-4500	12: Kuhio-Aleka S WBRT	0.656259	83.063845	48
Maximum	900-4500	13: Kuhio-KBR SBLT	11.655568	402.233988	45
Maximum	900-4500	17: Kuhio-KBR SBTH	106.350797	497.883425	598
Maximum	900-4500	19: Kuhio-KBR NBLT	25.295669	364.137704	116
Maximum	900-4500	20: Kuhio-KBR NBTH	64.618054	430.39743	471
Maximum	900-4500	21: Kuhio-KBR EBLT	0.931592	39.105145	3
Maximum	900-4500	23: Kuhio-Lanikai SBTH	2.537405	244.268406	32
Maximum	900-4500	24: Kuhio-Lanikai NBTH	0.263178	149.034137	5
Maximum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Maximum	900-4500	26: Kuhio-Lanikai WBRT	0.509566	27.344643	16
Maximum	900-4500	27: Kuhio-Haleilio SBTH	90.001902	547.123356	780
Maximum	900-4500	28: Kuhio-Haleilio NBLT	2.43674	175.584577	13
Maximum	900-4500	29: Kuhio-Haleilio NBTH	11.422389	457.423144	152
Maximum	900-4500	30: Kuhio-Haleilio EBLT	42.384607	371.992122	134
Maximum	900-4500	31: Kuhio-Haleilio EBRT	14.640085	398.260015	80
Maximum	900-4500	33: Kuhio-Papaloa S NBRT	1.252655	200.122731	10
Maximum	900-4500	34: Kuhio-Papaloa S WBRT	1.072053	73.709073	13
Maximum	900-4500	35: Kuhio-Kuamoo SBTH	136.449074	880.685288	888
Maximum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Maximum	900-4500	37: Kuhio-Kuamoo NBLT	18.482477	236.932786	81
Maximum	900-4500	38: Kuhio-Kuamoo NBTH	19.663247	333.259706	228
Maximum	900-4500	39: Kuhio-Kuamoo EBLT	1057.244665	1686.081351	2049
Maximum	900-4500	40: Kuhio-Kuamoo EBRT	1375.19119	1713.588161	3268
Maximum	900-4500	140: Kuhio-KBR WB	4.637552	107.908725	47
Maximum	900-4500	141: Kuhio-KBR EBRT	567.241364	1654.713773	1825
95% percentile	900-4500	1: Kuhio-Aleka N SBLT	0.859516	94.04147	4
95% percentile	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
95% percentile	900-4500	3: Kuhio-Aleka N NBTH	0.351286	152.420491	5
95% percentile	900-4500	4: Kuhio-Aleka N NBRT	0.229742	150.499829	3
95% percentile	900-4500	5: Kuhio-Aleka N WBLT	0.193474	56.479716	7
95% percentile	900-4500	6: Kuhio-Aleka N WBRT	0.529123	52.616346	12
95% percentile	900-4500	7: Kuhio-Aleka S SBLT	0.415184	94.547371	2
95% percentile	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
95% percentile	900-4500	9: Kuhio-Aleka S NBTH	1.574513	408.629744	11
95% percentile	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
95% percentile	900-4500	11: Kuhio-Aleka S WBLT	3.054239	107.290304	73
95% percentile	900-4500	12: Kuhio-Aleka S WBRT	0.656259	83.063845	48

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
95% percentile	900-4500	13: Kuhio-KBR SBLT	11.655568	402.233988	45
95% percentile	900-4500	17: Kuhio-KBR SBTH	106.350797	497.883425	598
95% percentile	900-4500	19: Kuhio-KBR NBLT	25.295669	364.137704	116
95% percentile	900-4500	20: Kuhio-KBR NBTH	64.618054	430.39743	471
95% percentile	900-4500	21: Kuhio-KBR EBLT	0.931592	39.105145	3
95% percentile	900-4500	23: Kuhio-Lanikai SBTH	2.537405	244.268406	32
95% percentile	900-4500	24: Kuhio-Lanikai NBTH	0.263178	149.034137	5
95% percentile	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
95% percentile	900-4500	26: Kuhio-Lanikai WBRT	0.509566	27.344643	16
95% percentile	900-4500	27: Kuhio-Haleilio SBTH	90.001902	547.123356	780
95% percentile	900-4500	28: Kuhio-Haleilio NBLT	2.43674	175.584577	13
95% percentile	900-4500	29: Kuhio-Haleilio NBTH	11.422389	457.423144	152
95% percentile	900-4500	30: Kuhio-Haleilio EBLT	42.384607	371.992122	134
95% percentile	900-4500	31: Kuhio-Haleilio EBRT	14.640085	398.260015	80
95% percentile	900-4500	33: Kuhio-Papaloa S NBRT	1.252655	200.122731	10
95% percentile	900-4500	34: Kuhio-Papaloa S WBRT	1.072053	73.709073	13
95% percentile	900-4500	35: Kuhio-Kuamoo SBTH	136.449074	880.685288	888
95% percentile	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
95% percentile	900-4500	37: Kuhio-Kuamoo NBLT	18.482477	236.932786	81
95% percentile	900-4500	38: Kuhio-Kuamoo NBTH	19.663247	333.259706	228
95% percentile	900-4500	39: Kuhio-Kuamoo EBLT	1057.244665	1686.081351	2049
95% percentile	900-4500	40: Kuhio-Kuamoo EBRT	1375.19119	1713.588161	3268
95% percentile	900-4500	140: Kuhio-KBR WB	4.637552	107.908725	47
95% percentile	900-4500	141: Kuhio-KBR EBRT	567.241364	1654.713773	1825

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) PM - Travel Time Results

SimRun	TimeInt	VehicleTravelTimeMeasurement	Vehs(All)	TravTm(All)	DistTrav(All)
1	900-4500	1: Kuhio SB	358	295.268853	7553.405653
1	900-4500	2: Kuhio NB	532	192.25202	7587.931168
1	900-4500	3: Kapaa Bypass Rd SB	464	264.707641	7667.549231
1	900-4500	4: Kapaa Bypass Rd NB	469	250.505147	7726.112565
2	900-4500	1: Kuhio SB	335	289.230933	7553.405653
2	900-4500	2: Kuhio NB	540	192.597824	7587.931168
2	900-4500	3: Kapaa Bypass Rd SB	454	255.385435	7667.549231
2	900-4500	4: Kapaa Bypass Rd NB	466	225.248824	7726.112565
3	900-4500	1: Kuhio SB	350	281.581398	7553.405653
3	900-4500	2: Kuhio NB	515	191.362089	7587.931168
3	900-4500	3: Kapaa Bypass Rd SB	425	255.427473	7667.549231
3	900-4500	4: Kapaa Bypass Rd NB	501	225.230116	7726.112565
4	900-4500	1: Kuhio SB	349	287.913176	7553.405653
4	900-4500	2: Kuhio NB	558	189.213048	7587.931168
4	900-4500	3: Kapaa Bypass Rd SB	425	249.497322	7667.549231
4	900-4500	4: Kapaa Bypass Rd NB	495	225.827384	7726.112565
5	900-4500	1: Kuhio SB	365	285.26688	7553.405653
5	900-4500	2: Kuhio NB	541	189.964037	7587.931168
5	900-4500	3: Kapaa Bypass Rd SB	422	251.601457	7667.549231
5	900-4500	4: Kapaa Bypass Rd NB	481	234.581531	7726.112565
Avg	900-4500	1: Kuhio SB	351	287.852248	7553.405653
Avg	900-4500	2: Kuhio NB	537	191.077804	7587.931168
Avg	900-4500	3: Kapaa Bypass Rd SB	438	255.323866	7667.549231
Avg	900-4500	4: Kapaa Bypass Rd NB	482	232.2786	7726.112565
Standard deviation	900-4500	1: Kuhio SB	11	5.07243	0
Standard deviation	900-4500	2: Kuhio NB	16	1.456696	0
Standard deviation	900-4500	3: Kapaa Bypass Rd SB	20	5.828265	0
Standard deviation	900-4500	4: Kapaa Bypass Rd NB	15	10.934207	0
Minimum	900-4500	1: Kuhio SB	335	281.581398	7553.405653
Minimum	900-4500	2: Kuhio NB	515	189.213048	7587.931168
Minimum	900-4500	3: Kapaa Bypass Rd SB	422	249.497322	7667.549231
Minimum	900-4500	4: Kapaa Bypass Rd NB	466	225.230116	7726.112565
Maximum	900-4500	1: Kuhio SB	365	295.268853	7553.405653
Maximum	900-4500	2: Kuhio NB	558	192.597824	7587.931168
Maximum	900-4500	3: Kapaa Bypass Rd SB	464	264.707641	7667.549231
Maximum	900-4500	4: Kapaa Bypass Rd NB	501	250.505147	7726.112565
95% percentile	900-4500	1: Kuhio SB	365	295.268853	7553.405653
95% percentile	900-4500	2: Kuhio NB	558	192.597824	7587.931168
95% percentile	900-4500	3: Kapaa Bypass Rd SB	464	264.707641	7667.549231
95% percentile	900-4500	4: Kapaa Bypass Rd NB	501	250.505147	7726.112565

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
1	900-4500	1: Kuhio-Aleka N SBLT	0.601686	96.170489	6
1	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
1	900-4500	3: Kuhio-Aleka N NBTH	0.081461	71.834884	3
1	900-4500	4: Kuhio-Aleka N NBRT	0.058628	79.148269	2
1	900-4500	5: Kuhio-Aleka N WBLT	0.186745	77.186635	4
1	900-4500	6: Kuhio-Aleka N WBRT	1.463857	110.118449	24
1	900-4500	7: Kuhio-Aleka S SBLT	0.273946	21.971805	1
1	900-4500	8: Kuhio-Aleka S SBTH	0.238072	46.646782	3
1	900-4500	9: Kuhio-Aleka S NBTH	1.632884	316.893441	16
1	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
1	900-4500	11: Kuhio-Aleka S WBLT	10.433512	150.469218	188
1	900-4500	12: Kuhio-Aleka S WBRT	0.940454	135.705457	59
1	900-4500	13: Kuhio-KBR SBLT	7.274596	385.116929	20
1	900-4500	17: Kuhio-KBR SBTH	133.705762	514.742426	576
1	900-4500	19: Kuhio-KBR NBLT	309.034557	1308.675812	606
1	900-4500	20: Kuhio-KBR NBTH	47.339531	385.679537	356
1	900-4500	21: Kuhio-KBR EBLT	24.716707	910.074577	59
1	900-4500	23: Kuhio-Lanikai SBTH	5.328406	352.981489	59
1	900-4500	24: Kuhio-Lanikai NBTH	2.381226	189.853157	32
1	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
1	900-4500	26: Kuhio-Lanikai WBRT	2.13044	59.961551	34
1	900-4500	27: Kuhio-Haleilio SBTH	84.022624	564.906627	736
1	900-4500	28: Kuhio-Haleilio NBLT	25.774857	414.985272	133
1	900-4500	29: Kuhio-Haleilio NBTH	14.716865	404.680806	193
1	900-4500	30: Kuhio-Haleilio EBLT	28.537685	211.539063	88
1	900-4500	31: Kuhio-Haleilio EBRT	0.73717	81.500523	9
1	900-4500	33: Kuhio-Papaloa S NBRT	1.493289	147.380393	17
1	900-4500	34: Kuhio-Papaloa S WBRT	0	0	0
1	900-4500	35: Kuhio-Kuamoo SBTH	68.175875	608.463304	442
1	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
1	900-4500	37: Kuhio-Kuamoo NBLT	99.010193	1121.258928	490
1	900-4500	38: Kuhio-Kuamoo NBTH	69.546648	739.471172	511
1	900-4500	39: Kuhio-Kuamoo EBLT	105.550346	657.871848	165
1	900-4500	40: Kuhio-Kuamoo EBRT	14.947836	379.672645	135
1	900-4500	140: Kuhio-KBR WB	12.963866	150.307915	66
1	900-4500	141: Kuhio-KBR EBRT	172.016894	910.101262	738
2	900-4500	1: Kuhio-Aleka N SBLT	0.734185	101.321445	5
2	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
2	900-4500	3: Kuhio-Aleka N NBTH	0.150398	139.570105	3
2	900-4500	4: Kuhio-Aleka N NBRT	0.022071	80.722465	0
2	900-4500	5: Kuhio-Aleka N WBLT	0.363667	56.941231	11
2	900-4500	6: Kuhio-Aleka N WBRT	0.979705	72.981509	22

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
2	900-4500	7: Kuhio-Aleka S SBLT	0.50276	62.315968	5
2	900-4500	8: Kuhio-Aleka S SBTH	0.000881	16.059787	1
2	900-4500	9: Kuhio-Aleka S NBTH	4.56042	395.880108	27
2	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
2	900-4500	11: Kuhio-Aleka S WBLT	17.527484	216.177851	223
2	900-4500	12: Kuhio-Aleka S WBRT	1.609402	216.574686	63
2	900-4500	13: Kuhio-KBR SBLT	19.5822	386.278526	53
2	900-4500	17: Kuhio-KBR SBTH	121.927102	512.834271	558
2	900-4500	19: Kuhio-KBR NBLT	188.954035	896.542512	526
2	900-4500	20: Kuhio-KBR NBTH	53.692346	472.327144	405
2	900-4500	21: Kuhio-KBR EBLT	10.911416	471.804417	33
2	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
2	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
2	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
2	900-4500	26: Kuhio-Lanikai WBRT	1.325134	45.34938	33
2	900-4500	27: Kuhio-Haleilio SBTH	57.173758	432.828102	530
2	900-4500	28: Kuhio-Haleilio NBLT	17.167845	265.814179	97
2	900-4500	29: Kuhio-Haleilio NBTH	13.260074	406.794568	209
2	900-4500	30: Kuhio-Haleilio EBLT	29.441066	168.594623	80
2	900-4500	31: Kuhio-Haleilio EBRT	0.019118	59.804953	1
2	900-4500	33: Kuhio-Papaloa S NBRT	2.736007	425.075035	17
2	900-4500	34: Kuhio-Papaloa S WBRT	0.112245	51.041757	2
2	900-4500	35: Kuhio-Kuamoo SBTH	56.900838	568.013554	381
2	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
2	900-4500	37: Kuhio-Kuamoo NBLT	79.31759	698.432905	363
2	900-4500	38: Kuhio-Kuamoo NBTH	69.580186	1121.35061	462
2	900-4500	39: Kuhio-Kuamoo EBLT	97.458119	565.997204	174
2	900-4500	40: Kuhio-Kuamoo EBRT	11.193084	179.713214	101
2	900-4500	140: Kuhio-KBR WB	9.770829	144.473732	69
2	900-4500	141: Kuhio-KBR EBRT	136.35567	820.67952	701
3	900-4500	1: Kuhio-Aleka N SBLT	2.271187	136.773771	8
3	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
3	900-4500	3: Kuhio-Aleka N NBTH	0.003354	18.20354	1
3	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
3	900-4500	5: Kuhio-Aleka N WBLT	0.000852	15.781131	2
3	900-4500	6: Kuhio-Aleka N WBRT	0.727513	72.749052	14
3	900-4500	7: Kuhio-Aleka S SBLT	1.462406	73.840177	5
3	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
3	900-4500	9: Kuhio-Aleka S NBTH	10.969141	590.833302	60
3	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
3	900-4500	11: Kuhio-Aleka S WBLT	7.624873	102.842608	148
3	900-4500	12: Kuhio-Aleka S WBRT	1.693585	112.581393	64

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
3	900-4500	13: Kuhio-KBR SBLT	14.943393	309.987887	50
3	900-4500	17: Kuhio-KBR SBTH	104.688667	443.453802	527
3	900-4500	19: Kuhio-KBR NBLT	187.72694	994.713608	531
3	900-4500	20: Kuhio-KBR NBTH	49.256638	451.142361	378
3	900-4500	21: Kuhio-KBR EBLT	5.186606	138.825616	13
3	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
3	900-4500	24: Kuhio-Lanikai NBTH	0.826095	146.069815	18
3	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
3	900-4500	26: Kuhio-Lanikai WBRT	1.401194	47.965299	31
3	900-4500	27: Kuhio-Haleilio SBTH	56.835576	504.105287	524
3	900-4500	28: Kuhio-Haleilio NBLT	12.791234	183.509426	85
3	900-4500	29: Kuhio-Haleilio NBTH	17.564271	528.753368	224
3	900-4500	30: Kuhio-Haleilio EBLT	33.203505	214.74593	87
3	900-4500	31: Kuhio-Haleilio EBRT	1.947108	103.615965	18
3	900-4500	33: Kuhio-Papaloa S NBRT	9.767994	474.534705	76
3	900-4500	34: Kuhio-Papaloa S WBRT	0.04417	51.091239	1
3	900-4500	35: Kuhio-Kuamoo SBTH	47.616703	439.355079	353
3	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
3	900-4500	37: Kuhio-Kuamoo NBLT	82.253899	1008.501808	454
3	900-4500	38: Kuhio-Kuamoo NBTH	62.644885	1009.325938	463
3	900-4500	39: Kuhio-Kuamoo EBLT	91.254944	661.485345	142
3	900-4500	40: Kuhio-Kuamoo EBRT	7.096601	155.496398	92
3	900-4500	140: Kuhio-KBR WB	13.152082	165.713991	77
3	900-4500	141: Kuhio-KBR EBRT	123.660375	699.465299	672
4	900-4500	1: Kuhio-Aleka N SBLT	1.956174	131.634502	12
4	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
4	900-4500	3: Kuhio-Aleka N NBTH	0.068554	74.197157	2
4	900-4500	4: Kuhio-Aleka N NBRT	0.046019	81.109969	1
4	900-4500	5: Kuhio-Aleka N WBLT	0.318401	100.786501	9
4	900-4500	6: Kuhio-Aleka N WBRT	1.534853	118.161107	19
4	900-4500	7: Kuhio-Aleka S SBLT	0.418568	51.106997	5
4	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
4	900-4500	9: Kuhio-Aleka S NBTH	1.404163	346.342045	4
4	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
4	900-4500	11: Kuhio-Aleka S WBLT	11.461816	131.84443	188
4	900-4500	12: Kuhio-Aleka S WBRT	1.413969	138.701992	65
4	900-4500	13: Kuhio-KBR SBLT	9.785774	399.315373	55
4	900-4500	17: Kuhio-KBR SBTH	128.801655	512.585723	608
4	900-4500	19: Kuhio-KBR NBLT	223.826202	1170.009054	587
4	900-4500	20: Kuhio-KBR NBTH	46.147443	342.204123	375
4	900-4500	21: Kuhio-KBR EBLT	5.597972	292.10308	21
4	900-4500	23: Kuhio-Lanikai SBTH	0.07931	48.571516	2

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
4	900-4500	24: Kuhio-Lanikai NBTH	0.36	92.313693	6
4	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
4	900-4500	26: Kuhio-Lanikai WBRT	1.521926	48.725783	33
4	900-4500	27: Kuhio-Haleilio SBTH	69.817981	526.310684	661
4	900-4500	28: Kuhio-Haleilio NBLT	9.615701	153.070598	65
4	900-4500	29: Kuhio-Haleilio NBTH	15.975295	336.237616	237
4	900-4500	30: Kuhio-Haleilio EBLT	26.64142	208.421538	76
4	900-4500	31: Kuhio-Haleilio EBRT	0.14223	62.523946	2
4	900-4500	33: Kuhio-Papaloa S NBRT	3.861337	325.723859	29
4	900-4500	34: Kuhio-Papaloa S WBRT	0.276467	52.142494	4
4	900-4500	35: Kuhio-Kuamoo SBTH	40.223035	559.039065	287
4	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
4	900-4500	37: Kuhio-Kuamoo NBLT	96.168866	1120.697073	490
4	900-4500	38: Kuhio-Kuamoo NBTH	46.322936	812.106191	386
4	900-4500	39: Kuhio-Kuamoo EBLT	88.628687	609.810886	155
4	900-4500	40: Kuhio-Kuamoo EBRT	21.399262	437.424433	156
4	900-4500	140: Kuhio-KBR WB	9.847037	147.629918	60
4	900-4500	141: Kuhio-KBR EBRT	109.770376	599.877571	608
5	900-4500	1: Kuhio-Aleka N SBLT	0.625338	50.310068	7
5	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
5	900-4500	3: Kuhio-Aleka N NBTH	0.168889	121.314349	4
5	900-4500	4: Kuhio-Aleka N NBRT	0.021933	80.579583	0
5	900-4500	5: Kuhio-Aleka N WBLT	0.25696	38.896243	6
5	900-4500	6: Kuhio-Aleka N WBRT	1.076298	74.335235	24
5	900-4500	7: Kuhio-Aleka S SBLT	1.005157	101.609091	4
5	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
5	900-4500	9: Kuhio-Aleka S NBTH	1.503074	339.00324	9
5	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
5	900-4500	11: Kuhio-Aleka S WBLT	8.705543	148.60052	165
5	900-4500	12: Kuhio-Aleka S WBRT	3.141795	135.509832	81
5	900-4500	13: Kuhio-KBR SBLT	3.43179	188.326614	16
5	900-4500	17: Kuhio-KBR SBTH	129.934111	513.344124	591
5	900-4500	19: Kuhio-KBR NBLT	294.716078	1206.58339	679
5	900-4500	20: Kuhio-KBR NBTH	50.475772	455.990458	402
5	900-4500	21: Kuhio-KBR EBLT	9.450225	454.11293	35
5	900-4500	23: Kuhio-Lanikai SBTH	0.368944	118.100238	4
5	900-4500	24: Kuhio-Lanikai NBTH	0.734765	139.608697	11
5	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
5	900-4500	26: Kuhio-Lanikai WBRT	1.160335	49.11743	30
5	900-4500	27: Kuhio-Haleilio SBTH	62.73503	509.00797	592
5	900-4500	28: Kuhio-Haleilio NBLT	17.766283	255.809693	103
5	900-4500	29: Kuhio-Haleilio NBTH	12.493102	267.10484	220

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
5	900-4500	30: Kuhio-Haleilio EBLT	27.616802	257.712469	71
5	900-4500	31: Kuhio-Haleilio EBRT	0.619763	105.878214	6
5	900-4500	33: Kuhio-Papaloa S NBRT	0.263475	146.803821	2
5	900-4500	34: Kuhio-Papaloa S WBRT	0.076074	51.794258	1
5	900-4500	35: Kuhio-Kuamoo SBTH	39.616004	393.775277	379
5	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
5	900-4500	37: Kuhio-Kuamoo NBLT	45.439492	412.269567	285
5	900-4500	38: Kuhio-Kuamoo NBTH	41.733187	765.020392	406
5	900-4500	39: Kuhio-Kuamoo EBLT	83.897597	606.5106	160
5	900-4500	40: Kuhio-Kuamoo EBRT	15.73008	232.384616	130
5	900-4500	140: Kuhio-KBR WB	9.343152	104.21668	62
5	900-4500	141: Kuhio-KBR EBRT	102.061142	932.820991	556
Avg	900-4500	1: Kuhio-Aleka N SBLT	1.237714	103.242055	8
Avg	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Avg	900-4500	3: Kuhio-Aleka N NBTH	0.094531	85.024007	3
Avg	900-4500	4: Kuhio-Aleka N NBRT	0.02973	64.312057	1
Avg	900-4500	5: Kuhio-Aleka N WBLT	0.225325	57.918348	6
Avg	900-4500	6: Kuhio-Aleka N WBRT	1.156445	89.66907	21
Avg	900-4500	7: Kuhio-Aleka S SBLT	0.732567	62.168808	4
Avg	900-4500	8: Kuhio-Aleka S SBTH	0.04779	12.541314	1
Avg	900-4500	9: Kuhio-Aleka S NBTH	4.013936	397.790427	23
Avg	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Avg	900-4500	11: Kuhio-Aleka S WBLT	11.150645	149.986925	182
Avg	900-4500	12: Kuhio-Aleka S WBRT	1.759841	147.814672	66
Avg	900-4500	13: Kuhio-KBR SBLT	11.003551	333.805066	39
Avg	900-4500	17: Kuhio-KBR SBTH	123.811459	499.392069	572
Avg	900-4500	19: Kuhio-KBR NBLT	240.851562	1115.304875	586
Avg	900-4500	20: Kuhio-KBR NBTH	49.382346	421.468724	383
Avg	900-4500	21: Kuhio-KBR EBLT	11.172585	453.384124	32
Avg	900-4500	23: Kuhio-Lanikai SBTH	1.155332	103.930649	13
Avg	900-4500	24: Kuhio-Lanikai NBTH	0.860417	113.569072	13
Avg	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Avg	900-4500	26: Kuhio-Lanikai WBRT	1.507806	50.223889	32
Avg	900-4500	27: Kuhio-Haleilio SBTH	66.116994	507.431734	609
Avg	900-4500	28: Kuhio-Haleilio NBLT	16.623184	254.637834	97
Avg	900-4500	29: Kuhio-Haleilio NBTH	14.801921	388.71424	217
Avg	900-4500	30: Kuhio-Haleilio EBLT	29.088096	212.202725	80
Avg	900-4500	31: Kuhio-Haleilio EBRT	0.693078	82.66472	7
Avg	900-4500	33: Kuhio-Papaloa S NBRT	3.624421	303.903562	28
Avg	900-4500	34: Kuhio-Papaloa S WBRT	0.101791	41.213949	2
Avg	900-4500	35: Kuhio-Kuamoo SBTH	50.506491	513.729256	368
Avg	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Avg	900-4500	37: Kuhio-Kuamoo NBLT	80.438008	872.232056	416
Avg	900-4500	38: Kuhio-Kuamoo NBTH	57.965568	889.454861	446
Avg	900-4500	39: Kuhio-Kuamoo EBLT	93.357939	620.335177	159
Avg	900-4500	40: Kuhio-Kuamoo EBRT	14.073373	276.938261	123
Avg	900-4500	140: Kuhio-KBR WB	11.015393	142.468447	67
Avg	900-4500	141: Kuhio-KBR EBRT	128.772892	792.588929	655
Standard deviation	900-4500	1: Kuhio-Aleka N SBLT	0.808908	34.590454	3
Standard deviation	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Standard deviation	900-4500	3: Kuhio-Aleka N NBTH	0.066725	47.561577	1
Standard deviation	900-4500	4: Kuhio-Aleka N NBRT	0.022933	35.959205	1
Standard deviation	900-4500	5: Kuhio-Aleka N WBLT	0.14202	32.966975	4
Standard deviation	900-4500	6: Kuhio-Aleka N WBRT	0.338873	22.526992	4
Standard deviation	900-4500	7: Kuhio-Aleka S SBLT	0.492115	29.28285	2
Standard deviation	900-4500	8: Kuhio-Aleka S SBTH	0.106371	20.294188	1
Standard deviation	900-4500	9: Kuhio-Aleka S NBTH	4.106649	111.709884	22
Standard deviation	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Standard deviation	900-4500	11: Kuhio-Aleka S WBLT	3.862796	41.638714	28
Standard deviation	900-4500	12: Kuhio-Aleka S WBRT	0.825809	39.844719	8
Standard deviation	900-4500	13: Kuhio-KBR SBLT	6.360724	88.613218	19
Standard deviation	900-4500	17: Kuhio-KBR SBTH	11.505631	31.281577	31
Standard deviation	900-4500	19: Kuhio-KBR NBLT	57.783537	166.670227	63
Standard deviation	900-4500	20: Kuhio-KBR NBTH	2.933649	55.277926	20
Standard deviation	900-4500	21: Kuhio-KBR EBLT	7.959055	288.905105	17
Standard deviation	900-4500	23: Kuhio-Lanikai SBTH	2.337753	147.389697	26
Standard deviation	900-4500	24: Kuhio-Lanikai NBTH	0.91112	72.289949	12
Standard deviation	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Standard deviation	900-4500	26: Kuhio-Lanikai WBRT	0.371935	5.6381	2
Standard deviation	900-4500	27: Kuhio-Haleilio SBTH	11.312303	48.059936	90
Standard deviation	900-4500	28: Kuhio-Haleilio NBLT	6.106249	101.504604	25
Standard deviation	900-4500	29: Kuhio-Haleilio NBTH	2.044661	97.128046	17
Standard deviation	900-4500	30: Kuhio-Haleilio EBLT	2.525622	31.599086	7
Standard deviation	900-4500	31: Kuhio-Haleilio EBRT	0.764455	21.836873	7
Standard deviation	900-4500	33: Kuhio-Papaloa S NBRT	3.688719	152.850801	28
Standard deviation	900-4500	34: Kuhio-Papaloa S WBRT	0.106023	23.044046	2
Standard deviation	900-4500	35: Kuhio-Kuamoo SBTH	12.101631	92.052674	56
Standard deviation	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Standard deviation	900-4500	37: Kuhio-Kuamoo NBLT	21.341479	309.875107	90
Standard deviation	900-4500	38: Kuhio-Kuamoo NBTH	13.133525	167.411599	50
Standard deviation	900-4500	39: Kuhio-Kuamoo EBLT	8.392746	39.864874	12
Standard deviation	900-4500	40: Kuhio-Kuamoo EBRT	5.342037	124.996028	26
Standard deviation	900-4500	140: Kuhio-KBR WB	1.875658	22.889256	7
Standard deviation	900-4500	141: Kuhio-KBR EBRT	27.514965	141.485811	73

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Minimum	900-4500	1: Kuhio-Aleka N SBLT	0.601686	50.310068	5
Minimum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Minimum	900-4500	3: Kuhio-Aleka N NBTH	0.003354	18.20354	1
Minimum	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
Minimum	900-4500	5: Kuhio-Aleka N WBLT	0.000852	15.781131	2
Minimum	900-4500	6: Kuhio-Aleka N WBRT	0.727513	72.749052	14
Minimum	900-4500	7: Kuhio-Aleka S SBLT	0.273946	21.971805	1
Minimum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Minimum	900-4500	9: Kuhio-Aleka S NBTH	1.404163	316.893441	4
Minimum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Minimum	900-4500	11: Kuhio-Aleka S WBLT	7.624873	102.842608	148
Minimum	900-4500	12: Kuhio-Aleka S WBRT	0.940454	112.581393	59
Minimum	900-4500	13: Kuhio-KBR SBLT	3.43179	188.326614	16
Minimum	900-4500	17: Kuhio-KBR SBTH	104.688667	443.453802	527
Minimum	900-4500	19: Kuhio-KBR NBLT	187.72694	896.542512	526
Minimum	900-4500	20: Kuhio-KBR NBTH	46.147443	342.204123	356
Minimum	900-4500	21: Kuhio-KBR EBLT	5.186606	138.825616	13
Minimum	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
Minimum	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
Minimum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Minimum	900-4500	26: Kuhio-Lanikai WBRT	1.160335	45.34938	30
Minimum	900-4500	27: Kuhio-Haleilio SBTH	56.835576	432.828102	524
Minimum	900-4500	28: Kuhio-Haleilio NBLT	9.615701	153.070598	65
Minimum	900-4500	29: Kuhio-Haleilio NBTH	12.493102	267.10484	193
Minimum	900-4500	30: Kuhio-Haleilio EBLT	26.64142	168.594623	71
Minimum	900-4500	31: Kuhio-Haleilio EBRT	0.019118	59.804953	1
Minimum	900-4500	33: Kuhio-Papaloa S NBRT	0.263475	146.803821	2
Minimum	900-4500	34: Kuhio-Papaloa S WBRT	0	0	0
Minimum	900-4500	35: Kuhio-Kuamoo SBTH	39.616004	393.775277	287
Minimum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Minimum	900-4500	37: Kuhio-Kuamoo NBLT	45.439492	412.269567	285
Minimum	900-4500	38: Kuhio-Kuamoo NBTH	41.733187	739.471172	386
Minimum	900-4500	39: Kuhio-Kuamoo EBLT	83.897597	565.997204	142
Minimum	900-4500	40: Kuhio-Kuamoo EBRT	7.096601	155.496398	92
Minimum	900-4500	140: Kuhio-KBR WB	9.343152	104.21668	60
Minimum	900-4500	141: Kuhio-KBR EBRT	102.061142	599.877571	556
Maximum	900-4500	1: Kuhio-Aleka N SBLT	2.271187	136.773771	12
Maximum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Maximum	900-4500	3: Kuhio-Aleka N NBTH	0.168889	139.570105	4
Maximum	900-4500	4: Kuhio-Aleka N NBRT	0.058628	81.109969	2
Maximum	900-4500	5: Kuhio-Aleka N WBLT	0.363667	100.786501	11
Maximum	900-4500	6: Kuhio-Aleka N WBRT	1.534853	118.161107	24

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Maximum	900-4500	7: Kuhio-Aleka S SBLT	1.462406	101.609091	5
Maximum	900-4500	8: Kuhio-Aleka S SBTH	0.238072	46.646782	3
Maximum	900-4500	9: Kuhio-Aleka S NBTH	10.969141	590.833302	60
Maximum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Maximum	900-4500	11: Kuhio-Aleka S WBLT	17.527484	216.177851	223
Maximum	900-4500	12: Kuhio-Aleka S WBRT	3.141795	216.574686	81
Maximum	900-4500	13: Kuhio-KBR SBLT	19.5822	399.315373	55
Maximum	900-4500	17: Kuhio-KBR SBTH	133.705762	514.742426	608
Maximum	900-4500	19: Kuhio-KBR NBLT	309.034557	1308.675812	679
Maximum	900-4500	20: Kuhio-KBR NBTH	53.692346	472.327144	405
Maximum	900-4500	21: Kuhio-KBR EBLT	24.716707	910.074577	59
Maximum	900-4500	23: Kuhio-Lanikai SBTH	5.328406	352.981489	59
Maximum	900-4500	24: Kuhio-Lanikai NBTH	2.381226	189.853157	32
Maximum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Maximum	900-4500	26: Kuhio-Lanikai WBRT	2.13044	59.961551	34
Maximum	900-4500	27: Kuhio-Haleilio SBTH	84.022624	564.906627	736
Maximum	900-4500	28: Kuhio-Haleilio NBLT	25.774857	414.985272	133
Maximum	900-4500	29: Kuhio-Haleilio NBTH	17.564271	528.753368	237
Maximum	900-4500	30: Kuhio-Haleilio EBLT	33.203505	257.712469	88
Maximum	900-4500	31: Kuhio-Haleilio EBRT	1.947108	105.878214	18
Maximum	900-4500	33: Kuhio-Papaloa S NBRT	9.767994	474.534705	76
Maximum	900-4500	34: Kuhio-Papaloa S WBRT	0.276467	52.142494	4
Maximum	900-4500	35: Kuhio-Kuamoo SBTH	68.175875	608.463304	442
Maximum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Maximum	900-4500	37: Kuhio-Kuamoo NBLT	99.010193	1121.258928	490
Maximum	900-4500	38: Kuhio-Kuamoo NBTH	69.580186	1121.35061	511
Maximum	900-4500	39: Kuhio-Kuamoo EBLT	105.550346	661.485345	174
Maximum	900-4500	40: Kuhio-Kuamoo EBRT	21.399262	437.424433	156
Maximum	900-4500	140: Kuhio-KBR WB	13.152082	165.713991	77
Maximum	900-4500	141: Kuhio-KBR EBRT	172.016894	932.820991	738
95% percentile	900-4500	1: Kuhio-Aleka N SBLT	2.271187	136.773771	12
95% percentile	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
95% percentile	900-4500	3: Kuhio-Aleka N NBTH	0.168889	139.570105	4
95% percentile	900-4500	4: Kuhio-Aleka N NBRT	0.058628	81.109969	2
95% percentile	900-4500	5: Kuhio-Aleka N WBLT	0.363667	100.786501	11
95% percentile	900-4500	6: Kuhio-Aleka N WBRT	1.534853	118.161107	24
95% percentile	900-4500	7: Kuhio-Aleka S SBLT	1.462406	101.609091	5
95% percentile	900-4500	8: Kuhio-Aleka S SBTH	0.238072	46.646782	3
95% percentile	900-4500	9: Kuhio-Aleka S NBTH	10.969141	590.833302	60
95% percentile	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
95% percentile	900-4500	11: Kuhio-Aleka S WBLT	17.527484	216.177851	223
95% percentile	900-4500	12: Kuhio-Aleka S WBRT	3.141795	216.574686	81

Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns) PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
95% percentile	900-4500	13: Kuhio-KBR SBLT	19.5822	399.315373	55
95% percentile	900-4500	17: Kuhio-KBR SBTH	133.705762	514.742426	608
95% percentile	900-4500	19: Kuhio-KBR NBLT	309.034557	1308.675812	679
95% percentile	900-4500	20: Kuhio-KBR NBTH	53.692346	472.327144	405
95% percentile	900-4500	21: Kuhio-KBR EBLT	24.716707	910.074577	59
95% percentile	900-4500	23: Kuhio-Lanikai SBTH	5.328406	352.981489	59
95% percentile	900-4500	24: Kuhio-Lanikai NBTH	2.381226	189.853157	32
95% percentile	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
95% percentile	900-4500	26: Kuhio-Lanikai WBRT	2.13044	59.961551	34
95% percentile	900-4500	27: Kuhio-Haleilio SBTH	84.022624	564.906627	736
95% percentile	900-4500	28: Kuhio-Haleilio NBLT	25.774857	414.985272	133
95% percentile	900-4500	29: Kuhio-Haleilio NBTH	17.564271	528.753368	237
95% percentile	900-4500	30: Kuhio-Haleilio EBLT	33.203505	257.712469	88
95% percentile	900-4500	31: Kuhio-Haleilio EBRT	1.947108	105.878214	18
95% percentile	900-4500	33: Kuhio-Papaloa S NBRT	9.767994	474.534705	76
95% percentile	900-4500	34: Kuhio-Papaloa S WBRT	0.276467	52.142494	4
95% percentile	900-4500	35: Kuhio-Kuamoo SBTH	68.175875	608.463304	442
95% percentile	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
95% percentile	900-4500	37: Kuhio-Kuamoo NBLT	99.010193	1121.258928	490
95% percentile	900-4500	38: Kuhio-Kuamoo NBTH	69.580186	1121.35061	511
95% percentile	900-4500	39: Kuhio-Kuamoo EBLT	105.550346	661.485345	174
95% percentile	900-4500	40: Kuhio-Kuamoo EBRT	21.399262	437.424433	156
95% percentile	900-4500	140: Kuhio-KBR WB	13.152082	165.713991	77
95% percentile	900-4500	141: Kuhio-KBR EBRT	172.016894	932.820991	738

APPENDIX B

VISSIM SIMULATION RESULTS

- Alternative 4: Traffic Signal with Dual Northbound Left-Turn Lanes

Alternative 4: Traffic Signal with Dual Northbound Left-Turns AM - Travel Time Results

SimRun	TimeInt	VehicleTravelTimeMeasurement	Vehs(All)	TravTm(All)	DistTrav(All)
1	900-4500	1: Kuhio SB	607	186.397793	7555.507667
1	900-4500	2: Kuhio NB	452	172.554339	7587.931168
1	900-4500	3: Kapaa Bypass Rd SB	760	200.022614	7665.110118
1	900-4500	4: Kapaa Bypass Rd NB	93	192.976993	7729.150292
2	900-4500	1: Kuhio SB	609	187.392094	7555.507667
2	900-4500	2: Kuhio NB	444	171.124908	7587.931168
2	900-4500	3: Kapaa Bypass Rd SB	718	199.810686	7665.110118
2	900-4500	4: Kapaa Bypass Rd NB	103	192.572267	7729.150292
3	900-4500	1: Kuhio SB	606	188.549083	7555.507667
3	900-4500	2: Kuhio NB	451	173.164938	7587.931168
3	900-4500	3: Kapaa Bypass Rd SB	741	201.642367	7665.110118
3	900-4500	4: Kapaa Bypass Rd NB	89	193.780743	7729.150292
4	900-4500	1: Kuhio SB	579	187.072759	7555.507667
4	900-4500	2: Kuhio NB	444	170.20182	7587.931168
4	900-4500	3: Kapaa Bypass Rd SB	668	198.411547	7665.110118
4	900-4500	4: Kapaa Bypass Rd NB	99	200.693692	7729.150292
5	900-4500	1: Kuhio SB	590	187.871942	7555.507667
5	900-4500	2: Kuhio NB	480	169.759531	7587.931168
5	900-4500	3: Kapaa Bypass Rd SB	714	197.764847	7665.110118
5	900-4500	4: Kapaa Bypass Rd NB	105	194.169304	7729.150292
Avg	900-4500	1: Kuhio SB	598	187.456734	7555.507667
Avg	900-4500	2: Kuhio NB	454	171.361107	7587.931168
Avg	900-4500	3: Kapaa Bypass Rd SB	720	199.530412	7665.110118
Avg	900-4500	4: Kapaa Bypass Rd NB	98	194.8386	7729.150292
Standard deviation	900-4500	1: Kuhio SB	13	0.812188	0
Standard deviation	900-4500	2: Kuhio NB	15	1.469897	0
Standard deviation	900-4500	3: Kapaa Bypass Rd SB	35	1.512469	0
Standard deviation	900-4500	4: Kapaa Bypass Rd NB	7	3.333578	0
Minimum	900-4500	1: Kuhio SB	579	186.397793	7555.507667
Minimum	900-4500	2: Kuhio NB	444	169.759531	7587.931168
Minimum	900-4500	3: Kapaa Bypass Rd SB	668	197.764847	7665.110118
Minimum	900-4500	4: Kapaa Bypass Rd NB	89	192.572267	7729.150292
Maximum	900-4500	1: Kuhio SB	609	188.549083	7555.507667
Maximum	900-4500	2: Kuhio NB	480	173.164938	7587.931168
Maximum	900-4500	3: Kapaa Bypass Rd SB	760	201.642367	7665.110118
Maximum	900-4500	4: Kapaa Bypass Rd NB	105	200.693692	7729.150292
95% percentile	900-4500	1: Kuhio SB	609	188.549083	7555.507667
95% percentile	900-4500	2: Kuhio NB	480	173.164938	7587.931168
95% percentile	900-4500	3: Kapaa Bypass Rd SB	760	201.642367	7665.110118
95% percentile	900-4500	4: Kapaa Bypass Rd NB	105	200.693692	7729.150292

Alternative 4: Traffic Signal with Dual Northbound Left-Turns AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
1	900-4500	1: Kuhio-Aleka N SBLT	0.330805	74.82226	2
1	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
1	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
1	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
1	900-4500	5: Kuhio-Aleka N WBLT	0.290139	56.508283	6
1	900-4500	6: Kuhio-Aleka N WBRT	0.577168	51.741079	13
1	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
1	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
1	900-4500	9: Kuhio-Aleka S NBTH	0.327948	174.279468	1
1	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
1	900-4500	11: Kuhio-Aleka S WBLT	1.806551	82.370525	70
1	900-4500	12: Kuhio-Aleka S WBRT	0.062548	19.685098	31
1	900-4500	13: Kuhio-KBR SBLT	3.701418	112.803528	37
1	900-4500	17: Kuhio-KBR SBRT	0.001725	16.063669	1
1	900-4500	19: Kuhio-KBR NBLT	13.862739	117.82327	110
1	900-4500	20: Kuhio-KBR NBTH	7.85431	188.706906	163
1	900-4500	21: Kuhio-KBR EBLT	1.707411	53.170622	9
1	900-4500	23: Kuhio-Lanikai SBTH	1.106391	231.122102	15
1	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
1	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
1	900-4500	26: Kuhio-Lanikai WBRT	0.346986	26.623374	10
1	900-4500	27: Kuhio-Haleilio SBTH	64.521144	525.137141	604
1	900-4500	28: Kuhio-Haleilio NBLT	1.204851	72.806817	2
1	900-4500	29: Kuhio-Haleilio NBTH	6.253393	233.127787	108
1	900-4500	30: Kuhio-Haleilio EBLT	43.336671	419.473606	135
1	900-4500	31: Kuhio-Haleilio EBRT	7.178984	138.222507	55
1	900-4500	33: Kuhio-Papaloa S NBRT	0.069385	184.251426	0
1	900-4500	34: Kuhio-Papaloa S WBRT	0.752624	72.86903	10
1	900-4500	35: Kuhio-Kuamoo SBTH	153.834	930.07902	904
1	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
1	900-4500	37: Kuhio-Kuamoo NBLT	29.73798	548.048704	94
1	900-4500	38: Kuhio-Kuamoo NBTH	15.611681	190.123732	183
1	900-4500	39: Kuhio-Kuamoo EBLT	874.345169	1689.003508	1921
1	900-4500	40: Kuhio-Kuamoo EBRT	1203.303652	1702.166656	2891
1	900-4500	140: Kuhio-KBR WB	2.25021	82.712331	58
1	900-4500	141: Kuhio-KBR EBRT	0.789625	147.844328	6
1	900-4500	145: Kuhio-KBR SBTH	0	0	0
2	900-4500	1: Kuhio-Aleka N SBLT	0	0	0
2	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
2	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
2	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
2	900-4500	5: Kuhio-Aleka N WBLT	0.100481	56.479716	6

Alternative 4: Traffic Signal with Dual Northbound Left-Turns AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
2	900-4500	6: Kuhio-Aleka N WBRT	0.286608	51.333832	6
2	900-4500	7: Kuhio-Aleka S SBLT	0.434441	94.306179	3
2	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
2	900-4500	9: Kuhio-Aleka S NBTH	0.002689	96.787483	0
2	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
2	900-4500	11: Kuhio-Aleka S WBLT	1.556889	107.290304	63
2	900-4500	12: Kuhio-Aleka S WBRT	0.215137	80.924249	48
2	900-4500	13: Kuhio-KBR SBLT	3.410598	79.304004	22
2	900-4500	17: Kuhio-KBR SBRT	0.046514	49.171632	6
2	900-4500	19: Kuhio-KBR NBLT	14.53652	147.057949	126
2	900-4500	20: Kuhio-KBR NBTH	7.1318	206.757078	150
2	900-4500	21: Kuhio-KBR EBLT	2.202067	41.951716	15
2	900-4500	23: Kuhio-Lanikai SBTH	0.317053	88.45654	4
2	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
2	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
2	900-4500	26: Kuhio-Lanikai WBRT	0.506857	44.110398	16
2	900-4500	27: Kuhio-Haleilio SBTH	69.593009	537.606068	638
2	900-4500	28: Kuhio-Haleilio NBLT	1.332371	55.624387	11
2	900-4500	29: Kuhio-Haleilio NBTH	5.720059	292.383993	91
2	900-4500	30: Kuhio-Haleilio EBLT	35.015937	211.040931	111
2	900-4500	31: Kuhio-Haleilio EBRT	12.928938	219.968701	82
2	900-4500	33: Kuhio-Papaloa S NBRT	0.05979	59.098871	2
2	900-4500	34: Kuhio-Papaloa S WBRT	0.586964	53.230533	8
2	900-4500	35: Kuhio-Kuamoo SBTH	154.919109	1339.405676	894
2	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
2	900-4500	37: Kuhio-Kuamoo NBLT	8.178743	160.539101	46
2	900-4500	38: Kuhio-Kuamoo NBTH	20.828257	276.482866	231
2	900-4500	39: Kuhio-Kuamoo EBLT	69.124724	741.031914	132
2	900-4500	40: Kuhio-Kuamoo EBRT	987.693078	1694.901039	2352
2	900-4500	140: Kuhio-KBR WB	2.96297	128.637557	56
2	900-4500	141: Kuhio-KBR EBRT	1.789906	297.148157	12
2	900-4500	145: Kuhio-KBR SBTH	0	0	0
3	900-4500	1: Kuhio-Aleka N SBLT	0	0	0
3	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
3	900-4500	3: Kuhio-Aleka N NBTH	0.032034	73.354978	1
3	900-4500	4: Kuhio-Aleka N NBRT	0.024513	80.668364	1
3	900-4500	5: Kuhio-Aleka N WBLT	0.000872	15.766559	2
3	900-4500	6: Kuhio-Aleka N WBRT	0.170377	51.145427	4
3	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
3	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
3	900-4500	9: Kuhio-Aleka S NBTH	0	0	0
3	900-4500	10: Kuhio-Aleka S NBRT	0	0	0

Alternative 4: Traffic Signal with Dual Northbound Left-Turns AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
3	900-4500	11: Kuhio-Aleka S WBLT	1.090853	84.822568	57
3	900-4500	12: Kuhio-Aleka S WBRT	0.084384	69.153907	35
3	900-4500	13: Kuhio-KBR SBLT	4.114114	45.147536	32
3	900-4500	17: Kuhio-KBR SBRT	0.016386	37.156445	2
3	900-4500	19: Kuhio-KBR NBLT	14.112755	100.277286	109
3	900-4500	20: Kuhio-KBR NBTH	8.08987	214.573386	152
3	900-4500	21: Kuhio-KBR EBLT	1.796473	61.247699	9
3	900-4500	23: Kuhio-Lanikai SBTH	0.293367	105.13581	5
3	900-4500	24: Kuhio-Lanikai NBTH	0.428572	110.462686	6
3	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
3	900-4500	26: Kuhio-Lanikai WBRT	0.31845	26.393496	14
3	900-4500	27: Kuhio-Haleilio SBTH	81.570668	526.389086	720
3	900-4500	28: Kuhio-Haleilio NBLT	1.150385	95.306246	10
3	900-4500	29: Kuhio-Haleilio NBTH	4.024885	261.081753	75
3	900-4500	30: Kuhio-Haleilio EBLT	36.803997	278.924473	105
3	900-4500	31: Kuhio-Haleilio EBRT	7.658326	128.150495	58
3	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
3	900-4500	34: Kuhio-Papaloa S WBRT	0.626231	73.709073	10
3	900-4500	35: Kuhio-Kuamoo SBTH	164.095382	986.836595	1039
3	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
3	900-4500	37: Kuhio-Kuamoo NBLT	13.758588	133.217008	68
3	900-4500	38: Kuhio-Kuamoo NBTH	24.57853	292.510428	256
3	900-4500	39: Kuhio-Kuamoo EBLT	32.794249	133.829671	63
3	900-4500	40: Kuhio-Kuamoo EBRT	556.718026	1645.188979	1456
3	900-4500	140: Kuhio-KBR WB	3.126969	86.679652	62
3	900-4500	141: Kuhio-KBR EBRT	2.310539	280.365751	15
3	900-4500	145: Kuhio-KBR SBTH	0	0	0
4	900-4500	1: Kuhio-Aleka N SBLT	0.174269	60.23444	3
4	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
4	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
4	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
4	900-4500	5: Kuhio-Aleka N WBLT	0.13652	36.735556	3
4	900-4500	6: Kuhio-Aleka N WBRT	0.366169	51.62609	9
4	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
4	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
4	900-4500	9: Kuhio-Aleka S NBTH	0.030239	112.259642	0
4	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
4	900-4500	11: Kuhio-Aleka S WBLT	2.451833	107.23732	77
4	900-4500	12: Kuhio-Aleka S WBRT	0.709504	108.834067	36
4	900-4500	13: Kuhio-KBR SBLT	4.758093	80.0621	29
4	900-4500	17: Kuhio-KBR SBRT	0.010039	18.076328	3
4	900-4500	19: Kuhio-KBR NBLT	16.041932	132.490138	116

Alternative 4: Traffic Signal with Dual Northbound Left-Turns AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
4	900-4500	20: Kuhio-KBR NBTH	5.263973	141.929298	120
4	900-4500	21: Kuhio-KBR EBLT	2.713634	45.931565	16
4	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
4	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
4	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
4	900-4500	26: Kuhio-Lanikai WBRT	0.363859	48.540349	12
4	900-4500	27: Kuhio-Haleilio SBTH	67.123972	461.890174	655
4	900-4500	28: Kuhio-Haleilio NBLT	1.194956	80.838701	7
4	900-4500	29: Kuhio-Haleilio NBTH	7.761458	255.440662	140
4	900-4500	30: Kuhio-Haleilio EBLT	32.85042	278.499994	121
4	900-4500	31: Kuhio-Haleilio EBRT	6.100084	126.924491	55
4	900-4500	33: Kuhio-Papaloa S NBRT	0.117114	217.98465	1
4	900-4500	34: Kuhio-Papaloa S WBRT	0.785058	52.102219	11
4	900-4500	35: Kuhio-Kuamoo SBTH	131.703777	790.859091	853
4	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
4	900-4500	37: Kuhio-Kuamoo NBLT	6.389211	95.73863	45
4	900-4500	38: Kuhio-Kuamoo NBTH	19.246949	295.057634	218
4	900-4500	39: Kuhio-Kuamoo EBLT	609.016204	1690.228715	1398
4	900-4500	40: Kuhio-Kuamoo EBRT	899.303664	1692.143832	2626
4	900-4500	140: Kuhio-KBR WB	3.42332	104.344172	57
4	900-4500	141: Kuhio-KBR EBRT	2.363833	312.088256	13
4	900-4500	145: Kuhio-KBR SBTH	0	0	0
5	900-4500	1: Kuhio-Aleka N SBLT	0.201979	50.85384	2
5	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
5	900-4500	3: Kuhio-Aleka N NBTH	0.022212	45.837928	2
5	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
5	900-4500	5: Kuhio-Aleka N WBLT	0.179678	39.780955	5
5	900-4500	6: Kuhio-Aleka N WBRT	0.246756	52.188205	8
5	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
5	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
5	900-4500	9: Kuhio-Aleka S NBTH	0.041113	108.8349	0
5	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
5	900-4500	11: Kuhio-Aleka S WBLT	2.008633	105.726077	62
5	900-4500	12: Kuhio-Aleka S WBRT	0.122573	80.705631	35
5	900-4500	13: Kuhio-KBR SBLT	5.106366	97.689237	34
5	900-4500	17: Kuhio-KBR SBRT	0.019194	35.535827	4
5	900-4500	19: Kuhio-KBR NBLT	14.833574	88.088643	125
5	900-4500	20: Kuhio-KBR NBTH	6.967974	126.407985	163
5	900-4500	21: Kuhio-KBR EBLT	2.199539	52.959195	12
5	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
5	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
5	900-4500	25: Kuhio-Lanikai WBLT	0	0	0

Alternative 4: Traffic Signal with Dual Northbound Left-Turns AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
5	900-4500	26: Kuhio-Lanikai WBRT	0.431975	26.196699	15
5	900-4500	27: Kuhio-Haleilio SBTH	57.256907	410.244107	629
5	900-4500	28: Kuhio-Haleilio NBLT	0.732531	52.772715	7
5	900-4500	29: Kuhio-Haleilio NBTH	6.220406	147.276732	112
5	900-4500	30: Kuhio-Haleilio EBLT	32.748072	316.004817	128
5	900-4500	31: Kuhio-Haleilio EBRT	4.909874	133.014241	48
5	900-4500	33: Kuhio-Papaloa S NBRT	0.490386	203.440021	0
5	900-4500	34: Kuhio-Papaloa S WBRT	1.030033	53.066155	12
5	900-4500	35: Kuhio-Kuamoo SBTH	167.839368	1209.33671	902
5	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
5	900-4500	37: Kuhio-Kuamoo NBLT	10.009797	202.837206	62
5	900-4500	38: Kuhio-Kuamoo NBTH	15.88958	252.243632	187
5	900-4500	39: Kuhio-Kuamoo EBLT	1049.893309	1713.970634	2076
5	900-4500	40: Kuhio-Kuamoo EBRT	1230.124103	1713.955044	2908
5	900-4500	140: Kuhio-KBR WB	3.254509	63.203168	63
5	900-4500	141: Kuhio-KBR EBRT	0.92162	251.422048	5
5	900-4500	145: Kuhio-KBR SBTH	0.029868	34.967396	1
Avg	900-4500	1: Kuhio-Aleka N SBLT	0.141411	37.182108	1
Avg	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Avg	900-4500	3: Kuhio-Aleka N NBTH	0.010849	23.838581	1
Avg	900-4500	4: Kuhio-Aleka N NBRT	0.004903	16.133673	0
Avg	900-4500	5: Kuhio-Aleka N WBLT	0.141538	41.054214	4
Avg	900-4500	6: Kuhio-Aleka N WBRT	0.329416	51.606927	8
Avg	900-4500	7: Kuhio-Aleka S SBLT	0.086888	18.861236	1
Avg	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Avg	900-4500	9: Kuhio-Aleka S NBTH	0.080398	98.432299	0
Avg	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Avg	900-4500	11: Kuhio-Aleka S WBLT	1.782952	97.489359	66
Avg	900-4500	12: Kuhio-Aleka S WBRT	0.238829	71.86059	37
Avg	900-4500	13: Kuhio-KBR SBLT	4.218118	83.001281	31
Avg	900-4500	17: Kuhio-KBR SBRT	0.018772	31.20078	3
Avg	900-4500	19: Kuhio-KBR NBLT	14.677504	117.147457	117
Avg	900-4500	20: Kuhio-KBR NBTH	7.061585	175.674931	150
Avg	900-4500	21: Kuhio-KBR EBLT	2.123825	51.05216	12
Avg	900-4500	23: Kuhio-Lanikai SBTH	0.343362	84.94289	5
Avg	900-4500	24: Kuhio-Lanikai NBTH	0.085714	22.092537	1
Avg	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Avg	900-4500	26: Kuhio-Lanikai WBRT	0.393625	34.372863	13
Avg	900-4500	27: Kuhio-Haleilio SBTH	68.01314	492.253315	649
Avg	900-4500	28: Kuhio-Haleilio NBLT	1.123019	71.469773	7
Avg	900-4500	29: Kuhio-Haleilio NBTH	5.99604	237.862186	105
Avg	900-4500	30: Kuhio-Haleilio EBLT	36.151019	300.788764	120

Alternative 4: Traffic Signal with Dual Northbound Left-Turns AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Avg	900-4500	31: Kuhio-Haleilio EBRT	7.755241	149.256087	60
Avg	900-4500	33: Kuhio-Papaloa S NBRT	0.147335	132.954994	1
Avg	900-4500	34: Kuhio-Papaloa S WBRT	0.756182	60.995402	10
Avg	900-4500	35: Kuhio-Kuamoo SBTH	154.478327	1051.303418	918
Avg	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Avg	900-4500	37: Kuhio-Kuamoo NBLT	13.614864	228.07613	63
Avg	900-4500	38: Kuhio-Kuamoo NBTH	19.230999	261.283659	215
Avg	900-4500	39: Kuhio-Kuamoo EBLT	527.034731	1193.612888	1118
Avg	900-4500	40: Kuhio-Kuamoo EBRT	975.428505	1689.67111	2447
Avg	900-4500	140: Kuhio-KBR WB	3.003595	93.115376	59
Avg	900-4500	141: Kuhio-KBR EBRT	1.635105	257.773708	10
Avg	900-4500	145: Kuhio-KBR SBTH	0.005974	6.993479	0
Standard deviation	900-4500	1: Kuhio-Aleka N SBLT	0.141961	35.000449	1
Standard deviation	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Standard deviation	900-4500	3: Kuhio-Aleka N NBTH	0.015257	34.061264	1
Standard deviation	900-4500	4: Kuhio-Aleka N NBRT	0.010963	36.075989	0
Standard deviation	900-4500	5: Kuhio-Aleka N WBLT	0.106107	16.856096	2
Standard deviation	900-4500	6: Kuhio-Aleka N WBRT	0.155475	0.401189	3
Standard deviation	900-4500	7: Kuhio-Aleka S SBLT	0.194288	42.175006	1
Standard deviation	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Standard deviation	900-4500	9: Kuhio-Aleka S NBTH	0.139502	62.737201	0
Standard deviation	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Standard deviation	900-4500	11: Kuhio-Aleka S WBLT	0.507197	12.727446	8
Standard deviation	900-4500	12: Kuhio-Aleka S WBRT	0.269509	32.622962	6
Standard deviation	900-4500	13: Kuhio-KBR SBLT	0.70895	25.293896	6
Standard deviation	900-4500	17: Kuhio-KBR SBRT	0.016899	13.95168	2
Standard deviation	900-4500	19: Kuhio-KBR NBLT	0.849806	23.767149	8
Standard deviation	900-4500	20: Kuhio-KBR NBTH	1.11028	39.417705	18
Standard deviation	900-4500	21: Kuhio-KBR EBLT	0.40009	7.434922	3
Standard deviation	900-4500	23: Kuhio-Lanikai SBTH	0.4531	95.156517	6
Standard deviation	900-4500	24: Kuhio-Lanikai NBTH	0.191663	49.400415	3
Standard deviation	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Standard deviation	900-4500	26: Kuhio-Lanikai WBRT	0.075837	11.023971	2
Standard deviation	900-4500	27: Kuhio-Haleilio SBTH	8.873891	54.660085	44
Standard deviation	900-4500	28: Kuhio-Haleilio NBLT	0.228544	17.736954	4
Standard deviation	900-4500	29: Kuhio-Haleilio NBTH	1.341165	54.88378	24
Standard deviation	900-4500	30: Kuhio-Haleilio EBLT	4.353802	76.398838	12
Standard deviation	900-4500	31: Kuhio-Haleilio EBRT	3.079946	39.780515	13
Standard deviation	900-4500	33: Kuhio-Papaloa S NBRT	0.196243	97.418251	1
Standard deviation	900-4500	34: Kuhio-Papaloa S WBRT	0.174186	11.234715	1
Standard deviation	900-4500	35: Kuhio-Kuamoo SBTH	14.056091	220.601454	71
Standard deviation	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0

Alternative 4: Traffic Signal with Dual Northbound Left-Turns AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Standard deviation	900-4500	37: Kuhio-Kuamoo NBLT	9.417185	183.092988	20
Standard deviation	900-4500	38: Kuhio-Kuamoo NBTH	3.721966	43.278937	31
Standard deviation	900-4500	39: Kuhio-Kuamoo EBLT	462.245017	722.976717	965
Standard deviation	900-4500	40: Kuhio-Kuamoo EBRT	272.974727	26.258211	598
Standard deviation	900-4500	140: Kuhio-KBR WB	0.453759	24.659143	3
Standard deviation	900-4500	141: Kuhio-KBR EBRT	0.747515	65.451566	4
Standard deviation	900-4500	145: Kuhio-KBR SBTH	0.013357	15.637895	0
Minimum	900-4500	1: Kuhio-Aleka N SBLT	0	0	0
Minimum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Minimum	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
Minimum	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
Minimum	900-4500	5: Kuhio-Aleka N WBLT	0.000872	15.766559	2
Minimum	900-4500	6: Kuhio-Aleka N WBRT	0.170377	51.145427	4
Minimum	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
Minimum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Minimum	900-4500	9: Kuhio-Aleka S NBTH	0	0	0
Minimum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Minimum	900-4500	11: Kuhio-Aleka S WBLT	1.090853	82.370525	57
Minimum	900-4500	12: Kuhio-Aleka S WBRT	0.062548	19.685098	31
Minimum	900-4500	13: Kuhio-KBR SBLT	3.410598	45.147536	22
Minimum	900-4500	17: Kuhio-KBR SBRT	0.001725	16.063669	1
Minimum	900-4500	19: Kuhio-KBR NBLT	13.862739	88.088643	109
Minimum	900-4500	20: Kuhio-KBR NBTH	5.263973	126.407985	120
Minimum	900-4500	21: Kuhio-KBR EBLT	1.707411	41.951716	9
Minimum	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
Minimum	900-4500	24: Kuhio-Lanikai NBTH	0	0	0
Minimum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Minimum	900-4500	26: Kuhio-Lanikai WBRT	0.31845	26.196699	10
Minimum	900-4500	27: Kuhio-Haleilio SBTH	57.256907	410.244107	604
Minimum	900-4500	28: Kuhio-Haleilio NBLT	0.732531	52.772715	2
Minimum	900-4500	29: Kuhio-Haleilio NBTH	4.024885	147.276732	75
Minimum	900-4500	30: Kuhio-Haleilio EBLT	32.748072	211.040931	105
Minimum	900-4500	31: Kuhio-Haleilio EBRT	4.909874	126.924491	48
Minimum	900-4500	33: Kuhio-Papaloa S NBRT	0	0	0
Minimum	900-4500	34: Kuhio-Papaloa S WBRT	0.586964	52.102219	8
Minimum	900-4500	35: Kuhio-Kuamoo SBTH	131.703777	790.859091	853
Minimum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Minimum	900-4500	37: Kuhio-Kuamoo NBLT	6.389211	95.73863	45
Minimum	900-4500	38: Kuhio-Kuamoo NBTH	15.611681	190.123732	183
Minimum	900-4500	39: Kuhio-Kuamoo EBLT	32.794249	133.829671	63
Minimum	900-4500	40: Kuhio-Kuamoo EBRT	556.718026	1645.188979	1456
Minimum	900-4500	140: Kuhio-KBR WB	2.25021	63.203168	56

Alternative 4: Traffic Signal with Dual Northbound Left-Turns AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Minimum	900-4500	141: Kuhio-KBR EBRT	0.789625	147.844328	5
Minimum	900-4500	145: Kuhio-KBR SBTH	0	0	0
Maximum	900-4500	1: Kuhio-Aleka N SBLT	0.330805	74.82226	3
Maximum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Maximum	900-4500	3: Kuhio-Aleka N NBTH	0.032034	73.354978	2
Maximum	900-4500	4: Kuhio-Aleka N NBRT	0.024513	80.668364	1
Maximum	900-4500	5: Kuhio-Aleka N WBLT	0.290139	56.508283	6
Maximum	900-4500	6: Kuhio-Aleka N WBRT	0.577168	52.188205	13
Maximum	900-4500	7: Kuhio-Aleka S SBLT	0.434441	94.306179	3
Maximum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Maximum	900-4500	9: Kuhio-Aleka S NBTH	0.327948	174.279468	1
Maximum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Maximum	900-4500	11: Kuhio-Aleka S WBLT	2.451833	107.290304	77
Maximum	900-4500	12: Kuhio-Aleka S WBRT	0.709504	108.834067	48
Maximum	900-4500	13: Kuhio-KBR SBLT	5.106366	112.803528	37
Maximum	900-4500	17: Kuhio-KBR SBRT	0.046514	49.171632	6
Maximum	900-4500	19: Kuhio-KBR NBLT	16.041932	147.057949	126
Maximum	900-4500	20: Kuhio-KBR NBTH	8.08987	214.573386	163
Maximum	900-4500	21: Kuhio-KBR EBLT	2.713634	61.247699	16
Maximum	900-4500	23: Kuhio-Lanikai SBTH	1.106391	231.122102	15
Maximum	900-4500	24: Kuhio-Lanikai NBTH	0.428572	110.462686	6
Maximum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Maximum	900-4500	26: Kuhio-Lanikai WBRT	0.506857	48.540349	16
Maximum	900-4500	27: Kuhio-Haleilio SBTH	81.570668	537.606068	720
Maximum	900-4500	28: Kuhio-Haleilio NBLT	1.332371	95.306246	11
Maximum	900-4500	29: Kuhio-Haleilio NBTH	7.761458	292.383993	140
Maximum	900-4500	30: Kuhio-Haleilio EBLT	43.336671	419.473606	135
Maximum	900-4500	31: Kuhio-Haleilio EBRT	12.928938	219.968701	82
Maximum	900-4500	33: Kuhio-Papaloa S NBRT	0.490386	217.98465	2
Maximum	900-4500	34: Kuhio-Papaloa S WBRT	1.030033	73.709073	12
Maximum	900-4500	35: Kuhio-Kuamoo SBTH	167.839368	1339.405676	1039
Maximum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Maximum	900-4500	37: Kuhio-Kuamoo NBLT	29.73798	548.048704	94
Maximum	900-4500	38: Kuhio-Kuamoo NBTH	24.57853	295.057634	256
Maximum	900-4500	39: Kuhio-Kuamoo EBLT	1049.893309	1713.970634	2076
Maximum	900-4500	40: Kuhio-Kuamoo EBRT	1230.124103	1713.955044	2908
Maximum	900-4500	140: Kuhio-KBR WB	3.42332	128.637557	63
Maximum	900-4500	141: Kuhio-KBR EBRT	2.363833	312.088256	15
Maximum	900-4500	145: Kuhio-KBR SBTH	0.029868	34.967396	1
95% percentile	900-4500	1: Kuhio-Aleka N SBLT	0.330805	74.82226	3
95% percentile	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
95% percentile	900-4500	3: Kuhio-Aleka N NBTH	0.032034	73.354978	2

Alternative 4: Traffic Signal with Dual Northbound Left-Turns AM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
95% percentile	900-4500	4: Kuhio-Aleka N NBRT	0.024513	80.668364	1
95% percentile	900-4500	5: Kuhio-Aleka N WBLT	0.290139	56.508283	6
95% percentile	900-4500	6: Kuhio-Aleka N WBRT	0.577168	52.188205	13
95% percentile	900-4500	7: Kuhio-Aleka S SBLT	0.434441	94.306179	3
95% percentile	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
95% percentile	900-4500	9: Kuhio-Aleka S NBTH	0.327948	174.279468	1
95% percentile	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
95% percentile	900-4500	11: Kuhio-Aleka S WBLT	2.451833	107.290304	77
95% percentile	900-4500	12: Kuhio-Aleka S WBRT	0.709504	108.834067	48
95% percentile	900-4500	13: Kuhio-KBR SBLT	5.106366	112.803528	37
95% percentile	900-4500	17: Kuhio-KBR SBRT	0.046514	49.171632	6
95% percentile	900-4500	19: Kuhio-KBR NBLT	16.041932	147.057949	126
95% percentile	900-4500	20: Kuhio-KBR NBTH	8.08987	214.573386	163
95% percentile	900-4500	21: Kuhio-KBR EBLT	2.713634	61.247699	16
95% percentile	900-4500	23: Kuhio-Lanikai SBTH	1.106391	231.122102	15
95% percentile	900-4500	24: Kuhio-Lanikai NBTH	0.428572	110.462686	6
95% percentile	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
95% percentile	900-4500	26: Kuhio-Lanikai WBRT	0.506857	48.540349	16
95% percentile	900-4500	27: Kuhio-Haleilio SBTH	81.570668	537.606068	720
95% percentile	900-4500	28: Kuhio-Haleilio NBLT	1.332371	95.306246	11
95% percentile	900-4500	29: Kuhio-Haleilio NBTH	7.761458	292.383993	140
95% percentile	900-4500	30: Kuhio-Haleilio EBLT	43.336671	419.473606	135
95% percentile	900-4500	31: Kuhio-Haleilio EBRT	12.928938	219.968701	82
95% percentile	900-4500	33: Kuhio-Papaloa S NBRT	0.490386	217.98465	2
95% percentile	900-4500	34: Kuhio-Papaloa S WBRT	1.030033	73.709073	12
95% percentile	900-4500	35: Kuhio-Kuamoo SBTH	167.839368	1339.405676	1039
95% percentile	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
95% percentile	900-4500	37: Kuhio-Kuamoo NBLT	29.73798	548.048704	94
95% percentile	900-4500	38: Kuhio-Kuamoo NBTH	24.57853	295.057634	256
95% percentile	900-4500	39: Kuhio-Kuamoo EBLT	1049.893309	1713.970634	2076
95% percentile	900-4500	40: Kuhio-Kuamoo EBRT	1230.124103	1713.955044	2908
95% percentile	900-4500	140: Kuhio-KBR WB	3.42332	128.637557	63
95% percentile	900-4500	141: Kuhio-KBR EBRT	2.363833	312.088256	15
95% percentile	900-4500	145: Kuhio-KBR SBTH	0.029868	34.967396	1

Alternative 4: Traffic Signal with Dual Northbound Left-Turns PM - Travel Time Results

SimRun	TimeInt	VehicleTravelTimeMeasurement	Vehs(All)	TravTm(All)	DistTrav(All)
1	900-4500	1: Kuhio SB	364	252.039508	7555.507667
1	900-4500	2: Kuhio NB	536	185.928473	7587.931168
1	900-4500	3: Kapaa Bypass Rd SB	466	232.925898	7665.110118
1	900-4500	4: Kapaa Bypass Rd NB	463	217.252971	7729.150292
2	900-4500	1: Kuhio SB	334	250.967754	7555.507667
2	900-4500	2: Kuhio NB	536	181.781111	7587.931168
2	900-4500	3: Kapaa Bypass Rd SB	455	231.12084	7665.110118
2	900-4500	4: Kapaa Bypass Rd NB	474	212.408372	7729.150292
3	900-4500	1: Kuhio SB	356	247.807656	7555.507667
3	900-4500	2: Kuhio NB	527	182.679367	7587.931168
3	900-4500	3: Kapaa Bypass Rd SB	429	232.823728	7665.110118
3	900-4500	4: Kapaa Bypass Rd NB	500	209.48437	7729.150292
4	900-4500	1: Kuhio SB	335	250.917268	7555.507667
4	900-4500	2: Kuhio NB	557	181.335173	7587.931168
4	900-4500	3: Kapaa Bypass Rd SB	434	233.812991	7665.110118
4	900-4500	4: Kapaa Bypass Rd NB	500	216.072779	7729.150292
5	900-4500	1: Kuhio SB	371	252.13784	7555.507667
5	900-4500	2: Kuhio NB	539	176.919578	7587.931168
5	900-4500	3: Kapaa Bypass Rd SB	418	230.092415	7665.110118
5	900-4500	4: Kapaa Bypass Rd NB	488	210.130927	7729.150292
Avg	900-4500	1: Kuhio SB	352	250.774005	7555.507667
Avg	900-4500	2: Kuhio NB	539	181.728741	7587.931168
Avg	900-4500	3: Kapaa Bypass Rd SB	440	232.155174	7665.110118
Avg	900-4500	4: Kapaa Bypass Rd NB	485	213.069884	7729.150292
Standard deviation	900-4500	1: Kuhio SB	17	1.75491	0
Standard deviation	900-4500	2: Kuhio NB	11	3.233695	0
Standard deviation	900-4500	3: Kapaa Bypass Rd SB	20	1.509483	0
Standard deviation	900-4500	4: Kapaa Bypass Rd NB	16	3.480179	0
Minimum	900-4500	1: Kuhio SB	334	247.807656	7555.507667
Minimum	900-4500	2: Kuhio NB	527	176.919578	7587.931168
Minimum	900-4500	3: Kapaa Bypass Rd SB	418	230.092415	7665.110118
Minimum	900-4500	4: Kapaa Bypass Rd NB	463	209.48437	7729.150292
Maximum	900-4500	1: Kuhio SB	371	252.13784	7555.507667
Maximum	900-4500	2: Kuhio NB	557	185.928473	7587.931168
Maximum	900-4500	3: Kapaa Bypass Rd SB	466	233.812991	7665.110118
Maximum	900-4500	4: Kapaa Bypass Rd NB	500	217.252971	7729.150292
95% percentile	900-4500	1: Kuhio SB	371	252.13784	7555.507667
95% percentile	900-4500	2: Kuhio NB	557	185.928473	7587.931168
95% percentile	900-4500	3: Kapaa Bypass Rd SB	466	233.812991	7665.110118
95% percentile	900-4500	4: Kapaa Bypass Rd NB	500	217.252971	7729.150292

Alternative 4: Traffic Signal with Dual Northbound Left-Turns PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
1	900-4500	1: Kuhio-Aleka N SBLT	0.463872	91.067172	4
1	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
1	900-4500	3: Kuhio-Aleka N NBTH	0.19554	146.539869	4
1	900-4500	4: Kuhio-Aleka N NBRT	0.193907	153.853254	1
1	900-4500	5: Kuhio-Aleka N WBLT	0.09221	35.621136	3
1	900-4500	6: Kuhio-Aleka N WBRT	1.241153	108.869843	22
1	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
1	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
1	900-4500	9: Kuhio-Aleka S NBTH	0.162659	146.669827	0
1	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
1	900-4500	11: Kuhio-Aleka S WBLT	12.502742	214.838585	195
1	900-4500	12: Kuhio-Aleka S WBRT	2.630313	183.625362	66
1	900-4500	13: Kuhio-KBR SBLT	9.858374	108.493396	56
1	900-4500	17: Kuhio-KBR SBRT	0.209819	49.113254	19
1	900-4500	19: Kuhio-KBR NBLT	53.851683	385.086281	428
1	900-4500	20: Kuhio-KBR NBTH	17.840915	232.176734	258
1	900-4500	21: Kuhio-KBR EBLT	5.51507	68.120747	25
1	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
1	900-4500	24: Kuhio-Lanikai NBTH	3.30741	292.398622	50
1	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
1	900-4500	26: Kuhio-Lanikai WBRT	1.569594	49.481896	34
1	900-4500	27: Kuhio-Haleilio SBTH	68.838949	513.415623	640
1	900-4500	28: Kuhio-Haleilio NBLT	20.631566	390.172103	107
1	900-4500	29: Kuhio-Haleilio NBTH	28.807983	902.026568	260
1	900-4500	30: Kuhio-Haleilio EBLT	29.559095	174.40026	82
1	900-4500	31: Kuhio-Haleilio EBRT	0.437446	63.589919	5
1	900-4500	33: Kuhio-Papaloa S NBRT	13.84097	644.726154	90
1	900-4500	34: Kuhio-Papaloa S WBRT	0	0	0
1	900-4500	35: Kuhio-Kuamoo SBTH	61.757128	517.777861	407
1	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
1	900-4500	37: Kuhio-Kuamoo NBLT	158.577558	1128.924823	748
1	900-4500	38: Kuhio-Kuamoo NBTH	135.823142	1105.210724	736
1	900-4500	39: Kuhio-Kuamoo EBLT	98.447001	748.862168	162
1	900-4500	40: Kuhio-Kuamoo EBRT	9.769969	161.215988	102
1	900-4500	140: Kuhio-KBR WB	7.388987	97.021191	81
1	900-4500	141: Kuhio-KBR EBRT	0.187444	103.770062	1
1	900-4500	145: Kuhio-KBR SBTH	0	0	0
2	900-4500	1: Kuhio-Aleka N SBLT	0.081744	35.457561	3
2	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
2	900-4500	3: Kuhio-Aleka N NBTH	0.032716	80.776524	3
2	900-4500	4: Kuhio-Aleka N NBRT	0.011395	43.247278	1
2	900-4500	5: Kuhio-Aleka N WBLT	0.299606	76.478679	10

Alternative 4: Traffic Signal with Dual Northbound Left-Turns PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
2	900-4500	6: Kuhio-Aleka N WBRT	0.926536	93.853285	23
2	900-4500	7: Kuhio-Aleka S SBLT	0.462098	60.526881	8
2	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
2	900-4500	9: Kuhio-Aleka S NBTH	0.363751	167.912989	0
2	900-4500	10: Kuhio-Aleka S NBRT	0.548337	203.788551	5
2	900-4500	11: Kuhio-Aleka S WBLT	15.557977	152.981015	215
2	900-4500	12: Kuhio-Aleka S WBRT	0.772071	135.301826	57
2	900-4500	13: Kuhio-KBR SBLT	10.206525	143.524256	53
2	900-4500	17: Kuhio-KBR SBRT	0.250174	60.274859	28
2	900-4500	19: Kuhio-KBR NBLT	61.862106	317.816785	444
2	900-4500	20: Kuhio-KBR NBTH	17.568214	255.502717	278
2	900-4500	21: Kuhio-KBR EBLT	5.428091	62.117201	25
2	900-4500	23: Kuhio-Lanikai SBTH	0.418302	97.628513	6
2	900-4500	24: Kuhio-Lanikai NBTH	0.030591	55.130046	2
2	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
2	900-4500	26: Kuhio-Lanikai WBRT	1.121744	45.34938	33
2	900-4500	27: Kuhio-Haleilio SBTH	55.303134	510.753687	535
2	900-4500	28: Kuhio-Haleilio NBLT	19.87802	379.048018	130
2	900-4500	29: Kuhio-Haleilio NBTH	13.428697	463.553874	191
2	900-4500	30: Kuhio-Haleilio EBLT	30.394834	172.551108	81
2	900-4500	31: Kuhio-Haleilio EBRT	0.511948	62.550296	7
2	900-4500	33: Kuhio-Papaloa S NBRT	1.253125	207.796095	7
2	900-4500	34: Kuhio-Papaloa S WBRT	0.4311	51.041757	2
2	900-4500	35: Kuhio-Kuamoo SBTH	60.018045	628.586986	429
2	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
2	900-4500	37: Kuhio-Kuamoo NBLT	82.28831	798.963366	427
2	900-4500	38: Kuhio-Kuamoo NBTH	72.450904	847.225716	506
2	900-4500	39: Kuhio-Kuamoo EBLT	87.683725	592.815613	153
2	900-4500	40: Kuhio-Kuamoo EBRT	13.241209	195.412379	106
2	900-4500	140: Kuhio-KBR WB	10.197488	168.782003	78
2	900-4500	141: Kuhio-KBR EBRT	0.144126	95.168331	0
2	900-4500	145: Kuhio-KBR SBTH	0	0	0
3	900-4500	1: Kuhio-Aleka N SBLT	1.5091	97.727452	6
3	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
3	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
3	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
3	900-4500	5: Kuhio-Aleka N WBLT	0.000438	15.781131	1
3	900-4500	6: Kuhio-Aleka N WBRT	0.542707	52.335928	16
3	900-4500	7: Kuhio-Aleka S SBLT	0.400181	41.987513	4
3	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
3	900-4500	9: Kuhio-Aleka S NBTH	2.456627	387.634256	16
3	900-4500	10: Kuhio-Aleka S NBRT	0	0	0

Alternative 4: Traffic Signal with Dual Northbound Left-Turns PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
3	900-4500	11: Kuhio-Aleka S WBLT	7.693678	106.213397	147
3	900-4500	12: Kuhio-Aleka S WBRT	0.545889	81.349785	62
3	900-4500	13: Kuhio-KBR SBLT	13.681678	145.955933	63
3	900-4500	17: Kuhio-KBR SBRT	0.137298	76.757081	30
3	900-4500	19: Kuhio-KBR NBLT	54.003872	291.714389	436
3	900-4500	20: Kuhio-KBR NBTH	18.235553	339.054065	295
3	900-4500	21: Kuhio-KBR EBLT	11.155434	497.603921	38
3	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
3	900-4500	24: Kuhio-Lanikai NBTH	3.991906	345.501114	51
3	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
3	900-4500	26: Kuhio-Lanikai WBRT	1.092739	47.965299	31
3	900-4500	27: Kuhio-Haleilio SBTH	67.833006	510.352844	599
3	900-4500	28: Kuhio-Haleilio NBLT	14.620024	183.496091	98
3	900-4500	29: Kuhio-Haleilio NBTH	10.732874	303.294085	178
3	900-4500	30: Kuhio-Haleilio EBLT	32.679773	241.727458	83
3	900-4500	31: Kuhio-Haleilio EBRT	1.074349	98.958711	15
3	900-4500	33: Kuhio-Papaloa S NBRT	7.050149	477.132327	53
3	900-4500	34: Kuhio-Papaloa S WBRT	0.089521	51.091239	1
3	900-4500	35: Kuhio-Kuamoo SBTH	53.174402	531.808799	420
3	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
3	900-4500	37: Kuhio-Kuamoo NBLT	70.08801	553.135841	379
3	900-4500	38: Kuhio-Kuamoo NBTH	59.21653	787.06551	467
3	900-4500	39: Kuhio-Kuamoo EBLT	86.578659	728.923678	132
3	900-4500	40: Kuhio-Kuamoo EBRT	12.961822	235.901853	97
3	900-4500	140: Kuhio-KBR WB	8.529817	146.930831	86
3	900-4500	141: Kuhio-KBR EBRT	0.62158	186.155414	1
3	900-4500	145: Kuhio-KBR SBTH	0	0	0
4	900-4500	1: Kuhio-Aleka N SBLT	1.805615	95.871545	13
4	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
4	900-4500	3: Kuhio-Aleka N NBTH	0.042255	74.954395	1
4	900-4500	4: Kuhio-Aleka N NBRT	0.031149	81.262903	0
4	900-4500	5: Kuhio-Aleka N WBLT	0.313216	98.835732	9
4	900-4500	6: Kuhio-Aleka N WBRT	1.123562	130.064752	22
4	900-4500	7: Kuhio-Aleka S SBLT	0.280669	61.992108	3
4	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
4	900-4500	9: Kuhio-Aleka S NBTH	1.132788	259.231452	1
4	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
4	900-4500	11: Kuhio-Aleka S WBLT	13.026085	152.16062	194
4	900-4500	12: Kuhio-Aleka S WBRT	2.425675	161.899405	65
4	900-4500	13: Kuhio-KBR SBLT	12.037863	84.802381	59
4	900-4500	17: Kuhio-KBR SBRT	0.123879	43.53744	18
4	900-4500	19: Kuhio-KBR NBLT	63.86263	357.23009	458

Alternative 4: Traffic Signal with Dual Northbound Left-Turns PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
4	900-4500	20: Kuhio-KBR NBTH	15.070224	232.146499	263
4	900-4500	21: Kuhio-KBR EBLT	4.992296	294.628465	27
4	900-4500	23: Kuhio-Lanikai SBTH	2.252677	202.015404	16
4	900-4500	24: Kuhio-Lanikai NBTH	2.10946	253.216856	36
4	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
4	900-4500	26: Kuhio-Lanikai WBRT	1.703207	48.725783	33
4	900-4500	27: Kuhio-Haleilio SBTH	66.494474	572.245137	588
4	900-4500	28: Kuhio-Haleilio NBLT	14.313689	498.932349	87
4	900-4500	29: Kuhio-Haleilio NBTH	21.51237	488.627883	271
4	900-4500	30: Kuhio-Haleilio EBLT	21.591755	208.714267	68
4	900-4500	31: Kuhio-Haleilio EBRT	0.342791	118.223675	4
4	900-4500	33: Kuhio-Papaloa S NBRT	4.987625	308.814321	35
4	900-4500	34: Kuhio-Papaloa S WBRT	0.22229	52.142494	4
4	900-4500	35: Kuhio-Kuamoo SBTH	57.16431	529.918183	411
4	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
4	900-4500	37: Kuhio-Kuamoo NBLT	60.781431	790.041478	321
4	900-4500	38: Kuhio-Kuamoo NBTH	58.790177	827.38632	475
4	900-4500	39: Kuhio-Kuamoo EBLT	66.643089	416.137371	122
4	900-4500	40: Kuhio-Kuamoo EBRT	21.934604	445.276382	160
4	900-4500	140: Kuhio-KBR WB	7.134135	143.527879	80
4	900-4500	141: Kuhio-KBR EBRT	0.221519	102.12154	0
4	900-4500	145: Kuhio-KBR SBTH	0.029275	35.120288	1
5	900-4500	1: Kuhio-Aleka N SBLT	0.827483	53.440548	10
5	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
5	900-4500	3: Kuhio-Aleka N NBTH	0.048961	78.155816	3
5	900-4500	4: Kuhio-Aleka N NBRT	0.015931	83.253744	0
5	900-4500	5: Kuhio-Aleka N WBLT	0.29146	52.296298	7
5	900-4500	6: Kuhio-Aleka N WBRT	0.5847	71.000244	14
5	900-4500	7: Kuhio-Aleka S SBLT	0.475781	40.560716	3
5	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
5	900-4500	9: Kuhio-Aleka S NBTH	0.416355	167.757021	0
5	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
5	900-4500	11: Kuhio-Aleka S WBLT	8.606462	123.184509	160
5	900-4500	12: Kuhio-Aleka S WBRT	1.863849	112.151212	75
5	900-4500	13: Kuhio-KBR SBLT	11.128968	125.507542	58
5	900-4500	17: Kuhio-KBR SBRT	0.125446	59.258825	16
5	900-4500	19: Kuhio-KBR NBLT	60.970789	315.322762	435
5	900-4500	20: Kuhio-KBR NBTH	12.136082	233.223521	222
5	900-4500	21: Kuhio-KBR EBLT	7.552451	103.460026	30
5	900-4500	23: Kuhio-Lanikai SBTH	0.419759	116.593285	8
5	900-4500	24: Kuhio-Lanikai NBTH	0.367341	130.801499	5
5	900-4500	25: Kuhio-Lanikai WBLT	0	0	0

Alternative 4: Traffic Signal with Dual Northbound Left-Turns PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
5	900-4500	26: Kuhio-Lanikai WBRT	1.034398	49.11743	30
5	900-4500	27: Kuhio-Haleilio SBTH	63.486965	542.101782	572
5	900-4500	28: Kuhio-Haleilio NBLT	28.72773	365.778008	147
5	900-4500	29: Kuhio-Haleilio NBTH	16.225042	439.482385	225
5	900-4500	30: Kuhio-Haleilio EBLT	20.529412	206.744033	70
5	900-4500	31: Kuhio-Haleilio EBRT	0.456448	83.652326	6
5	900-4500	33: Kuhio-Papaloa S NBRT	2.109363	182.181972	26
5	900-4500	34: Kuhio-Papaloa S WBRT	0.133004	51.794258	1
5	900-4500	35: Kuhio-Kuamoo SBTH	54.946451	434.142065	379
5	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
5	900-4500	37: Kuhio-Kuamoo NBLT	51.312441	479.03853	291
5	900-4500	38: Kuhio-Kuamoo NBTH	56.587745	1056.903638	434
5	900-4500	39: Kuhio-Kuamoo EBLT	80.689875	606.5106	146
5	900-4500	40: Kuhio-Kuamoo EBRT	22.15681	370.493154	142
5	900-4500	140: Kuhio-KBR WB	7.433338	148.461777	80
5	900-4500	141: Kuhio-KBR EBRT	0.2117	115.700028	1
5	900-4500	145: Kuhio-KBR SBTH	0	0	0
Avg	900-4500	1: Kuhio-Aleka N SBLT	0.937563	74.712856	7
Avg	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Avg	900-4500	3: Kuhio-Aleka N NBTH	0.063894	76.085321	2
Avg	900-4500	4: Kuhio-Aleka N NBRT	0.050476	72.323436	0
Avg	900-4500	5: Kuhio-Aleka N WBLT	0.199386	55.802595	6
Avg	900-4500	6: Kuhio-Aleka N WBRT	0.883732	91.22481	19
Avg	900-4500	7: Kuhio-Aleka S SBLT	0.323746	41.013443	4
Avg	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Avg	900-4500	9: Kuhio-Aleka S NBTH	0.906436	225.841109	3
Avg	900-4500	10: Kuhio-Aleka S NBRT	0.109667	40.75771	1
Avg	900-4500	11: Kuhio-Aleka S WBLT	11.477389	149.875625	182
Avg	900-4500	12: Kuhio-Aleka S WBRT	1.647559	134.865518	65
Avg	900-4500	13: Kuhio-KBR SBLT	11.382681	121.656701	58
Avg	900-4500	17: Kuhio-KBR SBRT	0.169323	57.788292	22
Avg	900-4500	19: Kuhio-KBR NBLT	58.910216	333.434061	440
Avg	900-4500	20: Kuhio-KBR NBTH	16.170198	258.420707	263
Avg	900-4500	21: Kuhio-KBR EBLT	6.928668	205.186072	29
Avg	900-4500	23: Kuhio-Lanikai SBTH	0.618148	83.24744	6
Avg	900-4500	24: Kuhio-Lanikai NBTH	1.961342	215.409628	29
Avg	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Avg	900-4500	26: Kuhio-Lanikai WBRT	1.304336	48.127958	32
Avg	900-4500	27: Kuhio-Haleilio SBTH	64.391306	529.773815	587
Avg	900-4500	28: Kuhio-Haleilio NBLT	19.634206	363.485314	114
Avg	900-4500	29: Kuhio-Haleilio NBTH	18.141393	519.396959	225
Avg	900-4500	30: Kuhio-Haleilio EBLT	26.950974	200.827425	77

Alternative 4: Traffic Signal with Dual Northbound Left-Turns PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Avg	900-4500	31: Kuhio-Haleilio EBRT	0.564596	85.394986	7
Avg	900-4500	33: Kuhio-Papaloa S NBRT	5.848246	364.130174	42
Avg	900-4500	34: Kuhio-Papaloa S WBRT	0.175183	41.213949	2
Avg	900-4500	35: Kuhio-Kuamoo SBTH	57.412067	528.446779	409
Avg	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Avg	900-4500	37: Kuhio-Kuamoo NBLT	84.60955	750.020808	433
Avg	900-4500	38: Kuhio-Kuamoo NBTH	76.5737	924.758382	524
Avg	900-4500	39: Kuhio-Kuamoo EBLT	84.00847	618.649886	143
Avg	900-4500	40: Kuhio-Kuamoo EBRT	16.012883	281.659951	121
Avg	900-4500	140: Kuhio-KBR WB	8.136753	140.944736	81
Avg	900-4500	141: Kuhio-KBR EBRT	0.277274	120.583075	1
Avg	900-4500	145: Kuhio-KBR SBTH	0.005855	7.024058	0
Standard deviation	900-4500	1: Kuhio-Aleka N SBLT	0.715733	28.453096	4
Standard deviation	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Standard deviation	900-4500	3: Kuhio-Aleka N NBTH	0.075954	51.914335	2
Standard deviation	900-4500	4: Kuhio-Aleka N NBRT	0.080954	56.838806	1
Standard deviation	900-4500	5: Kuhio-Aleka N WBLT	0.143654	32.789687	4
Standard deviation	900-4500	6: Kuhio-Aleka N WBRT	0.313376	30.611172	4
Standard deviation	900-4500	7: Kuhio-Aleka S SBLT	0.196701	25.020666	3
Standard deviation	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Standard deviation	900-4500	9: Kuhio-Aleka S NBTH	0.941039	100.36117	7
Standard deviation	900-4500	10: Kuhio-Aleka S NBRT	0.245224	91.137011	2
Standard deviation	900-4500	11: Kuhio-Aleka S WBLT	3.265719	41.394011	28
Standard deviation	900-4500	12: Kuhio-Aleka S WBRT	0.948447	40.275356	7
Standard deviation	900-4500	13: Kuhio-KBR SBLT	1.539958	25.568463	4
Standard deviation	900-4500	17: Kuhio-KBR SBRT	0.05743	12.713217	6
Standard deviation	900-4500	19: Kuhio-KBR NBLT	4.667628	37.237926	11
Standard deviation	900-4500	20: Kuhio-KBR NBTH	2.573688	46.163382	27
Standard deviation	900-4500	21: Kuhio-KBR EBLT	2.561942	189.15069	5
Standard deviation	900-4500	23: Kuhio-Lanikai SBTH	0.937443	85.564102	7
Standard deviation	900-4500	24: Kuhio-Lanikai NBTH	1.748261	119.507914	24
Standard deviation	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Standard deviation	900-4500	26: Kuhio-Lanikai WBRT	0.308399	1.65201	2
Standard deviation	900-4500	27: Kuhio-Haleilio SBTH	5.464953	27.213608	38
Standard deviation	900-4500	28: Kuhio-Haleilio NBLT	5.856541	113.689994	24
Standard deviation	900-4500	29: Kuhio-Haleilio NBTH	7.174742	225.586677	41
Standard deviation	900-4500	30: Kuhio-Haleilio EBLT	5.509975	28.583065	7
Standard deviation	900-4500	31: Kuhio-Haleilio EBRT	0.291411	23.780639	4
Standard deviation	900-4500	33: Kuhio-Papaloa S NBRT	5.028997	195.005722	31
Standard deviation	900-4500	34: Kuhio-Papaloa S WBRT	0.16395	23.044046	2
Standard deviation	900-4500	35: Kuhio-Kuamoo SBTH	3.527362	69.008576	19
Standard deviation	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0

Alternative 4: Traffic Signal with Dual Northbound Left-Turns PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Standard deviation	900-4500	37: Kuhio-Kuamoo NBLT	42.906894	254.833459	184
Standard deviation	900-4500	38: Kuhio-Kuamoo NBTH	33.706295	145.32496	121
Standard deviation	900-4500	39: Kuhio-Kuamoo EBLT	11.631359	133.174358	16
Standard deviation	900-4500	40: Kuhio-Kuamoo EBRT	5.674058	121.141312	28
Standard deviation	900-4500	140: Kuhio-KBR WB	1.270858	26.472642	3
Standard deviation	900-4500	141: Kuhio-KBR EBRT	0.194777	37.39315	1
Standard deviation	900-4500	145: Kuhio-KBR SBTH	0.013092	15.70627	0
Minimum	900-4500	1: Kuhio-Aleka N SBLT	0.081744	35.457561	3
Minimum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Minimum	900-4500	3: Kuhio-Aleka N NBTH	0	0	0
Minimum	900-4500	4: Kuhio-Aleka N NBRT	0	0	0
Minimum	900-4500	5: Kuhio-Aleka N WBLT	0.000438	15.781131	1
Minimum	900-4500	6: Kuhio-Aleka N WBRT	0.542707	52.335928	14
Minimum	900-4500	7: Kuhio-Aleka S SBLT	0	0	0
Minimum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Minimum	900-4500	9: Kuhio-Aleka S NBTH	0.162659	146.669827	0
Minimum	900-4500	10: Kuhio-Aleka S NBRT	0	0	0
Minimum	900-4500	11: Kuhio-Aleka S WBLT	7.693678	106.213397	147
Minimum	900-4500	12: Kuhio-Aleka S WBRT	0.545889	81.349785	57
Minimum	900-4500	13: Kuhio-KBR SBLT	9.858374	84.802381	53
Minimum	900-4500	17: Kuhio-KBR SBRT	0.123879	43.53744	16
Minimum	900-4500	19: Kuhio-KBR NBLT	53.851683	291.714389	428
Minimum	900-4500	20: Kuhio-KBR NBTH	12.136082	232.146499	222
Minimum	900-4500	21: Kuhio-KBR EBLT	4.992296	62.117201	25
Minimum	900-4500	23: Kuhio-Lanikai SBTH	0	0	0
Minimum	900-4500	24: Kuhio-Lanikai NBTH	0.030591	55.130046	2
Minimum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Minimum	900-4500	26: Kuhio-Lanikai WBRT	1.034398	45.34938	30
Minimum	900-4500	27: Kuhio-Haleilio SBTH	55.303134	510.352844	535
Minimum	900-4500	28: Kuhio-Haleilio NBLT	14.313689	183.496091	87
Minimum	900-4500	29: Kuhio-Haleilio NBTH	10.732874	303.294085	178
Minimum	900-4500	30: Kuhio-Haleilio EBLT	20.529412	172.551108	68
Minimum	900-4500	31: Kuhio-Haleilio EBRT	0.342791	62.550296	4
Minimum	900-4500	33: Kuhio-Papaloa S NBRT	1.253125	182.181972	7
Minimum	900-4500	34: Kuhio-Papaloa S WBRT	0	0	0
Minimum	900-4500	35: Kuhio-Kuamoo SBTH	53.174402	434.142065	379
Minimum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Minimum	900-4500	37: Kuhio-Kuamoo NBLT	51.312441	479.03853	291
Minimum	900-4500	38: Kuhio-Kuamoo NBTH	56.587745	787.06551	434
Minimum	900-4500	39: Kuhio-Kuamoo EBLT	66.643089	416.137371	122
Minimum	900-4500	40: Kuhio-Kuamoo EBRT	9.769969	161.215988	97
Minimum	900-4500	140: Kuhio-KBR WB	7.134135	97.021191	78

Alternative 4: Traffic Signal with Dual Northbound Left-Turns PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
Minimum	900-4500	141: Kuhio-KBR EBRT	0.144126	95.168331	0
Minimum	900-4500	145: Kuhio-KBR SBTH	0	0	0
Maximum	900-4500	1: Kuhio-Aleka N SBLT	1.805615	97.727452	13
Maximum	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
Maximum	900-4500	3: Kuhio-Aleka N NBTH	0.19554	146.539869	4
Maximum	900-4500	4: Kuhio-Aleka N NBRT	0.193907	153.853254	1
Maximum	900-4500	5: Kuhio-Aleka N WBLT	0.313216	98.835732	10
Maximum	900-4500	6: Kuhio-Aleka N WBRT	1.241153	130.064752	23
Maximum	900-4500	7: Kuhio-Aleka S SBLT	0.475781	61.992108	8
Maximum	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
Maximum	900-4500	9: Kuhio-Aleka S NBTH	2.456627	387.634256	16
Maximum	900-4500	10: Kuhio-Aleka S NBRT	0.548337	203.788551	5
Maximum	900-4500	11: Kuhio-Aleka S WBLT	15.557977	214.838585	215
Maximum	900-4500	12: Kuhio-Aleka S WBRT	2.630313	183.625362	75
Maximum	900-4500	13: Kuhio-KBR SBLT	13.681678	145.955933	63
Maximum	900-4500	17: Kuhio-KBR SBRT	0.250174	76.757081	30
Maximum	900-4500	19: Kuhio-KBR NBLT	63.86263	385.086281	458
Maximum	900-4500	20: Kuhio-KBR NBTH	18.235553	339.054065	295
Maximum	900-4500	21: Kuhio-KBR EBLT	11.155434	497.603921	38
Maximum	900-4500	23: Kuhio-Lanikai SBTH	2.252677	202.015404	16
Maximum	900-4500	24: Kuhio-Lanikai NBTH	3.991906	345.501114	51
Maximum	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
Maximum	900-4500	26: Kuhio-Lanikai WBRT	1.703207	49.481896	34
Maximum	900-4500	27: Kuhio-Haleilio SBTH	68.838949	572.245137	640
Maximum	900-4500	28: Kuhio-Haleilio NBLT	28.72773	498.932349	147
Maximum	900-4500	29: Kuhio-Haleilio NBTH	28.807983	902.026568	271
Maximum	900-4500	30: Kuhio-Haleilio EBLT	32.679773	241.727458	83
Maximum	900-4500	31: Kuhio-Haleilio EBRT	1.074349	118.223675	15
Maximum	900-4500	33: Kuhio-Papaloa S NBRT	13.84097	644.726154	90
Maximum	900-4500	34: Kuhio-Papaloa S WBRT	0.4311	52.142494	4
Maximum	900-4500	35: Kuhio-Kuamoo SBTH	61.757128	628.586986	429
Maximum	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
Maximum	900-4500	37: Kuhio-Kuamoo NBLT	158.577558	1128.924823	748
Maximum	900-4500	38: Kuhio-Kuamoo NBTH	135.823142	1105.210724	736
Maximum	900-4500	39: Kuhio-Kuamoo EBLT	98.447001	748.862168	162
Maximum	900-4500	40: Kuhio-Kuamoo EBRT	22.15681	445.276382	160
Maximum	900-4500	140: Kuhio-KBR WB	10.197488	168.782003	86
Maximum	900-4500	141: Kuhio-KBR EBRT	0.62158	186.155414	1
Maximum	900-4500	145: Kuhio-KBR SBTH	0.029275	35.120288	1
95% percentile	900-4500	1: Kuhio-Aleka N SBLT	1.805615	97.727452	13
95% percentile	900-4500	2: Kuhio-Aleka N SBTH	0	0	0
95% percentile	900-4500	3: Kuhio-Aleka N NBTH	0.19554	146.539869	4

Alternative 4: Traffic Signal with Dual Northbound Left-Turns PM - Queue Results

SimRun	TimeInt	QueueCounter	Qlen	QLenMax	Qstops
95% percentile	900-4500	4: Kuhio-Aleka N NBRT	0.193907	153.853254	1
95% percentile	900-4500	5: Kuhio-Aleka N WBLT	0.313216	98.835732	10
95% percentile	900-4500	6: Kuhio-Aleka N WBRT	1.241153	130.064752	23
95% percentile	900-4500	7: Kuhio-Aleka S SBLT	0.475781	61.992108	8
95% percentile	900-4500	8: Kuhio-Aleka S SBTH	0	0	0
95% percentile	900-4500	9: Kuhio-Aleka S NBTH	2.456627	387.634256	16
95% percentile	900-4500	10: Kuhio-Aleka S NBRT	0.548337	203.788551	5
95% percentile	900-4500	11: Kuhio-Aleka S WBLT	15.557977	214.838585	215
95% percentile	900-4500	12: Kuhio-Aleka S WBRT	2.630313	183.625362	75
95% percentile	900-4500	13: Kuhio-KBR SBLT	13.681678	145.955933	63
95% percentile	900-4500	17: Kuhio-KBR SBRT	0.250174	76.757081	30
95% percentile	900-4500	19: Kuhio-KBR NBLT	63.86263	385.086281	458
95% percentile	900-4500	20: Kuhio-KBR NBTH	18.235553	339.054065	295
95% percentile	900-4500	21: Kuhio-KBR EBLT	11.155434	497.603921	38
95% percentile	900-4500	23: Kuhio-Lanikai SBTH	2.252677	202.015404	16
95% percentile	900-4500	24: Kuhio-Lanikai NBTH	3.991906	345.501114	51
95% percentile	900-4500	25: Kuhio-Lanikai WBLT	0	0	0
95% percentile	900-4500	26: Kuhio-Lanikai WBRT	1.703207	49.481896	34
95% percentile	900-4500	27: Kuhio-Haleilio SBTH	68.838949	572.245137	640
95% percentile	900-4500	28: Kuhio-Haleilio NBLT	28.72773	498.932349	147
95% percentile	900-4500	29: Kuhio-Haleilio NBTH	28.807983	902.026568	271
95% percentile	900-4500	30: Kuhio-Haleilio EBLT	32.679773	241.727458	83
95% percentile	900-4500	31: Kuhio-Haleilio EBRT	1.074349	118.223675	15
95% percentile	900-4500	33: Kuhio-Papaloa S NBRT	13.84097	644.726154	90
95% percentile	900-4500	34: Kuhio-Papaloa S WBRT	0.4311	52.142494	4
95% percentile	900-4500	35: Kuhio-Kuamoo SBTH	61.757128	628.586986	429
95% percentile	900-4500	36: Kuhio-Kuamoo SBRT	0	0	0
95% percentile	900-4500	37: Kuhio-Kuamoo NBLT	158.577558	1128.924823	748
95% percentile	900-4500	38: Kuhio-Kuamoo NBTH	135.823142	1105.210724	736
95% percentile	900-4500	39: Kuhio-Kuamoo EBLT	98.447001	748.862168	162
95% percentile	900-4500	40: Kuhio-Kuamoo EBRT	22.15681	445.276382	160
95% percentile	900-4500	140: Kuhio-KBR WB	10.197488	168.782003	86
95% percentile	900-4500	141: Kuhio-KBR EBRT	0.62158	186.155414	1
95% percentile	900-4500	145: Kuhio-KBR SBTH	0.029275	35.120288	1

APPENDIX C

LEVEL OF SERVICE ANALYSIS

APPENDIX C

LEVEL OF SERVICE ANALYSIS

- Existing Conditions

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	40	746	7	26	628
Future Vol, veh/h	0	40	746	7	26	628
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	85	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	43	811	8	28	683

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	409	0	0	818	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	4.14	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	0	591	-	-	806	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	591	-	-	806	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	11.57	0	0.38
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	591	806	-
HCM Lane V/C Ratio	-	-	0.074	0.035	-
HCM Control Delay (s/veh)	-	-	11.6	9.6	-
HCM Lane LOS	-	-	B	A	-
HCM 95th %tile Q(veh)	-	-	0.2	0.1	-

Intersection	
Int Delay, s/veh	1.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	7	664	141	740	661	6
Future Vol, veh/h	7	664	141	740	661	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	0	250	180	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	8	722	153	804	718	7

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1427	718	718	0	-	0
Stage 1	718	-	-	-	-	-
Stage 2	709	-	-	-	-	-
Critical Hdwy	6.63	-	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	-	2.219	-	-	-
Pot Cap-1 Maneuver	137	0	881	-	-	-
Stage 1	482	0	-	-	-	-
Stage 2	450	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	113	-	881	-	-	-
Mov Cap-2 Maneuver	113	-	-	-	-	-
Stage 1	398	-	-	-	-	-
Stage 2	450	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	39.1	1.59	0
HCM LOS	E		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	881	-	113	-	-	-
HCM Lane V/C Ratio	0.174	-	0.067	-	-	-
HCM Control Delay (s/veh)	9.9	-	39.1	0	-	-
HCM Lane LOS	A	-	E	A	-	-
HCM 95th %tile Q(veh)	0.6	-	0.2	-	-	-

Intersection	
Int Delay, s/veh	0.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	58	809	20	44	564
Future Vol, veh/h	0	58	809	20	44	564
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	85	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	63	879	22	48	613

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	451	0	0	901	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	4.14	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	0	556	-	-	750	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	556	-	-	750	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	12.3	0	0.73
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	556	750	-
HCM Lane V/C Ratio	-	-	0.113	0.064	-
HCM Control Delay (s/veh)	-	-	12.3	10.1	-
HCM Lane LOS	-	-	B	B	-
HCM 95th %tile Q(veh)	-	-	0.4	0.2	-

Intersection	
Int Delay, s/veh	8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	17	491	526	808	543	34
Future Vol, veh/h	17	491	526	808	543	34
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	0	250	180	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	18	534	572	878	590	37

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2173	590	590	0	-	0
Stage 1	590	-	-	-	-	-
Stage 2	1583	-	-	-	-	-
Critical Hdwy	6.63	-	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	-	2.219	-	-	-
Pot Cap-1 Maneuver	45	0	983	-	-	-
Stage 1	553	0	-	-	-	-
Stage 2	155	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	19	-	983	-	-	-
Mov Cap-2 Maneuver	19	-	-	-	-	-
Stage 1	231	-	-	-	-	-
Stage 2	155	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, $/480.42		5.37	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	983	-	19	-	-	-
HCM Lane V/C Ratio	0.581	-	0.978	-	-	-
HCM Control Delay (s/veh)	13.6	-	$ 480.4	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	3.9	-	2.6	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

APPENDIX C

LEVEL OF SERVICE ANALYSIS

- Alternative 0: No Action

Intersection	
Int Delay, s/veh	0.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	44	873	8	29	735
Future Vol, veh/h	0	44	873	8	29	735
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	85	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	48	949	9	32	799

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	479	0	0	958	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	4.14	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	0	533	-	-	714	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	533	-	-	714	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	12.42	0	0.39
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	533	714	-
HCM Lane V/C Ratio	-	-	0.09	0.044	-
HCM Control Delay (s/veh)	-	-	12.4	10.3	-
HCM Lane LOS	-	-	B	B	-
HCM 95th %tile Q(veh)	-	-	0.3	0.1	-

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	8	734	156	866	774	7
Future Vol, veh/h	8	734	156	866	774	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	0	250	180	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	798	170	941	841	8

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1651	841	841	0	-	0
Stage 1	841	-	-	-	-	-
Stage 2	810	-	-	-	-	-
Critical Hdwy	6.63	-	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	-	2.219	-	-	-
Pot Cap-1 Maneuver	99	0	792	-	-	-
Stage 1	422	0	-	-	-	-
Stage 2	399	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	77	-	792	-	-	-
Mov Cap-2 Maneuver	77	-	-	-	-	-
Stage 1	332	-	-	-	-	-
Stage 2	399	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	57.28	1.65	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	792	-	77	-	-	-
HCM Lane V/C Ratio	0.214	-	0.112	-	-	-
HCM Control Delay (s/veh)	10.8	-	57.3	0	-	-
HCM Lane LOS	B	-	F	A	-	-
HCM 95th %tile Q(veh)	0.8	-	0.4	-	-	-

Intersection	
Int Delay, s/veh	0.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	64	947	22	49	660
Future Vol, veh/h	0	64	947	22	49	660
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	85	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	70	1029	24	53	717

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	-	527	0	0	1053	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	4.14	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	0	496	-	-	657	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	496	-	-	657	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s/v	13.44	0	0.76
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	496	657	-
HCM Lane V/C Ratio	-	-	0.14	0.081	-
HCM Control Delay (s/veh)	-	-	13.4	11	-
HCM Lane LOS	-	-	B	B	-
HCM 95th %tile Q(veh)	-	-	0.5	0.3	-

Intersection	
Int Delay, s/veh	17.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	19	543	581	946	636	38
Future Vol, veh/h	19	543	581	946	636	38
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	Free	-	None	-	Yield
Storage Length	0	250	180	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	21	590	632	1028	691	41

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	2468	691	691	0	-	0
Stage 1	691	-	-	-	-	-
Stage 2	1777	-	-	-	-	-
Critical Hdwy	6.63	-	4.13	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	-	2.219	-	-	-
Pot Cap-1 Maneuver	29	0	901	-	-	-
Stage 1	496	0	-	-	-	-
Stage 2	121	0	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	~ 9	-	901	-	-	-
Mov Cap-2 Maneuver	~ 9	-	-	-	-	-
Stage 1	149	-	-	-	-	-
Stage 2	121	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s/v	$ 1478.93	6.76	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	901	-	9	-	-	-
HCM Lane V/C Ratio	0.701	-	2.398	-	-	-
HCM Control Delay (s/veh)	17.8	-	$ 1478.9	0	-	-
HCM Lane LOS	C	-	F	A	-	-
HCM 95th %tile Q(veh)	6	-	3.6	-	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

APPENDIX C

LEVEL OF SERVICE ANALYSIS

- Alternative 1: Double-Lane Roundabout

LEVEL OF SERVICE

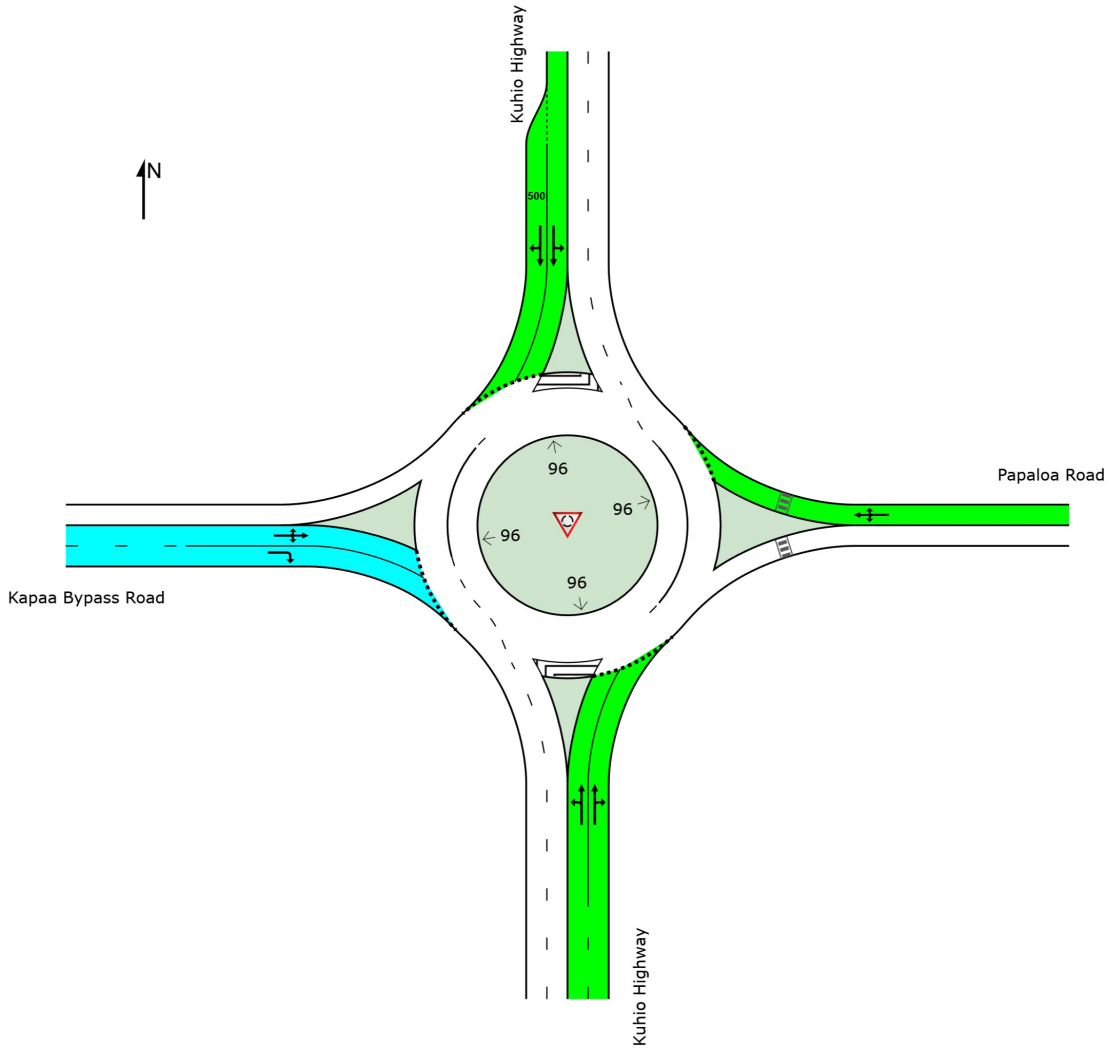
Lane Level of Service

Site: 101 [Double without Bypass (Site Folder: FY 2043 AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

	Approaches				Intersection
	South	East	North	West	
LOS	A	A	A	B	A



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Roundabout Level of Service Method: Same as Sign Control
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

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LANE SUMMARY

Site: 101 [Double without Bypass (Site Folder: FY 2043 AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: Kuhio Highway															
Lane 1	544	2.0	544	2.0	1343	0.405	100	5.2	LOS A	3.4	87.2	Full	1600	0.0	0.0
Lane 2[d]	593	2.0	593	2.0	1466	0.405	100	3.3	LOS A	3.5	87.7	Full	1600	0.0	0.0
Approach	1137	2.0	1137	2.0		0.405		4.2	LOS A	3.5	87.7				
East: Papaloa Road															
Lane 1[d]	86	2.0	86	2.0	593	0.145	100	7.5	LOS A	0.6	15.4	Full	1600	0.0	0.0
Approach	86	2.0	86	2.0		0.145		7.5	LOS A	0.6	15.4				
North: Kuhio Highway															
Lane 1	395	2.0	395	2.0	1123	0.352	100	5.1	LOS A	2.5	63.2	Full	1600	0.0	0.0
Lane 2[d]	447	2.0	447	2.0	1270	0.352	100	4.4	LOS A	2.5	64.4	Short	500	0.0	NA
Approach	842	2.0	842	2.0		0.352		4.7	LOS A	2.5	64.4				
West: Kapaa Bypass Road															
Lane 1	413	2.0	413	2.0	614	0.673	100	12.2	LOS B	5.0	127.5	Full	1600	0.0	0.0
Lane 2[d]	444	2.0	444	2.0	660	0.673	100	11.5	LOS B	5.1	130.0	Full	1600	0.0	0.0
Approach	858	2.0	858	2.0		0.673		11.8	LOS B	5.1	130.0				
All Vehicles	2923	2.0	2923	2.0		0.673		6.7	LOS A	5.1	130.0				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA HCM.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Kuhio Highway

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	179	364	-	544	2.0	1343	0.405	100	NA	NA
Lane 2	-	585	9	593	2.0	1466	0.405	100	NA	NA

Approach	179	949	9	1137	2.0		0.405			
East: Papaloa Road										
Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	36	5	45	86	2.0	593	0.145	100	NA	NA
Approach	36	5	45	86	2.0		0.145			
North: Kuhio Highway										
Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	36	359	-	395	2.0	1123	0.352	100	NA	NA
Lane 2	-	440	8	447	2.0	1270	0.352	100	0.0	1
Approach	36	799	8	842	2.0		0.352			
West: Kapaa Bypass Road										
Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	9	4	400	413	2.0	614	0.673	100	NA	NA
Lane 2	-	-	444	444	2.0	660	0.673	100	NA	NA
Approach	9	4	845	858	2.0		0.673			

	Total	%HV	Deg.Satn (v/c)
All Vehicles	2923	2.0	0.673

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis

	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Kuhio Highway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: Papaloa Road				
Lane 1	0.0	0.0	0.0	0.0
North: Kuhio Highway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: Kapaa Bypass Road				
Lane 1	0.0	0.0	0.0	0.0

Lane 2	0.0	0.0	0.0	0.0

LEVEL OF SERVICE

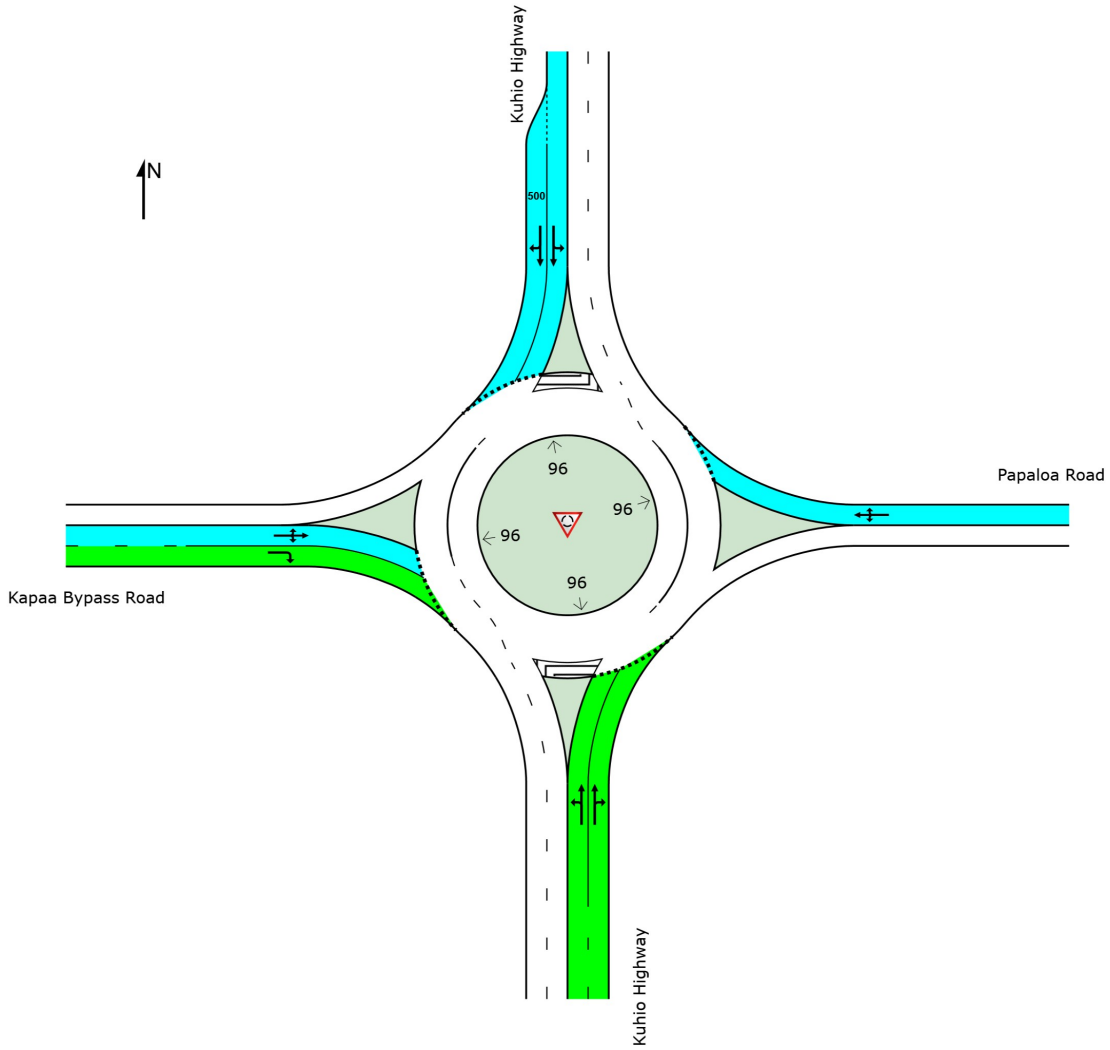
Lane Level of Service

Site: 101 [Double without Bypass (Site Folder: FY 2043 PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

	Approaches				Intersection
	South	East	North	West	
LOS	A	B	B	A	A



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Roundabout Level of Service Method: Same as Sign Control
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

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LANE SUMMARY

Site: 101 [Double without Bypass (Site Folder: FY 2043 PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: Kuhio Highway															
Lane 1	819	2.0	819	2.0	1255	0.653	100	8.8	LOS A	8.1	206.1	Full	1600	0.0	0.0
Lane 2[d]	903	2.0	903	2.0	1383	0.653	100	4.0	LOS A	8.2	208.9	Full	1600	0.0	0.0
Approach	1723	2.0	1723	2.0		0.653		6.3	LOS A	8.2	208.9				
East: Papaloa Road															
Lane 1[d]	109	2.0	109	2.0	378	0.287	100	10.4	LOS B	1.4	34.7	Full	1600	0.0	0.0
Approach	109	2.0	109	2.0		0.287		10.4	LOS B	1.4	34.7				
North: Kuhio Highway															
Lane 1	370	2.0	370	2.0	621	0.596	100	14.9	LOS B	6.0	151.4	Full	1600	0.0	0.0
Lane 2[d]	462	2.0	462	2.0	775	0.596	100	11.9	LOS B	6.5	164.1	Short	500	0.0	NA
Approach	833	2.0	833	2.0		0.596		13.2	LOS B	6.5	164.1				
West: Kapaa Bypass Road															
Lane 1	316	2.0	316	2.0	569	0.555	100	10.1	LOS B	3.6	92.3	Full	1600	0.0	0.0
Lane 2[d]	337	2.0	337	2.0	607	0.555	100	9.3	LOS A	3.7	93.9	Full	1600	0.0	0.0
Approach	652	2.0	652	2.0		0.555		9.7	LOS A	3.7	93.9				
All Vehicles	3316	2.0	3316	2.0		0.653		8.8	LOS A	8.2	208.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA HCM.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Kuhio Highway

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	670	150	-	819	2.0	1255	0.653	100	NA	NA
Lane 2	-	880	24	903	2.0	1383	0.653	100	NA	NA

Approach	670	1029	24	1723	2.0		0.653			
East: Papaloa Road										
Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	39	8	62	109	2.0	378	0.287	100	NA	NA
Approach	39	8	62	109	2.0		0.287			
North: Kuhio Highway										
Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	72	299	-	370	2.0	621	0.596	100	NA	NA
Lane 2	-	419	43	462	2.0	775	0.596	100	0.0	1
Approach	72	717	43	833	2.0		0.596			
West: Kapaa Bypass Road										
Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	22	5	288	316	2.0	569	0.555	100	NA	NA
Lane 2	-	-	337	337	2.0	607	0.555	100	NA	NA
Approach	22	5	625	652	2.0		0.555			

	Total	%HV	Deg.Satn (v/c)
All Vehicles	3316	2.0	0.653

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
There are no Exit Short Lanes for Merge Analysis at this Site.												

Variable Demand Analysis

	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Kuhio Highway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: Papaloa Road				
Lane 1	0.0	0.0	0.0	0.0
North: Kuhio Highway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: Kapaa Bypass Road				
Lane 1	0.0	0.0	0.0	0.0

Lane 2	0.0	0.0	0.0	0.0

APPENDIX C

LEVEL OF SERVICE ANALYSIS

- Alternative 2: Turbo Roundabout

LEVEL OF SERVICE

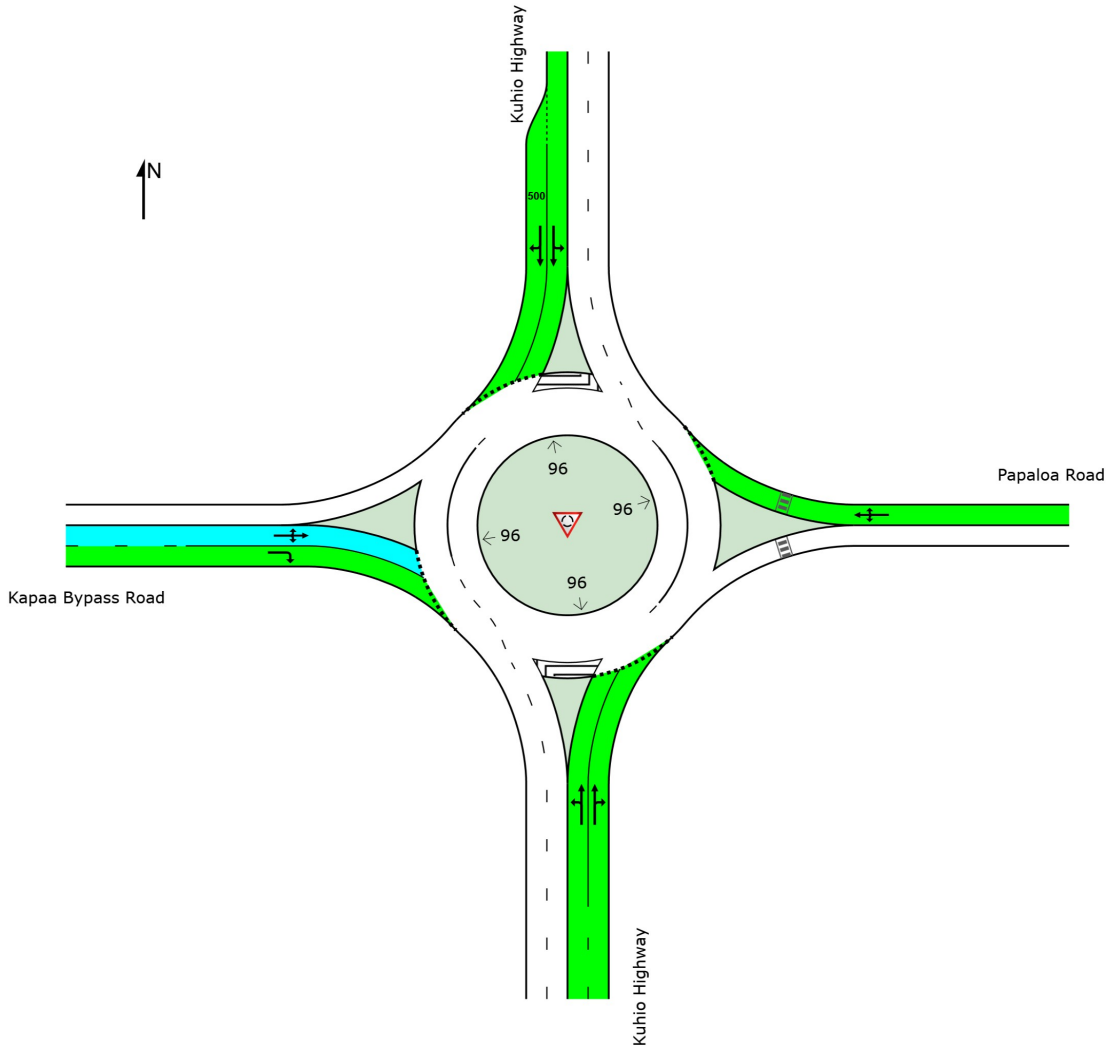
Lane Level of Service

Site: 101 [Turbo without Bypass (Site Folder: FY 2043 AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

	Approaches				Intersection
	South	East	North	West	
LOS	A	A	A	A	A



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Roundabout Level of Service Method: Same as Sign Control
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

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LANE SUMMARY

Site: 101 [Turbo without Bypass (Site Folder: FY 2043 AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: Kuhio Highway															
Lane 1	544	2.0	544	2.0	1343	0.405	100	5.2	LOS A	3.4	87.2	Full	1600	0.0	0.0
Lane 2[d]	593	2.0	593	2.0	1466	0.405	100	3.3	LOS A	3.5	87.7	Full	1600	0.0	0.0
Approach	1137	2.0	1137	2.0		0.405		4.2	LOS A	3.5	87.7				
East: Papaloa Road															
Lane 1[d]	86	2.0	86	2.0	652	0.132	100	6.9	LOS A	0.6	16.2	Full	1600	0.0	0.0
Approach	86	2.0	86	2.0		0.132		6.9	LOS A	0.6	16.2				
North: Kuhio Highway															
Lane 1	395	2.0	395	2.0	1123	0.352	100	5.1	LOS A	2.5	63.2	Full	1600	0.0	0.0
Lane 2[d]	447	2.0	447	2.0	1270	0.352	100	4.4	LOS A	2.5	64.4	Short	500	0.0	NA
Approach	842	2.0	842	2.0		0.352		4.7	LOS A	2.5	64.4				
West: Kapaa Bypass Road															
Lane 1	359	2.0	359	2.0	575	0.625	100	11.1	LOS B	4.2	106.6	Full	1600	0.0	0.0
Lane 2[d]	498	2.0	498	2.0	798	0.625	100	8.9	LOS A	6.2	158.1	Full	1600	0.0	0.0
Approach	858	2.0	858	2.0		0.625		9.8	LOS A	6.2	158.1				
All Vehicles	2923	2.0	2923	2.0		0.625		6.1	LOS A	6.2	158.1				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA HCM.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Kuhio Highway

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	179	364	-	544	2.0	1343	0.405	100	NA	NA
Lane 2	-	585	9	593	2.0	1466	0.405	100	NA	NA

Approach	179	949	9	1137	2.0		0.405			
East: Papaloa Road										
Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	36	5	45	86	2.0	652	0.132	100	NA	NA
Approach	36	5	45	86	2.0		0.132			
North: Kuhio Highway										
Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	36	359	-	395	2.0	1123	0.352	100	NA	NA
Lane 2	-	440	8	447	2.0	1270	0.352	100	0.0	1
Approach	36	799	8	842	2.0		0.352			
West: Kapaa Bypass Road										
Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	9	4	346	359	2.0	575	0.625	100	NA	NA
Lane 2	-	-	498	498	2.0	798	0.625	100	NA	NA
Approach	9	4	845	858	2.0		0.625			
	Total	%HV	Deg.Satn (v/c)							
All Vehicles	2923	2.0		0.625						

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap pcu/h	Follow up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
There are no Exit Short Lanes for Merge Analysis at this Site.											

Variable Demand Analysis

	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Kuhio Highway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: Papaloa Road				
Lane 1	0.0	0.0	0.0	0.0
North: Kuhio Highway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: Kapaa Bypass Road				
Lane 1	0.0	0.0	0.0	0.0

Lane 2	0.0	0.0	0.0	0.0

LEVEL OF SERVICE

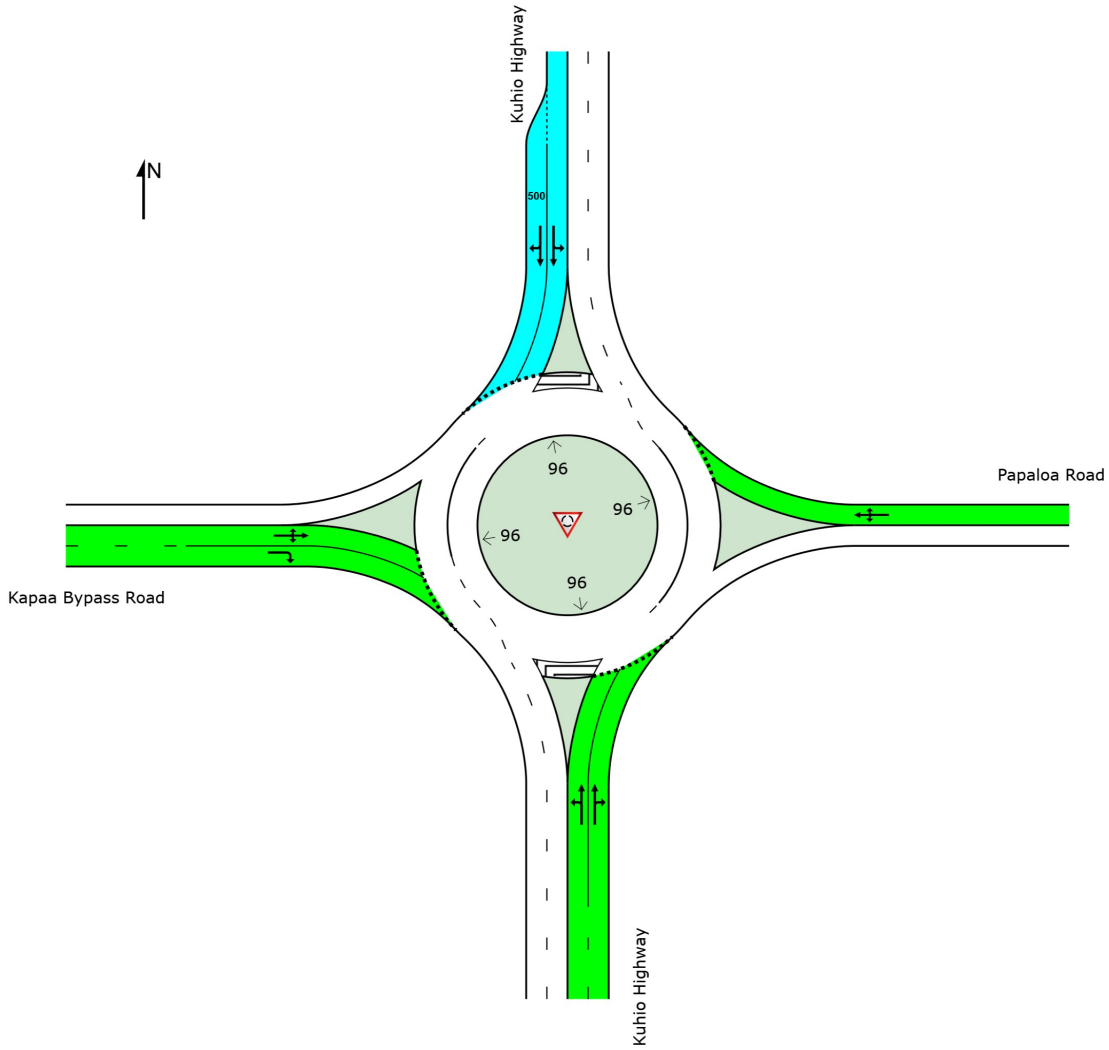
Lane Level of Service

Site: 101 [Turbo without Bypass (Site Folder: FY 2043 PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

	Approaches				Intersection
	South	East	North	West	
LOS	A	A	B	A	A



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Roundabout Level of Service Method: Same as Sign Control
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

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LANE SUMMARY

Site: 101 [Turbo without Bypass (Site Folder: FY 2043 PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: Kuhio Highway															
Lane 1	819	2.0	819	2.0	1255	0.653	100	8.8	LOS A	8.1	206.1	Full	1600	0.0	0.0
Lane 2[d]	903	2.0	903	2.0	1383	0.653	100	4.0	LOS A	8.2	208.9	Full	1600	0.0	0.0
Approach	1723	2.0	1723	2.0		0.653		6.3	LOS A	8.2	208.9				
East: Papaloa Road															
Lane 1[d]	109	2.0	109	2.0	412	0.264	100	9.9	LOS A	1.5	38.6	Full	1600	0.0	0.0
Approach	109	2.0	109	2.0		0.264		9.9	LOS A	1.5	38.6				
North: Kuhio Highway															
Lane 1	370	2.0	370	2.0	621	0.596	100	14.9	LOS B	6.0	151.4	Full	1600	0.0	0.0
Lane 2[d]	462	2.0	462	2.0	775	0.596	100	11.9	LOS B	6.5	164.1	Short	500	0.0	NA
Approach	833	2.0	833	2.0		0.596		13.2	LOS B	6.5	164.1				
West: Kapaa Bypass Road															
Lane 1	274	2.0	274	2.0	532	0.516	100	9.7	LOS A	3.2	80.3	Full	1600	0.0	0.0
Lane 2[d]	378	2.0	378	2.0	731	0.516	100	7.1	LOS A	4.6	117.1	Full	1600	0.0	0.0
Approach	652	2.0	652	2.0		0.516		8.2	LOS A	4.6	117.1				
All Vehicles	3316	2.0	3316	2.0		0.653		8.5	LOS A	8.2	208.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA HCM.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Kuhio Highway

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	670	150	-	819	2.0	1255	0.653	100	NA	NA
Lane 2	-	880	24	903	2.0	1383	0.653	100	NA	NA

Approach	670	1029	24	1723	2.0		0.653			
East: Papaloa Road										
Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	39	8	62	109	2.0	412	0.264	100	NA	NA
Approach	39	8	62	109	2.0		0.264			
North: Kuhio Highway										
Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	72	299	-	370	2.0	621	0.596	100	NA	NA
Lane 2	-	419	43	462	2.0	775	0.596	100	0.0	1
Approach	72	717	43	833	2.0		0.596			
West: Kapaa Bypass Road										
Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	22	5	247	274	2.0	532	0.516	100	NA	NA
Lane 2	-	-	378	378	2.0	731	0.516	100	NA	NA
Approach	22	5	625	652	2.0		0.516			

	Total	%HV	Deg.Satn (v/c)
All Vehicles	3316	2.0	0.653

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap pcu/h	Follow up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
There are no Exit Short Lanes for Merge Analysis at this Site.											

Variable Demand Analysis

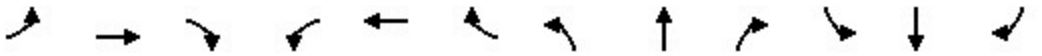
	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Kuhio Highway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: Papaloa Road				
Lane 1	0.0	0.0	0.0	0.0
North: Kuhio Highway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
West: Kapaa Bypass Road				
Lane 1	0.0	0.0	0.0	0.0

Lane 2	0.0	0.0	0.0	0.0

APPENDIX C

LEVEL OF SERVICE ANALYSIS

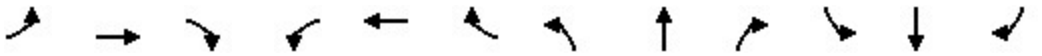
- Alternative 3A: Traffic Signal (Protected Only Left-Turns)



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	4	777	33	5	41	165	873	8	33	735	7
Future Volume (veh/h)	8	4	777	33	5	41	165	873	8	33	735	7
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	9	4	488	36	5	13	179	949	8	36	799	3
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	428	175	530	315	52	88	230	1479	12	65	1125	502
Arrive On Green	0.33	0.33	0.33	0.33	0.33	0.33	0.13	0.41	0.41	0.04	0.32	0.32
Sat Flow, veh/h	1014	524	1585	679	154	264	1781	3611	30	1781	3554	1585
Grp Volume(v), veh/h	13	0	488	54	0	0	179	467	490	36	799	3
Grp Sat Flow(s),veh/h/ln	1538	0	1585	1098	0	0	1781	1777	1865	1781	1777	1585
Q Serve(g_s), s	0.0	0.0	20.2	0.7	0.0	0.0	6.6	14.3	14.3	1.4	13.5	0.1
Cycle Q Clear(g_c), s	0.3	0.0	20.2	1.7	0.0	0.0	6.6	14.3	14.3	1.4	13.5	0.1
Prop In Lane	0.69		1.00	0.67		0.24	1.00		0.02	1.00		1.00
Lane Grp Cap(c), veh/h	603	0	530	455	0	0	230	727	764	65	1125	502
V/C Ratio(X)	0.02	0.00	0.92	0.12	0.00	0.00	0.78	0.64	0.64	0.56	0.71	0.01
Avail Cap(c_a), veh/h	653	0	581	490	0	0	915	1825	1915	261	2346	1046
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	15.2	0.0	21.8	15.6	0.0	0.0	28.7	16.1	16.1	32.3	20.5	16.0
Incr Delay (d2), s/veh	0.0	0.0	19.2	0.1	0.0	0.0	5.6	1.0	0.9	7.3	0.8	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	9.8	0.6	0.0	0.0	3.0	5.3	5.6	0.7	5.2	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	15.2	0.0	41.1	15.7	0.0	0.0	34.3	17.1	17.0	39.6	21.4	16.0
LnGrp LOS	B		D	B			C	B	B	D	C	B
Approach Vol, veh/h		501			54			1136			838	
Approach Delay, s/veh		40.4			15.7			19.8			22.1	
Approach LOS		D			B			B			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.5	32.9		27.8	13.8	26.6		27.8				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	10.0	70.0		25.0	35.0	45.0		25.0				
Max Q Clear Time (g_c+I1), s	3.4	16.3		22.2	8.6	15.5		3.7				
Green Ext Time (p_c), s	0.0	7.3		0.6	0.5	6.1		0.3				

Intersection Summary			
HCM 7th Control Delay, s/veh		24.6	
HCM 7th LOS		C	



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	5	575	36	7	57	616	947	22	66	660	40
Future Volume (veh/h)	20	5	575	36	7	57	616	947	22	66	660	40
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	22	5	193	39	8	17	670	1029	23	72	717	9
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	258	51	236	179	43	55	708	2193	49	93	967	431
Arrive On Green	0.15	0.15	0.15	0.15	0.15	0.15	0.40	0.62	0.62	0.05	0.27	0.27
Sat Flow, veh/h	1202	342	1585	729	286	367	1781	3553	79	1781	3554	1585
Grp Volume(v), veh/h	27	0	193	64	0	0	670	515	537	72	717	9
Grp Sat Flow(s),veh/h/ln	1544	0	1585	1382	0	0	1781	1777	1856	1781	1777	1585
Q Serve(g_s), s	0.0	0.0	9.7	1.8	0.0	0.0	30.0	12.9	12.9	3.3	15.2	0.3
Cycle Q Clear(g_c), s	1.1	0.0	9.7	3.1	0.0	0.0	30.0	12.9	12.9	3.3	15.2	0.3
Prop In Lane	0.81		1.00	0.61		0.27	1.00		0.04	1.00		1.00
Lane Grp Cap(c), veh/h	309	0	236	276	0	0	708	1097	1146	93	967	431
V/C Ratio(X)	0.09	0.00	0.82	0.23	0.00	0.00	0.95	0.47	0.47	0.77	0.74	0.02
Avail Cap(c_a), veh/h	534	0	480	482	0	0	756	1508	1575	216	1939	865
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.3	0.0	34.0	31.1	0.0	0.0	24.0	8.5	8.5	38.6	27.4	22.0
Incr Delay (d2), s/veh	0.1	0.0	6.9	0.4	0.0	0.0	20.1	0.3	0.3	12.6	1.1	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	4.2	1.2	0.0	0.0	15.4	4.2	4.4	1.7	6.2	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	30.5	0.0	40.9	31.5	0.0	0.0	44.1	8.8	8.8	51.2	28.5	22.0
LnGrp LOS	C		D	C			D	A	A	D	C	C
Approach Vol, veh/h		220			64			1722			798	
Approach Delay, s/veh		39.6			31.5			22.5			30.5	
Approach LOS		D			C			C			C	

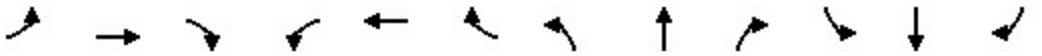
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	9.3	55.9		17.3	37.8	27.4		17.3				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	10.0	70.0		25.0	35.0	45.0		25.0				
Max Q Clear Time (g_c+I1), s	5.3	14.9		11.7	32.0	17.2		5.1				
Green Ext Time (p_c), s	0.0	8.5		0.6	0.8	5.3		0.3				

Intersection Summary	
HCM 7th Control Delay, s/veh	26.4
HCM 7th LOS	C

APPENDIX C

LEVEL OF SERVICE ANALYSIS

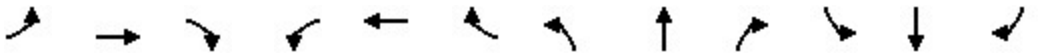
- Alternative 3B: Traffic Signal (Protected-Permissive Left-Turns)



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	4	777	33	5	41	165	873	8	33	735	7
Future Volume (veh/h)	8	4	777	33	5	41	165	873	8	33	735	7
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	9	4	498	36	5	15	179	949	8	36	799	3
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	443	180	545	317	54	102	373	1387	12	275	1149	512
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.10	0.38	0.38	0.04	0.32	0.32
Sat Flow, veh/h	1010	524	1585	654	157	296	1781	3611	30	1781	3554	1585
Grp Volume(v), veh/h	13	0	498	56	0	0	179	467	490	36	799	3
Grp Sat Flow(s),veh/h/ln	1534	0	1585	1107	0	0	1781	1777	1865	1781	1777	1585
Q Serve(g_s), s	0.0	0.0	19.2	0.4	0.0	0.0	4.0	14.0	14.0	0.8	12.5	0.1
Cycle Q Clear(g_c), s	0.3	0.0	19.2	1.5	0.0	0.0	4.0	14.0	14.0	0.8	12.5	0.1
Prop In Lane	0.69		1.00	0.64		0.27	1.00		0.02	1.00		1.00
Lane Grp Cap(c), veh/h	623	0	545	473	0	0	373	682	716	275	1149	512
V/C Ratio(X)	0.02	0.00	0.91	0.12	0.00	0.00	0.48	0.68	0.68	0.13	0.70	0.01
Avail Cap(c_a), veh/h	695	0	621	524	0	0	1175	1948	2044	488	2504	1117
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	13.8	0.0	20.0	14.2	0.0	0.0	13.2	16.4	16.4	14.2	18.9	14.7
Incr Delay (d2), s/veh	0.0	0.0	16.8	0.1	0.0	0.0	1.0	1.2	1.2	0.2	0.8	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	9.0	0.5	0.0	0.0	1.5	5.2	5.4	0.3	4.7	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	13.8	0.0	36.8	14.3	0.0	0.0	14.2	17.7	17.6	14.4	19.6	14.7
LnGrp LOS	B		D	B			B	B	B	B	B	B
Approach Vol, veh/h		511			56			1136			838	
Approach Delay, s/veh		36.2			14.3			17.1			19.4	
Approach LOS		D			B			B			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.4	29.5		27.0	11.2	25.6		27.0				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	10.0	70.0		25.0	35.0	45.0		25.0				
Max Q Clear Time (g_c+I1), s	2.8	16.0		21.2	6.0	14.5		3.5				
Green Ext Time (p_c), s	0.0	7.3		0.8	0.5	6.1		0.3				

Intersection Summary		
HCM 7th Control Delay, s/veh		21.6
HCM 7th LOS		C



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	5	575	36	7	57	616	947	22	66	660	40
Future Volume (veh/h)	20	5	575	36	7	57	616	947	22	66	660	40
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	22	5	193	39	8	17	670	1029	23	72	717	10
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	286	55	246	201	49	57	744	1968	44	381	1111	495
Arrive On Green	0.16	0.16	0.16	0.16	0.16	0.16	0.30	0.55	0.55	0.06	0.31	0.31
Sat Flow, veh/h	1183	354	1585	710	313	370	1781	3553	79	1781	3554	1585
Grp Volume(v), veh/h	27	0	193	64	0	0	670	515	537	72	717	10
Grp Sat Flow(s),veh/h/ln	1537	0	1585	1393	0	0	1781	1777	1856	1781	1777	1585
Q Serve(g_s), s	0.0	0.0	7.5	1.0	0.0	0.0	14.8	11.6	11.6	1.7	11.1	0.3
Cycle Q Clear(g_c), s	0.8	0.0	7.5	2.3	0.0	0.0	14.8	11.6	11.6	1.7	11.1	0.3
Prop In Lane	0.81		1.00	0.61		0.27	1.00		0.04	1.00		1.00
Lane Grp Cap(c), veh/h	341	0	246	307	0	0	744	984	1028	381	1111	495
V/C Ratio(X)	0.08	0.00	0.78	0.21	0.00	0.00	0.90	0.52	0.52	0.19	0.65	0.02
Avail Cap(c_a), veh/h	684	0	619	621	0	0	1188	1944	2031	559	2499	1115
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	23.2	0.0	26.0	23.7	0.0	0.0	10.6	9.0	9.0	13.3	18.9	15.2
Incr Delay (d2), s/veh	0.1	0.0	5.4	0.3	0.0	0.0	6.1	0.4	0.4	0.2	0.6	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	3.1	0.8	0.0	0.0	5.3	3.6	3.8	0.6	4.2	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	23.3	0.0	31.4	24.0	0.0	0.0	16.8	9.4	9.4	13.5	19.6	15.2
LnGrp LOS	C		C	C			B	A	A	B	B	B
Approach Vol, veh/h		220			64			1722			799	
Approach Delay, s/veh		30.4			24.0			12.3			19.0	
Approach LOS		C			C			B			B	

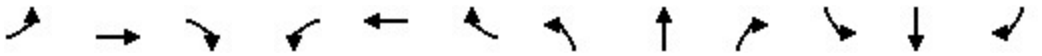
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.6	40.4		14.9	24.0	25.0		14.9				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	10.0	70.0		25.0	35.0	45.0		25.0				
Max Q Clear Time (g_c+I1), s	3.7	13.6		9.5	16.8	13.1		4.3				
Green Ext Time (p_c), s	0.1	8.5		0.7	2.2	5.4		0.3				

Intersection Summary												
HCM 7th Control Delay, s/veh			15.9									
HCM 7th LOS			B									

APPENDIX C

LEVEL OF SERVICE ANALYSIS

- Alternative 4: Traffic Signal with Dual Northbound Left-Turn Lanes



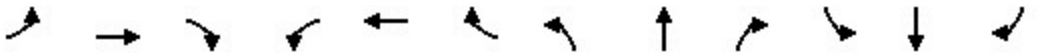
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	4	777	33	5	41	165	873	8	33	735	7
Future Volume (veh/h)	8	4	777	33	5	41	165	873	8	33	735	7
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	9	4	0	36	5	11	179	949	9	36	799	4
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	192	28		186	8	17	334	2113	20	71	990	839
Arrive On Green	0.05	0.05	0.00	0.05	0.05	0.05	0.10	0.59	0.59	0.04	0.53	0.53
Sat Flow, veh/h	1161	538	1585	1055	147	322	3456	3607	34	1781	1870	1585
Grp Volume(v), veh/h	13	0	0	52	0	0	179	468	490	36	799	4
Grp Sat Flow(s),veh/h/ln	1699	0	1585	1524	0	0	1728	1777	1864	1781	1870	1585
Q Serve(g_s), s	0.0	0.0	0.0	1.2	0.0	0.0	2.3	6.9	6.9	0.9	16.4	0.1
Cycle Q Clear(g_c), s	0.3	0.0	0.0	1.5	0.0	0.0	2.3	6.9	6.9	0.9	16.4	0.1
Prop In Lane	0.69		1.00	0.69		0.21	1.00		0.02	1.00		1.00
Lane Grp Cap(c), veh/h	220	0		211	0	0	334	1041	1092	71	990	839
V/C Ratio(X)	0.06	0.00		0.25	0.00	0.00	0.54	0.45	0.45	0.51	0.81	0.00
Avail Cap(c_a), veh/h	953	0		927	0	0	2594	2668	2799	382	1805	1530
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.1	0.0	0.0	21.6	0.0	0.0	20.1	5.4	5.4	21.9	9.0	5.2
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.6	0.0	0.0	1.3	0.3	0.3	5.5	1.6	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.0	0.6	0.0	0.0	0.9	1.5	1.6	0.4	4.6	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	21.2	0.0	0.0	22.2	0.0	0.0	21.4	5.7	5.7	27.4	10.6	5.2
LnGrp LOS	C			C			C	A	A	C	B	A
Approach Vol, veh/h		13			52			1137			839	
Approach Delay, s/veh		21.2			22.2			8.2			11.3	
Approach LOS		C			C			A			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	6.9	32.3		7.5	9.5	29.7		7.5				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	10.0	70.0		25.0	35.0	45.0		25.0				
Max Q Clear Time (g_c+I1), s	2.9	8.9		2.3	4.3	18.4		3.5				
Green Ext Time (p_c), s	0.0	7.3		0.0	0.6	6.3		0.2				

Intersection Summary		
HCM 7th Control Delay, s/veh	9.9	
HCM 7th LOS	A	

Notes

Unsignalized Delay for [EBR] is excluded from calculations of the approach delay and intersection delay.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	5	575	36	7	57	616	947	22	66	660	40
Future Volume (veh/h)	20	5	575	36	7	57	616	947	22	66	660	40
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width Adj.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	22	5	0	39	8	17	670	1029	23	72	717	17
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	176	21		145	11	23	870	2303	51	102	848	719
Arrive On Green	0.05	0.05	0.00	0.05	0.05	0.05	0.25	0.65	0.65	0.06	0.45	0.45
Sat Flow, veh/h	1321	386	1585	966	198	421	3456	3553	79	1781	1870	1585
Grp Volume(v), veh/h	27	0	0	64	0	0	670	515	537	72	717	17
Grp Sat Flow(s),veh/h/ln	1707	0	1585	1585	0	0	1728	1777	1856	1781	1870	1585
Q Serve(g_s), s	0.0	0.0	0.0	1.5	0.0	0.0	11.2	8.9	8.9	2.5	21.2	0.4
Cycle Q Clear(g_c), s	0.9	0.0	0.0	2.4	0.0	0.0	11.2	8.9	8.9	2.5	21.2	0.4
Prop In Lane	0.81		1.00	0.61		0.27	1.00		0.04	1.00		1.00
Lane Grp Cap(c), veh/h	197	0		178	0	0	870	1152	1203	102	848	719
V/C Ratio(X)	0.14	0.00		0.36	0.00	0.00	0.77	0.45	0.45	0.71	0.85	0.02
Avail Cap(c_a), veh/h	703	0		700	0	0	1942	1997	2086	286	1352	1145
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	28.3	0.0	0.0	29.0	0.0	0.0	21.6	5.4	5.4	28.8	15.1	9.4
Incr Delay (d2), s/veh	0.3	0.0	0.0	1.2	0.0	0.0	1.5	0.3	0.3	8.6	2.9	0.0
Initial Q Delay(d3), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	1.0	0.0	0.0	4.3	2.3	2.4	1.2	8.1	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d), s/veh	28.6	0.0	0.0	30.2	0.0	0.0	23.1	5.7	5.7	37.5	18.0	9.4
LnGrp LOS	C			C			C	A	A	D	B	A
Approach Vol, veh/h		27			64			1722			806	
Approach Delay, s/veh		28.6			30.2			12.5			19.6	
Approach LOS		C			C			B			B	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.6	45.4		8.3	20.7	33.2		8.3				
Change Period (Y+Rc), s	5.0	5.0		5.0	5.0	5.0		5.0				
Max Green Setting (Gmax), s	10.0	70.0		25.0	35.0	45.0		25.0				
Max Q Clear Time (g_c+I1), s	4.5	10.9		2.9	13.2	23.2		4.4				
Green Ext Time (p_c), s	0.1	8.5		0.1	2.5	5.1		0.3				

Intersection Summary	
HCM 7th Control Delay, s/veh	15.3
HCM 7th LOS	B

Notes

Unsignalized Delay for [EBR] is excluded from calculations of the approach delay and intersection delay.

APPENDIX D

2-1 ROUNDABOUT CONCEPT

KUHIO HIGHWAY & KAPAA BYPASS ROAD ALTERNATIVES ANALYSIS

AustinTsutsumi & ASSOCIATES, INC.
Engineers & Surveyors

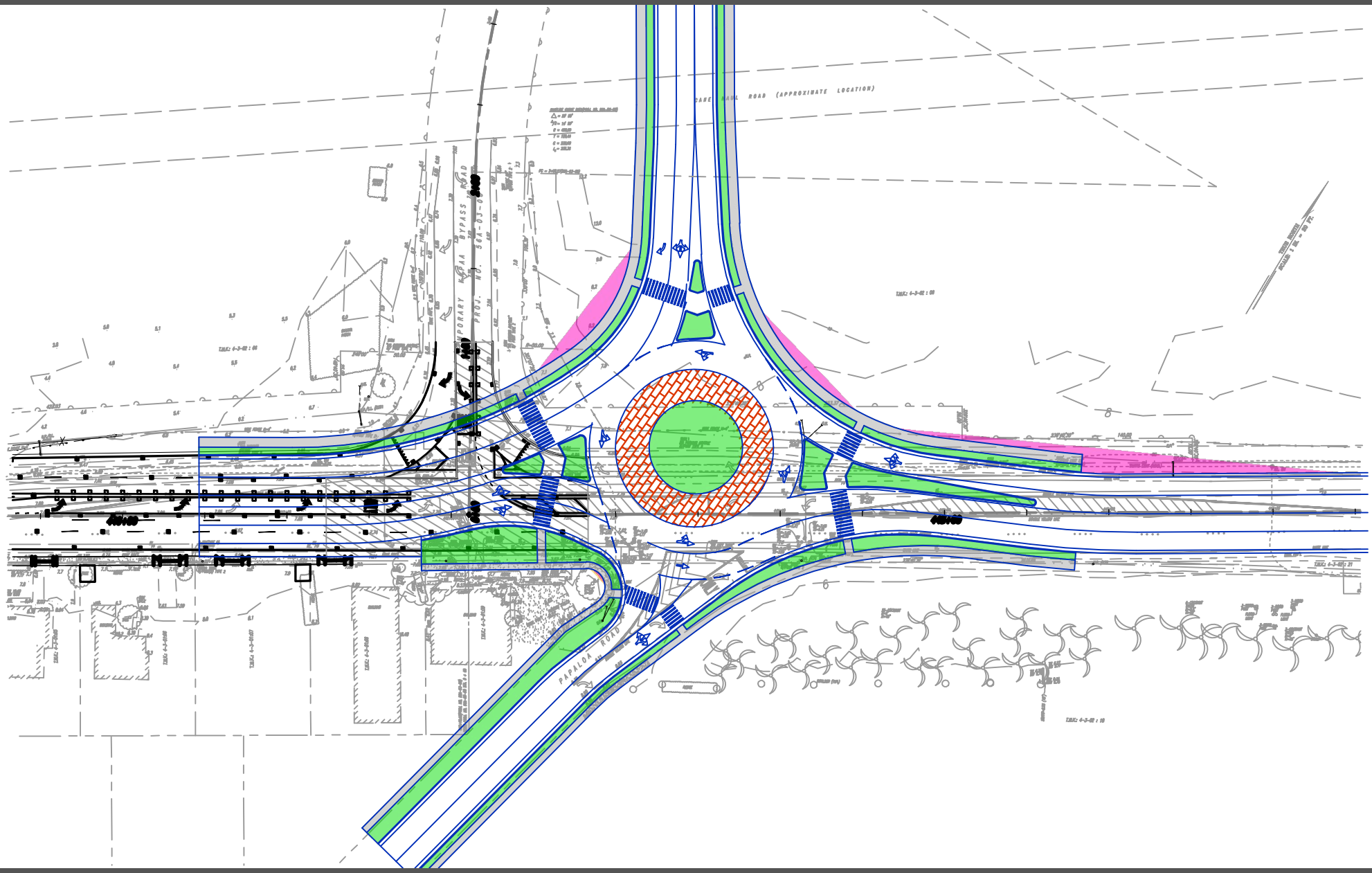


FIGURE D

2-1 ROUNDABOUT CONCEPT

LEVEL OF SERVICE

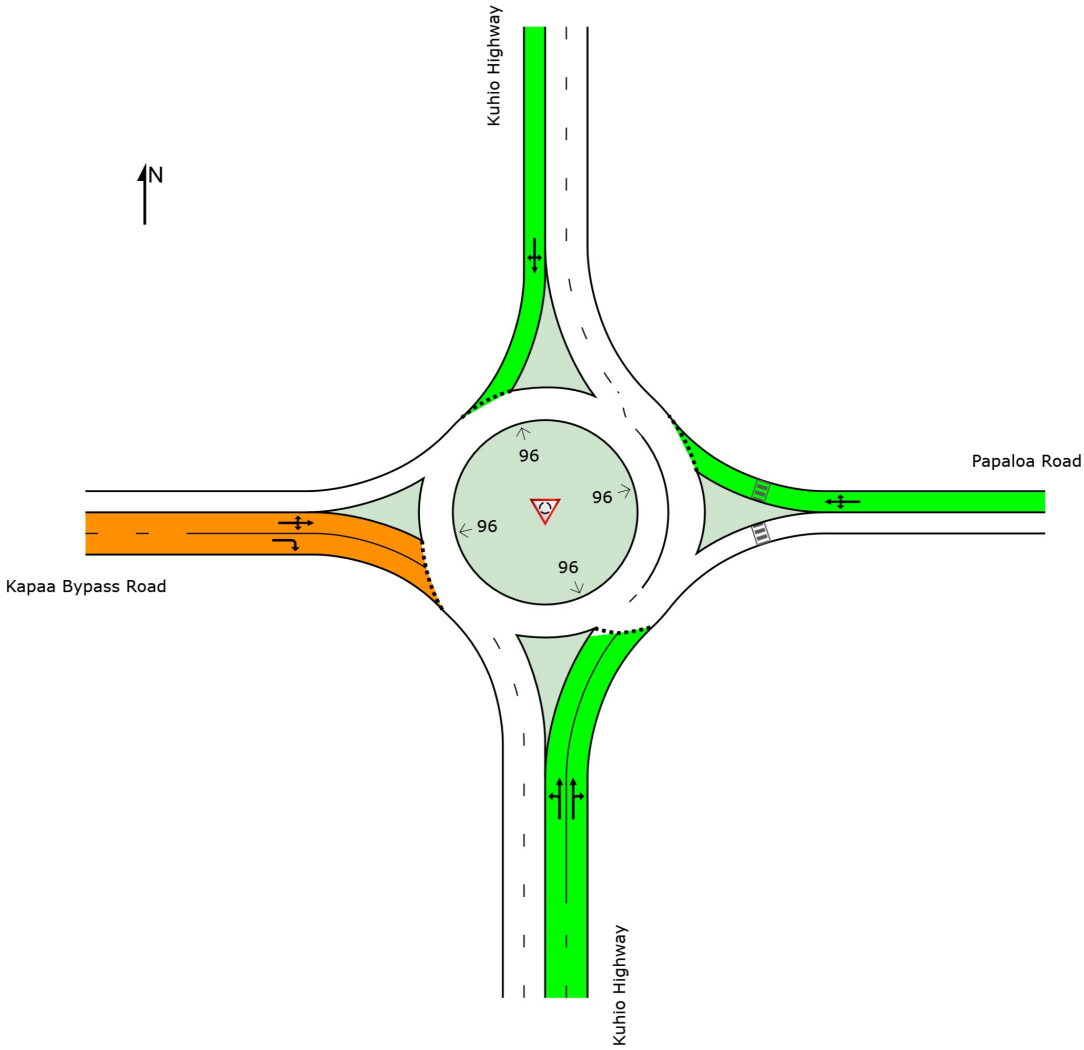
Lane Level of Service

Site: 101 [Double/Single Hybrid (Site Folder: FY 2043 AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

	Approaches				Intersection
	South	East	North	West	
LOS	A	A	A	E	C



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Roundabout Level of Service Method: Same as Sign Control
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

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LANE SUMMARY

Site: 101 [Double/Single Hybrid (Site Folder: FY 2043 AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: Kuhio Highway															
Lane 1	543	2.0	543	2.0	1336	0.407	100	5.3	LOS A	3.7	94.3	Full	1600	0.0	0.0
Lane 2[d]	593	2.0	593	2.0	1459	0.407	100	3.5	LOS A	3.8	95.4	Full	1600	0.0	0.0
Approach	1137	2.0	1137	2.0		0.407		4.4	LOS A	3.8	95.4				
East: Papaloa Road															
Lane 1[d]	86	2.0	86	2.0	561	0.153	100	7.9	LOS A	0.6	16.2	Full	1600	0.0	0.0
Approach	86	2.0	86	2.0		0.153		7.9	LOS A	0.6	16.2				
North: Kuhio Highway															
Lane 1[d]	842	2.0	842	2.0	1044	0.807	100	9.6	LOS A	13.6	346.6	Full	1600	0.0	0.0
Approach	842	2.0	842	2.0		0.807		9.6	LOS A	13.6	346.6				
West: Kapaa Bypass Road															
Lane 1	387	2.0	387	2.0	414	0.935	100	47.8	LOS E	16.5	418.5	Full	1600	0.0	0.0
Lane 2[d]	471	2.0	471	2.0	503	0.935	100	43.9	LOS E	18.7	475.8	Full	1600	0.0	0.0
Approach	858	2.0	858	2.0		0.935		45.6	LOS E	18.7	475.8				
All Vehicles	2923	2.0	2923	2.0		0.935		18.1	LOS C	18.7	475.8				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA HCM.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Kuhio Highway

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	179	364	-	543	2.0	1336	0.407	100	NA	NA
Lane 2	-	585	9	593	2.0	1459	0.407	100	NA	NA
Approach	179	949	9	1137	2.0		0.407			

East: Papaloa Road										
Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	36	5	45	86	2.0	561	0.153	100	NA	NA
Approach	36	5	45	86	2.0		0.153			
North: Kuhio Highway										
Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	36	799	8	842	2.0	1044	0.807	100	NA	NA
Approach	36	799	8	842	2.0		0.807			
West: Kapaa Bypass Road										
Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	9	4	374	387	2.0	414	0.935	100	NA	NA
Lane 2	-	-	471	471	2.0	503	0.935	100	NA	NA
Approach	9	4	845	858	2.0		0.935			

	Total	%HV	Deg.Satn (v/c)
All Vehicles	2923	2.0	0.935

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap pcu/h	Follow up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
There are no Exit Short Lanes for Merge Analysis at this Site.											

Variable Demand Analysis

	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Kuhio Highway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: Papaloa Road				
Lane 1	0.0	0.0	0.0	0.0
North: Kuhio Highway				
Lane 1	0.0	0.0	0.0	0.0
West: Kapaa Bypass Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

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LEVEL OF SERVICE

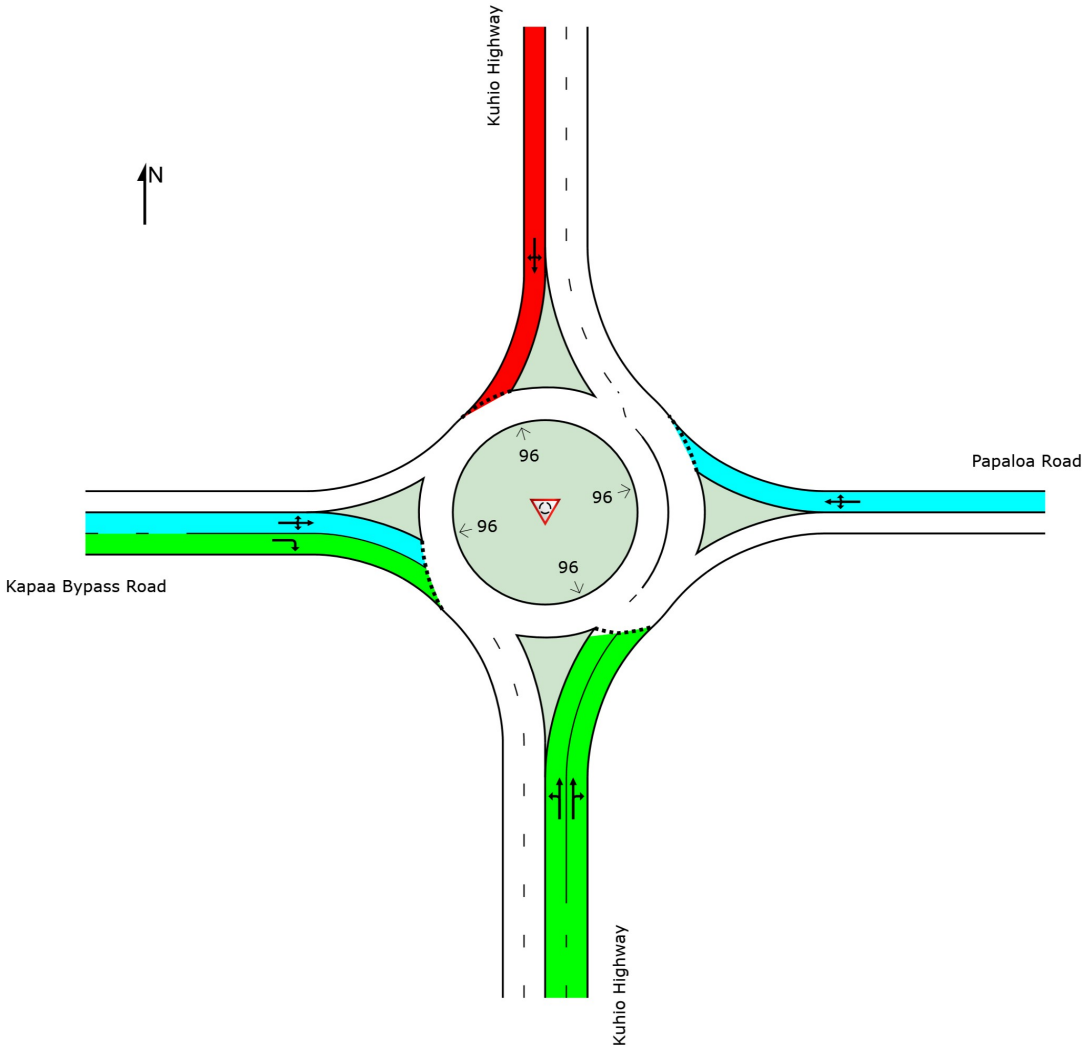
Lane Level of Service

Site: 101 [Double/Single Hybrid (Site Folder: FY 2043 PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

	Approaches				Intersection
	South	East	North	West	
LOS	A	B	F	A	F



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Roundabout Level of Service Method: Same as Sign Control
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

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LANE SUMMARY

Site: 101 [Double/Single Hybrid (Site Folder: FY 2043 PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: Kuhio Highway															
Lane 1	821	2.0	821	2.0	1284	0.639	100	8.5	LOS A	7.9	201.9	Full	1600	0.0	0.0
Lane 2[d]	902	2.0	902	2.0	1411	0.639	100	4.0	LOS A	8.0	203.9	Full	1600	0.0	0.0
Approach	1723	2.0	1723	2.0		0.639		6.1	LOS A	8.0	203.9				
East: Papaloa Road															
Lane 1[d]	109	2.0	109	2.0	372	0.292	100	11.1	LOS B	1.4	34.4	Full	1600	0.0	0.0
Approach	109	2.0	109	2.0		0.292		11.1	LOS B	1.4	34.4				
North: Kuhio Highway															
Lane 1[d]	833	2.0	833	2.0	611	1.364	100	184.4	LOS F	83.4	2118.3	Full	1600	0.0	14.0
Approach	833	2.0	833	2.0		1.364		184.4	LOS F	83.4	2118.3				
West: Kapaa Bypass Road															
Lane 1	301	2.0	301	2.0	611	0.493	100	10.4	LOS B	4.2	107.3	Full	1600	0.0	0.0
Lane 2[d]	351	2.0	351	2.0	712	0.493	100	8.9	LOS A	4.4	112.3	Full	1600	0.0	0.0
Approach	652	2.0	652	2.0		0.493		9.6	LOS A	4.4	112.3				
All Vehicles	3316	2.0	3316	2.0		1.364		51.7	LOS F	83.4	2118.3				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA HCM.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Kuhio Highway

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	670	151	-	821	2.0	1284	0.639	100	NA	NA
Lane 2	-	878	24	902	2.0	1411	0.639	100	NA	NA
Approach	670	1029	24	1723	2.0		0.639			

East: Papaloa Road										
Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	39	8	62	109	2.0	372	0.292	100	NA	NA
Approach	39	8	62	109	2.0		0.292			
North: Kuhio Highway										
Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	72	717	43	833	2.0	611	1.364	100	NA	NA
Approach	72	717	43	833	2.0		1.364			
West: Kapaa Bypass Road										
Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	22	5	274	301	2.0	611	0.493	100	NA	NA
Lane 2	-	-	351	351	2.0	712	0.493	100	NA	NA
Approach	22	5	625	652	2.0		0.493			
	Total	%HV	Deg.Satn (v/c)							
All Vehicles	3316	2.0	1.364							

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Critical Gap pcu/h	Follow up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
There are no Exit Short Lanes for Merge Analysis at this Site.											

Variable Demand Analysis

	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Kuhio Highway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: Papaloa Road				
Lane 1	0.0	0.0	0.0	0.0
North: Kuhio Highway				
Lane 1	0.0	55.5	327.3	NA
West: Kapaa Bypass Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

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APPENDIX E

MERGING ROUNDABOUT CONCEPT

KUHIO HIGHWAY & KAPAA BYPASS ROAD ALTERNATIVES ANALYSIS

AustinTsutsumi & ASSOCIATES, INC.
Engineers & Surveyors

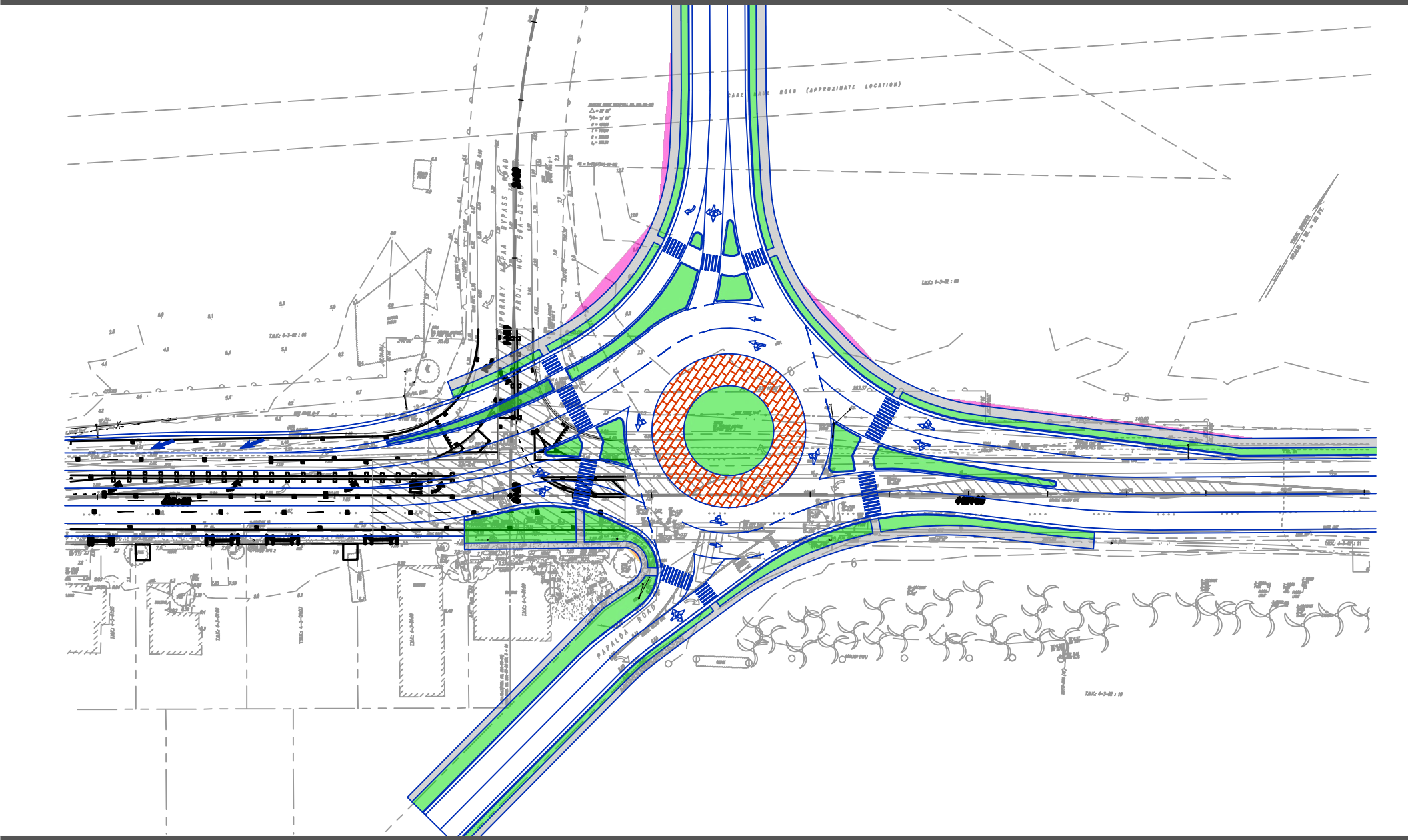


FIGURE E

MERGING ROUNDABOUT CONCEPT

LEVEL OF SERVICE

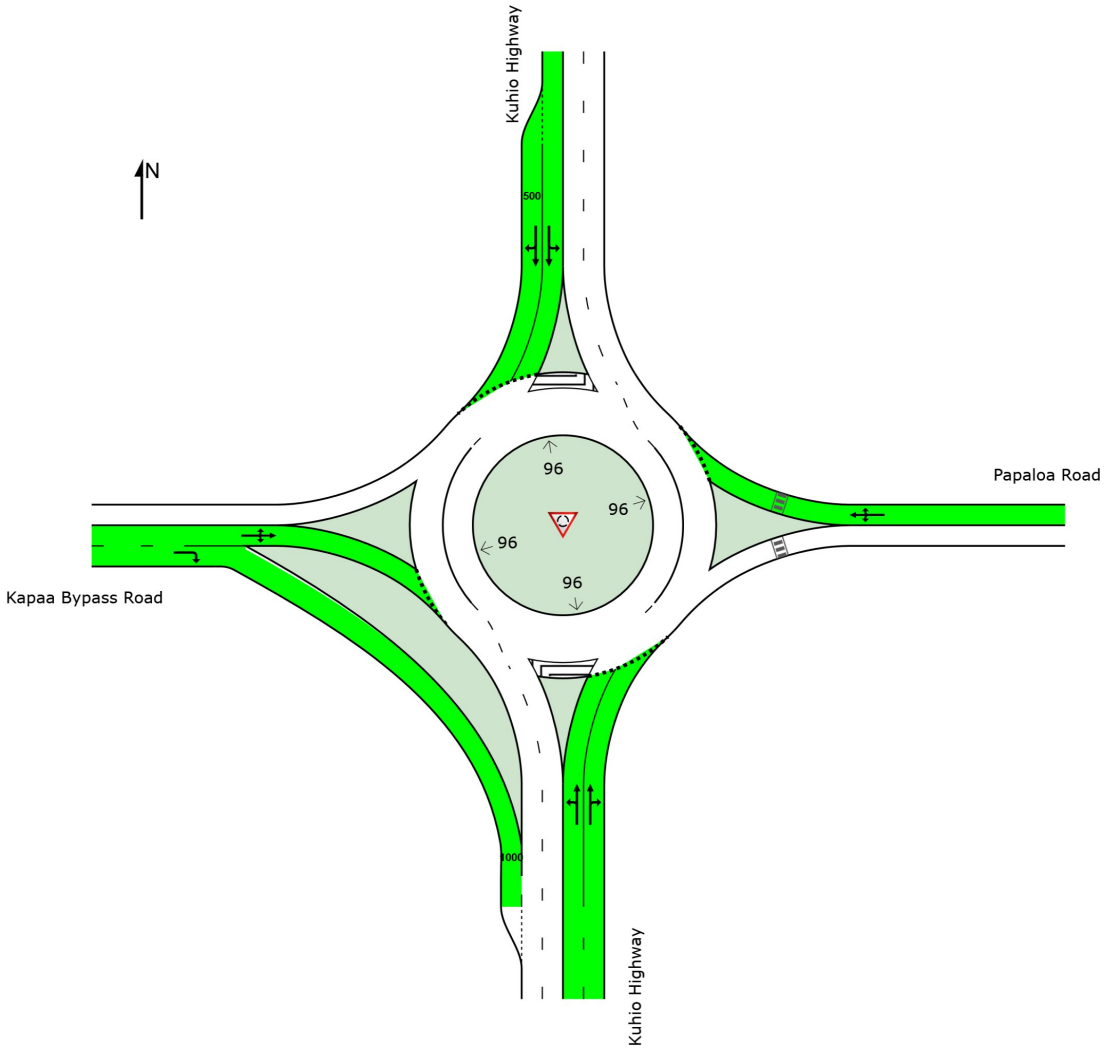
Lane Level of Service

Site: 101 [Double with Bypass (Site Folder: FY 2043 AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

	Approaches				Intersection
	South	East	North	West	
LOS	A	A	A	A	A



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Roundabout Level of Service Method: Same as Sign Control
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

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LANE SUMMARY

Site: 101 [Double with Bypass (Site Folder: FY 2043 AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: Kuhio Highway															
Lane 1	544	2.0	544	2.0	1343	0.405	100	5.2	LOS A	3.4	87.2	Full	1600	0.0	0.0
Lane 2[d]	593	2.0	593	2.0	1466	0.405	100	3.3	LOS A	3.5	87.7	Full	1600	0.0	0.0
Approach	1137	2.0	1137	2.0		0.405		4.2	LOS A	3.5	87.7				
East: Papaloa Road															
Lane 1[d]	86	2.0	86	2.0	593	0.145	100	7.5	LOS A	0.6	15.4	Full	1600	0.0	0.0
Approach	86	2.0	86	2.0		0.145		7.5	LOS A	0.6	15.4				
North: Kuhio Highway															
Lane 1	395	2.0	395	2.0	1123	0.352	100	5.1	LOS A	2.5	63.2	Full	1600	0.0	0.0
Lane 2[d]	447	2.0	447	2.0	1270	0.352	100	4.4	LOS A	2.5	64.4	Short	500	0.0	NA
Approach	842	2.0	842	2.0		0.352		4.7	LOS A	2.5	64.4				
West: Kapaa Bypass Road															
Lane 1[d]	253	2.0	253	2.0	660	0.383	100	7.5	LOS A	2.0	50.7	Full	1600	0.0	0.0
Lane 2	605	2.0	605	2.0	1579	0.383	100	6.4	LOS A	0.0	0.0	Full	1600	0.0	0.0
Approach	858	2.0	858	2.0		0.383		6.7	LOS A	2.0	50.7				
All Vehicles	2923	2.0	2923	2.0		0.405		5.2	LOS A	3.5	87.7				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA HCM.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Kuhio Highway

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	179	364	-	544	2.0	1343	0.405	100	NA	NA
Lane 2	-	585	9	593	2.0	1466	0.405	100	NA	NA

Approach	179	949	9	1137	2.0		0.405			
East: Papaloa Road										
Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	36	5	45	86	2.0	593	0.145	100	NA	NA
Approach	36	5	45	86	2.0		0.145			
North: Kuhio Highway										
Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	36	359	-	395	2.0	1123	0.352	100	NA	NA
Lane 2	-	440	8	447	2.0	1270	0.352	100	0.0	1
Approach	36	799	8	842	2.0		0.352			
West: Kapaa Bypass Road										
Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	9	4	240	253	2.0	660	0.383	100	NA	NA
Lane 2	-	-	605	605	2.0	1579	0.383	100	NA	NA
Approach	9	4	845	858	2.0		0.383			

	Total	%HV	Deg.Satn (v/c)
All Vehicles	2923	2.0	0.405

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Kuhio Highway Merge Type: **Priority**												
Exit Short Lane	3	1000	0.0	679	693	3.06	2.04	605	1048	0.577	1.4	3.6
Merge Lane	2	-	100.0	Merge Lane is not Opposed				679	1800	0.377	0.0	0.0

Variable Demand Analysis

	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Kuhio Highway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: Papaloa Road				
Lane 1	0.0	0.0	0.0	0.0
North: Kuhio Highway				
Lane 1	0.0	0.0	0.0	0.0

Lane 2	0.0	0.0	0.0	0.0
West: Kapaa Bypass Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

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LEVEL OF SERVICE

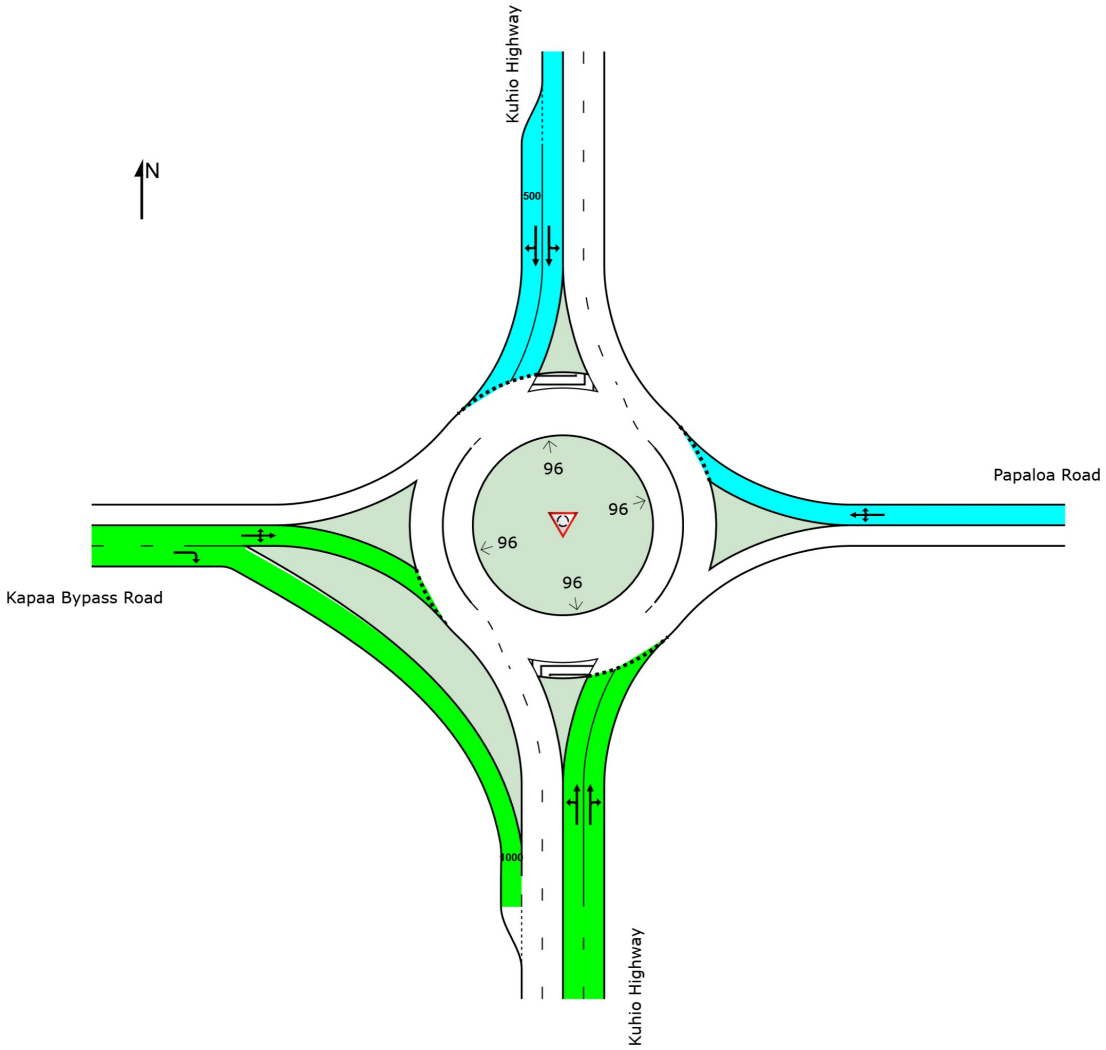
Lane Level of Service

Site: 101 [Double with Bypass (Site Folder: FY 2043 PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

	Approaches				Intersection
	South	East	North	West	
LOS	A	B	B	A	A



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Roundabout Level of Service Method: Same as Sign Control
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

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LANE SUMMARY

Site: 101 [Double with Bypass (Site Folder: FY 2043 PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

Lane Use and Performance

	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh	Dist] ft	Lane Config	Lane Length ft	Cap. Adj. %	Prob. Block. %
South: Kuhio Highway															
Lane 1	819	2.0	819	2.0	1255	0.653	100	8.8	LOS A	8.1	206.1	Full	1600	0.0	0.0
Lane 2[d]	903	2.0	903	2.0	1383	0.653	100	4.0	LOS A	8.2	208.9	Full	1600	0.0	0.0
Approach	1723	2.0	1723	2.0		0.653		6.3	LOS A	8.2	208.9				
East: Papaloa Road															
Lane 1[d]	109	2.0	109	2.0	378	0.287	100	10.4	LOS B	1.4	34.7	Full	1600	0.0	0.0
Approach	109	2.0	109	2.0		0.287		10.4	LOS B	1.4	34.7				
North: Kuhio Highway															
Lane 1	370	2.0	370	2.0	621	0.596	100	14.9	LOS B	6.0	151.4	Full	1600	0.0	0.0
Lane 2[d]	462	2.0	462	2.0	775	0.596	100	11.9	LOS B	6.5	164.1	Short	500	0.0	NA
Approach	833	2.0	833	2.0		0.596		13.2	LOS B	6.5	164.1				
West: Kapaa Bypass Road															
Lane 1[d]	181	2.0	181	2.0	607	0.298	100	7.2	LOS A	1.5	38.8	Full	1600	0.0	0.0
Lane 2	471	2.0	471	2.0	1579	0.298	100	4.9	LOS A	0.0	0.0	Full	1600	0.0	0.0
Approach	652	2.0	652	2.0		0.298		5.6	LOS A	1.5	38.8				
All Vehicles	3316	2.0	3316	2.0		0.653		8.0	LOS A	8.2	208.9				

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: Same as Sign Control.
Lane LOS values are based on average delay and v/c ratio (degree of saturation) per lane.
LOS F will result if v/c > 1 irrespective of lane delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all lanes (v/c not used as specified in HCM 6).
Roundabout Capacity Model: SIDRA HCM.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

d Dominant lane on roundabout approach

Approach Lane Flows (veh/h)

South: Kuhio Highway

Mov. From S To Exit:	L2 W	T1 N	R2 E	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	670	150	-	819	2.0	1255	0.653	100	NA	NA
Lane 2	-	880	24	903	2.0	1383	0.653	100	NA	NA

Approach	670	1029	24	1723	2.0		0.653			
East: Papaloa Road										
Mov. From E To Exit:	L2 S	T1 W	R2 N	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	39	8	62	109	2.0	378	0.287	100	NA	NA
Approach	39	8	62	109	2.0		0.287			
North: Kuhio Highway										
Mov. From N To Exit:	L2 E	T1 S	R2 W	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	72	299	-	370	2.0	621	0.596	100	NA	NA
Lane 2	-	419	43	462	2.0	775	0.596	100	0.0	1
Approach	72	717	43	833	2.0		0.596			
West: Kapaa Bypass Road										
Mov. From W To Exit:	L2 N	T1 E	R2 S	Total	%HV	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Prob. SL Ov. %	Ov. Lane No.
Lane 1	22	5	154	181	2.0	607	0.298	100	NA	NA
Lane 2	-	-	471	471	2.0	1579	0.298	100	NA	NA
Approach	22	5	625	652	2.0		0.298			
	Total	%HV	Deg.Satn (v/c)							
All Vehicles	3316	2.0	0.653							

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

Merge Analysis

	Exit Lane Number	Short Lane Length ft	Percent Opng in Lane %	Opposing Flow Rate veh/h	Opposing Flow Rate pcu/h	Critical Gap sec	Follow up Headway sec	Lane Flow Rate veh/h	Capacity veh/h	Deg. Satn v/c	Min. Delay sec	Merge Delay sec
South Exit: Kuhio Highway Merge Type: **Priority**												
Exit Short Lane	3	1000	0.0	573	584	3.06	2.04	471	1164	0.405	1.1	2.2
Merge Lane	2	-	100.0	Merge Lane is not Opposed				573	1800	0.318	0.0	0.0

Variable Demand Analysis

	Initial Queued Demand veh	Residual Queued Demand veh	Time for Residual Demand to Clear sec	Duration of Oversatn sec
South: Kuhio Highway				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0
East: Papaloa Road				
Lane 1	0.0	0.0	0.0	0.0
North: Kuhio Highway				
Lane 1	0.0	0.0	0.0	0.0

Lane 2	0.0	0.0	0.0	0.0
West: Kapaa Bypass Road				
Lane 1	0.0	0.0	0.0	0.0
Lane 2	0.0	0.0	0.0	0.0

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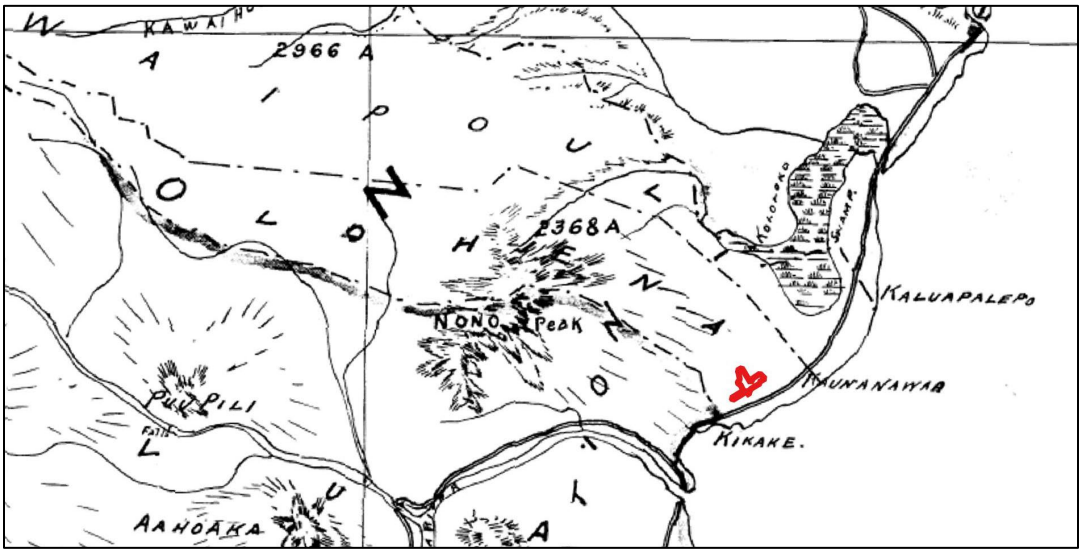
Appendix C Archaeological Literature Review and Field Inspection Report

DRAFT—Archaeological Literature Review and Field Inspection for the Kūhiō Highway, Intersection Improvements at Kapa‘a Bypass Road Project, South Olohena Ahupua‘a, Puna District, Island of Kaua‘i

TMKs: (4) 4-3-001:009, 999; 4-3-010:001, 005; 4-3-002:999 por.



Prepared For:

Hawai‘i Department of Transportation
Kaua‘i District
1720 Haleukana St.
Lihue, HI 96766

March 2026

Keala Pono Archaeological Consulting, LLC ● 98-030 Hekaha St., Suite 31, Aiea, HI 96701 ● Phone 808.381.2361

DRAFT— Archaeological Literature Review and Field Inspection for the Kūhiō Highway, Intersection Improvements at Kapa‘a Bypass Road Project, South Olohena Ahupua‘a, Puna District, Island of Kaua‘i

TMKs: (4) 4-3-001:009, 999; 4-3-010:001, 005; 4-3-002:999 por.

Prepared For:

Hawai‘i Department of Transportation
Kaua‘i District
1720 Haleukana St.
Lihue, HI 96766

Prepared By:

Kālenalani McElroy, MA
Tiffany Brown, BA
and
Windy Keala McElroy, PhD

March 2026

Keala Pono Archaeological Consulting, LLC ● 98-030 Hekaha St., Suite 31, Aiea, HI 96701 ● Phone 808.381.2361

MANAGEMENT SUMMARY

Keala Pono Archaeological Consulting has prepared an archaeological literature review and field inspection (LRFI) for the proposed Kūhiō Highway, Intersection Improvements at Kapa‘a Bypass Road Project in South Olohena Ahupua‘a in Puna District, on the island of Kaua‘i, Hawai‘i. This is located on portions of TMKs: (4) 4-3-001:009, 999; 4-3-010:001, 005; and 4-3-002:999 within and adjacent to the Kūhiō Highway Right-of-Way. The purpose of this LRFI is to identify any archaeological, historical, or cultural properties within the project area in anticipation of the proposed work.

The literature review consists of archival research, which has identified the region as rich in natural resources such as fresh water, coastal flora and fauna, and bountiful fishing grounds in traditional times, thus known for being a dense population center. Pre-contact use of Olohena would have centered around cultivation at the nearby Wailua River valley and floodplain. This was supplemented by marine and inland terrestrial resources. People traveled between the neighboring ahupua‘a using the inland or coastal trail that passed through the district. Several prominent heiau are noted for the greater region, with Olohena known for a navigational heiau that was utilized in traditional times. Olohena was also known for Halepaiwi, where games of riddles were played and for the Sleeping Giant of Nounou Mountain. No LCA awards were found within the entire South Olohena Ahupua‘a, which was granted to Rufus P. Spalding during the Māhele, under Grant 5264 for use under the Lihue Planation Co. In the historic period, sugarcane and rice cultivation dominated the region, with the Ahukini Terminal and Railway Company (AT&R) providing transportation for these endeavors. Previous archaeological studies have recorded several burials and cultural layers, Kukui Heiau, a hearth, grinding stones, Debora Kupule’s historic fishponds, the AT&R railroad bed, post-contact ‘auwai, imu, and historic structures of the Coco Palms Resort located within 0.5 km of the project area. No historic properties are known to be located within the current project area, although one of the human burials was documented at the project area boundary.

A field inspection of the project area was performed, which identified a total of 13 surface archaeological features. The features are all historic or possibly historic in age. Because of the occurrence of archaeological resources within the project area and known iwi kūpuna at the project boundary, archaeological monitoring is recommended for all ground disturbance.

CONTENTS

MANAGEMENT SUMMARY i
FIGURES iii
TABLES iii

INTRODUCTION 1
Project Location and Environment 1
The Project 5
BACKGROUND 7
South Olohena Ahupua‘a in the Pre-Contact Era 7
Place Names 7
Subsistence and Traditional Land Use 8
Mo‘olelo 9
‘Ōlelo No‘eau 12
Historic South Olohena 12
Early Historic Accounts 13
South Olohena Changes in Land Tenure 14
The Late 19th Century and Beyond 14
Previous Archaeology 21
Summary of Background Research 30
FIELD INSPECTION 31
ASSESSMENT AND RECOMMENDATIONS 47
Results of Historical Research on Land Use 47
Results of Land Commission Awards Search 47
Evidence from Historic Maps 47
Knowledge from Previous Archaeological Studies 48
Results of the Field Inspection 48
Site Significance Assessment 48
Summary and Recommendations 49
GLOSSARY 50
REFERENCES 53

FIGURES

Figure 1. Location of the project area on a USGS topographic map (USGS 2022). 2
Figure 2. Project area on a TMK plat 4-3-02 (State of Hawai‘i 1984) 3
Figure 3. Western portion of the project area on a TMK plat 4-3-01 (State of Hawai‘i 1982). 4
Figure 4. Soils in the vicinity of the project area (data from Foote et al. 1972). 6
Figure 5. Portion of a map of the island of Kaua‘i (Kitteridge 1878). 16
Figure 6. Portion of a Kaua‘i map showing trails and nearby ahupua‘a (Alexander 1900). 17
Figure 7. Photograph of the Wailua Concrete Arch Bridge (Hawai‘i State Archives n.d.). 18
Figure 8. USGS map showing roads, landmarks, and railroad lines (USGS 1954). 19
Figure 9. Photograph of the Coco Palms sign and property in 1958 (in Hammatt 2017:37). 20
Figure 10. Ruins of the historic Coco Palms resort, facing north (Keala Pono 3/8/21) 20
Figure 11. USGS map showing roads, landmarks, and important cultural sites (USGS 1963). 22
Figure 12. Previous archaeological studies within approximately 0.5 km of the project area. 23
Figure 13. Previously recorded archaeological sites near the project area with known locations .. 24
Figure 14. Location of possible archaeological features identified during the field inspection. 32
Figure 15. Healing Horses Kaua‘i, facing north. 34
Figure 16. Tall grass field, facing east. 34
Figure 17. Southwest horse pasture, facing east. 35
Figure 18. Northeast horse pasture, facing south. 35
Figure 19. Dirt horse corral, facing north. 36
Figure 20. Corral riding trail, facing east-northeast. 36
Figure 21. Pasture riding trail, facing southwest. 37
Figure 22. Kapa‘a Bypass Road and dirt shoulder, facing north. 37
Figure 23. Kūhiō Highway, facing west-southwest. 38
Figure 24. Kūhiō Highway, facing northeast. 38
Figure 25. Papaloa Road, facing south-southwest. 39
Figure 26. Feature 1, a possibly historic concrete foundation, facing east. 39
Figure 27. Feature 2, a possibly historic boulder alignment, facing east. 40
Figure 28. Feature 3, a possibly historic v-lock concrete block, facing east-southeast. 40
Figure 29. Feature 4, a historic iron railroad plate, facing east-southeast. 41
Figure 30. Vegetation separating the corral area from Kapa‘a Bypass Road, facing northwest. 41
Figure 31. Feature 5, a possibly historic stone and mortar wall, facing east-southeast. 42
Figure 32. Feature 6, two possibly historic wooden posts, facing northwest. 42
Figure 33. Feature 7, a possibly historic wooden post, facing north-northwest. 43
Figure 34. Feature 8, a possibly historic concrete post, facing east-northeast. 43
Figure 35. Feature 9, a possibly historic concrete footing with posts, facing south-southwest. 44
Figure 36. Feature 10, a historic railroad track embedded in a concrete block, facing east. 44
Figure 37. Feature 11, a possibly historic fence with a historic railroad track, facing south. 45
Figure 38. Feature 12, a possibly historic boulder and mortar culvert, facing east. 45
Figure 39. Feature 12, a possibly historic basalt boulder and mortar culvert, facing north. 46
Figure 40. Feature 13, a possibly historic concrete sidewalk along Papaloa Road, facing south.... 46

TABLES

Table 1. Previous Archaeological Studies in the Vicinity of the Project Area 25
Table 2. Known Archaeological Sites Within 0.5 km of the Project Area 27
Table 3. Possible Archaeological Features Identified During the Field Inspection 33

INTRODUCTION

At the request of WSP USA on behalf of the Hawai‘i Department of Transportation (HDOT) Kaua‘i District, Keala Pono Archaeological Consulting conducted an archaeological literature review and field inspection (LRFI) for the proposed Kūhiō Highway, Intersection Improvements at Kapa‘a Bypass Road Project in South Olohena Ahupua‘a in Puna District, on the island of Kaua‘i, Hawai‘i. This is located on portions of Tax Map Keys (TMKs): (4) 4-3-001:009, 999; 4-3-010:001, 005; and 4-3-002:999 within and adjacent to the Kūhiō Highway Right-of-Way (ROW). The purpose of this LRFI is to identify any archaeological, historical, or cultural properties within the project area in anticipation of the proposed work.

The report begins with a description of the project area and a historical overview of land use and archaeology in the region. Results of the LRFI are summarized, and recommendations are made in the final sections. Hawaiian words and technical terms are defined in a glossary at the end of the document.

Project Location and Environment

The project area is located on portions of TMKs: (4) 4-3-001:009, 999; 4-3-010:001, 005; and 4-3-002:999 in South Olohena Ahupua‘a, Puna District on the island of Kaua‘i (Figures 1–3). This is located at the intersection of the highway with Papaloa Road and Kapa‘a Bypass Road (Route 5600). The project lands are predominantly located within the Kūhiō Highway ROW with the mauka portion extending into privately owned land. The project area encompasses a total of 3.599 hectares (ha) [8.894 acres (ac.)]. TMKs: (4) 4-3-010:001 and 005 are agricultural parcels owned by My Kapaa LLC. The project overlaps a small portion of TMK: (4) 4-3-001:009 at the corner of Papaloa Road and Kūhio Highway, which is owned by Robert H. Middleton Revocable Trust. TMKs: (4) 4-3-001:999 and 4-3-002:999 are the Kūhiō Highway ROW, owned by the Hawai‘i Department of Transportation.

The island of Kaua‘i was formed by a single shield volcano, Wai‘ale‘ale, which once had the largest caldera in the islands measuring roughly 15–20 kilometers (km) [9.3–12.4 miles (mi.)] in diameter and is 5,100 meters (m) [16,732.28 feet (ft.)] above the ocean floor (MacDonald et al. 1983:453). Based on predictive models of weathering and erosion, it is estimated that the Kaua‘i shield volcano became dormant roughly 1–2 million years ago or more, however an alternative model predicts that the Kaua‘i Volcano stopped building during the Pliocene epoch, roughly 4 million years ago (MacDonald et al. 1983:298–299). The project area is located within the Līhu‘e Basin, also called the Līhu‘e depression, which formed when the east side of the shield collapsed to create a 10–15 km (6.2–9.3 mi.) caldera (MacDonald et al. 1983:453). While the basin was never filled with lava from the shield volcano, it was later filled with rejuvenated period volcanics. The Līhu‘e Basin is one of only two flank calderas found in Hawai‘i. The project area’s volcanic history is further explained by MacDonald et al.:

> Lava flows of the Koloa Series cover about half of the surface of the eastern part of the island. They form the entire floor of the Līhu‘e Basin, except for two small kipuka of Waimea Canyon rocks (Aaohoaka Hill and Pu‘u Pilo), that protrude through them west of the gap through which the Wailua River crosses the Kālepa-Nounou Ridge…The greatest exposed thickness of Koloa lava is 650 meters, in the east wall of Hanalei Valley; but they may be even thicker in Līhu‘e Basin....(MacDonald et al. 1983:460–461)

Rainfall averages 118.62 centimeters (cm) [46.70 inches (in.)] per year, with June through September being the driest months and October to January receiving the most rain (Giambelluca et al. 2013). The wettest month of the year is November, which has 17.29 cm (6.81 in.) of rain on average. The nearest major water source is Wailua River, which flows out to the ocean roughly 1.17 km (0.73 mi.) to the southwest of the project. Wailua River is the largest river in all of the Hawaiian Islands and is formed



Figure 1. Location of the project area on a USGS topographic map (USGS 2022).

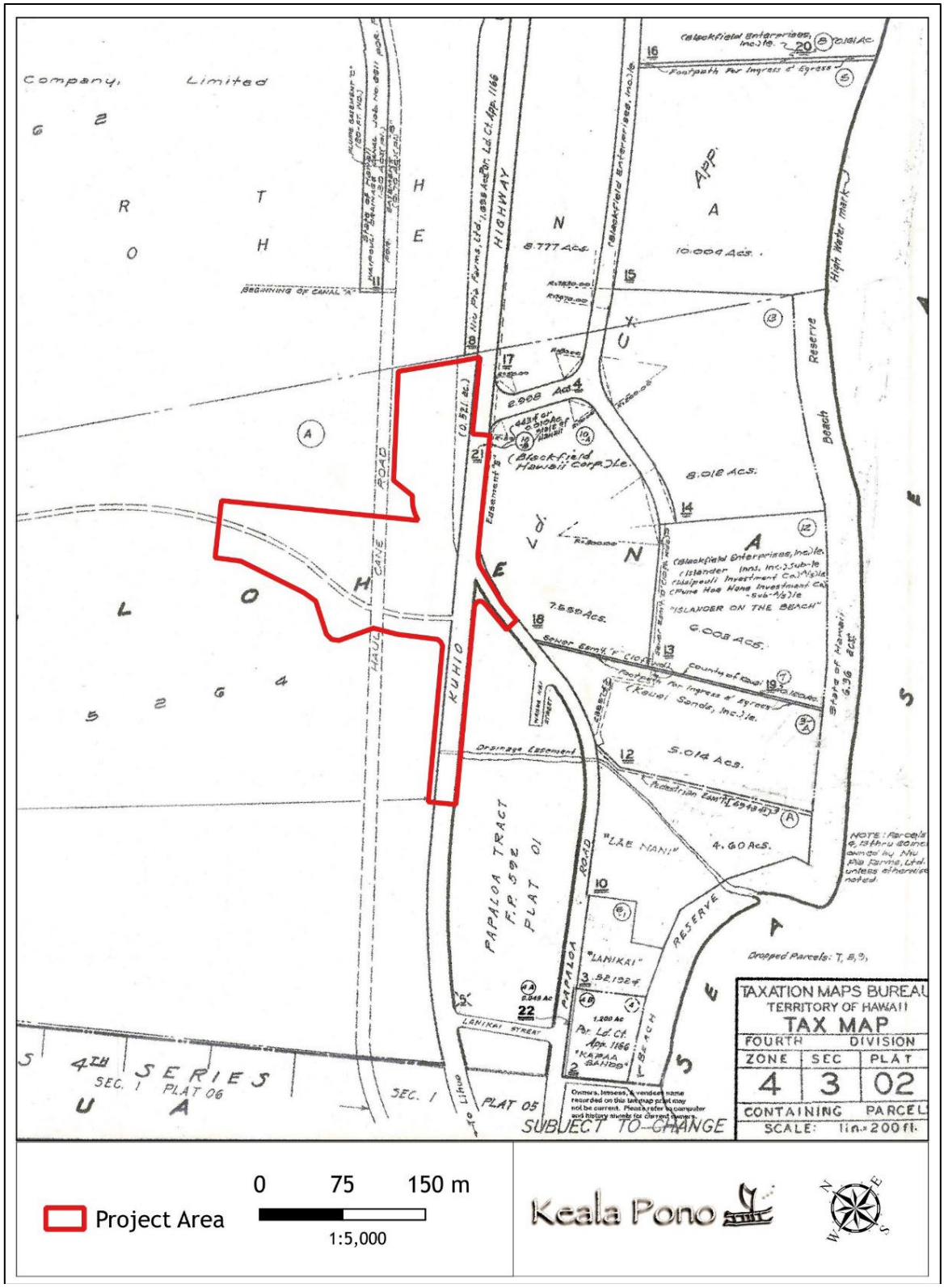


Figure 2. Project area on a TMK plat 4-3-02 (State of Hawai‘i 1984).

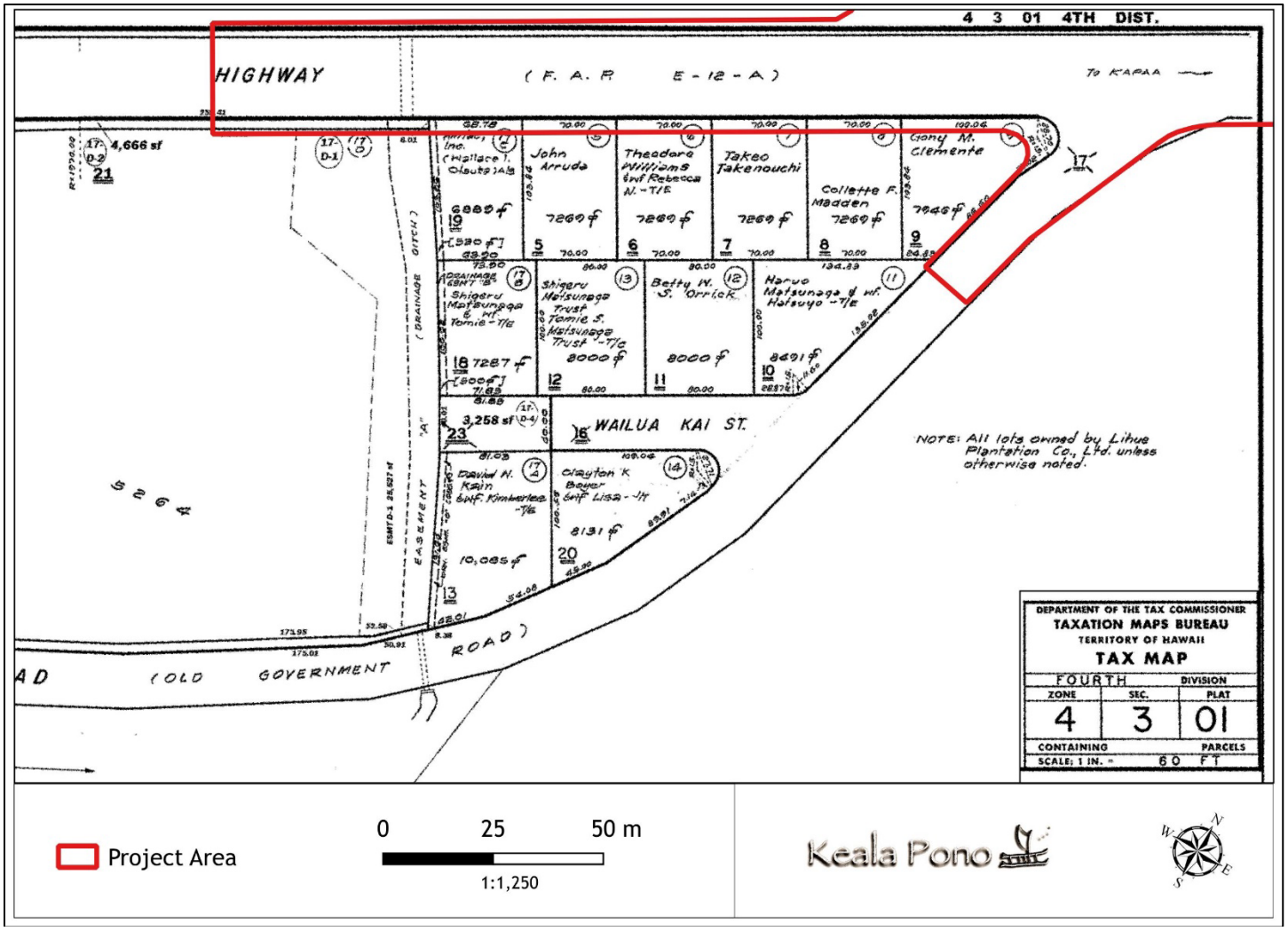


Figure 3. Western portion of the project area on a TMK plat 4-3-01 (State of Hawai‘i 1982).

when the north and south fork meet to form the larger river. The project area is roughly 332.34 m (1,090.35 ft.) from the ocean at Waipouli Beach.

Soils of the project area consist predominantly of the Kaloko, Lihue, and Mokuleia series. The specific soils within these series are Lihue silty clay, 8–15% slopes (LhC) located in the northern portion of the study lands, Mokuleia fine sandy loam (Mr) at the eastern half, and Kaloko clay (Kfa) at the southwest end (Figure 4) (Foote et al. 1972). Soil series of the project area are described as follows:

> **Kaloko Series**
>
> This series consists of poorly drained soils on coastal plains on the islands of Kauai and Oahu. These soils developed in alluvium derived from basic igneous rock; the alluvium has been deposited over marly lagoon deposits. The soils are nearly level. Elevations range from sea level to 20 feet…Kaloko soils are geographically associated with Nohili soils on Kauai and with Keaau, Pearl Harbor, and Waialua soils on Oahu…These soils are used for irrigated sugarcane and pasture. The natural vegetations consist of kiawe, klu, bermudagrass, and annuals. (Foote et al. 1972:58)
>
> **Lihue Series**
>
> This series consists of well-drained soils on uplands on the island of Kauai. These soils developed in material weathered from basic igneous rock. They are gently sloping to steep. Elevations range from nearly sea level to 800 feet…Lihue soils are geographically associated with Ioleau and Puhi soils. These soils are used for irrigated sugarcane, pineapple, pasture, truck crops, orchards, wildlife habitat, woodland, and homesites. The natural vegetation consists of lantana, guava, koa haole, joee, kikuyugrass, molassesgrass, guineagrass, bermudagrass, and Java plum. (Foote et al. 1972:82)
>
> **Mokuleia Series**
>
> This series consists of well-drained soils along the coastal plains on the islands of Oahu and Kauai. These soils formed in recent alluvium deposited over coral sand. They are shallow and nearly level. Elevations range from nearly sea level to 100 feet…Mokuleia soils are geographically associated with Hanalei, Jaucas, and Keaau soils…These soils are used for sugarcane, truck crops, and pasture. The natural vegetation consists of kiawe, klu, koa haole, and bermudagrass in the drier areas and napiergrass, guava, and joee in the wetter areas. (Foote et al. 1972:95)

Other soils in the vicinity include Lihue silty clay, 0–8% slopes (LhB) in the uplands and to the southwest, as well as beaches (BS) along the coastline (Foote et al. 1972).

The Project

The HDOT is planning improvements to Kūhiō Highway at its intersections with Papaloa Road and Kapa‘a Bypass Road. The HDOT is currently evaluating realigning the southern terminus of Kapa‘a Bypass Road at Kūhiō Highway to intersect the existing intersection of Kūhiō Highway with Papaloa Road (North) near the Coconut Marketplace. The realignment will consolidate the two (2) existing T-intersections into a single full access intersection. In addition to consolidating the intersections, the realignment will provide the opportunity to allow left turns from Papaloa Road (North) onto Kūhiō Highway.

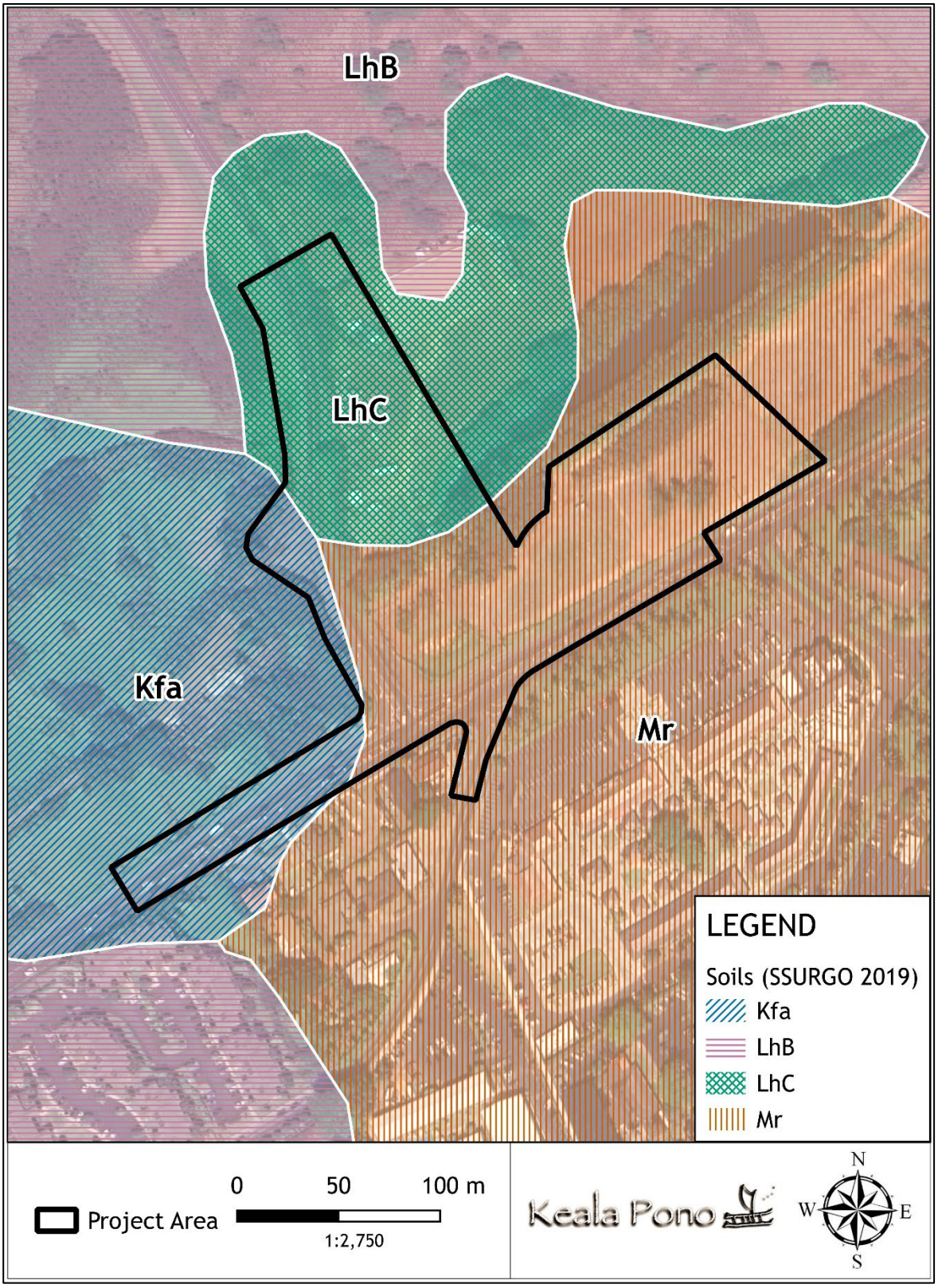


Figure 4. Soils in the vicinity of the project area (data from Foote et al. 1972).

BACKGROUND

A historic review of South Olohena Ahupuaʻa is provided below, to offer a better holistic understanding of the use and occupation of the project area. In the attempt to record and preserve both the tangible (e.g., traditional and historic archaeological sites) and intangible (e.g., moʻolelo, ʻōlelo noʻeau) culture, this research assists in the discussion of anticipated finds. Research was conducted at the Hawaiʻi State Library, the University of Hawaiʻi at Mānoa libraries, the State Historic Preservation Division (SHPD) library, and online on the Waihona ʻAina database and the State of Hawaiʻi Department of Accounting and General Services (DAGS) website. Historical maps, archaeological reports, Māhele data, and historical reference books were among the materials examined.

South Olohena Ahupuaʻa in the Pre-Contact Era

The island of Kauaʻi is split into five moku (traditional districts): Haleleʻa, Koʻolau, Puna, Kona, and Nā Pali. Wailua is the largest of the 13 ahupuaʻa within the Puna District on Kauaʻi's eastern shore. The Puna District is located between the Kona District, which encompasses the island's south shore, and the small Koʻolau District on the north shore. The project area is located in the coastal portion of the narrow South Olohena Ahupuaʻa. It is surrounded by North Olohena Ahupuaʻa to the north and Wailua Ahupuaʻa in the south.

Place Names

One often overlooked source of history is the information embedded in the Hawaiian landscape. Hawaiian place names "usually have understandable meanings, and the stories illustrating many of the place names are well known and appreciated…The place names provide a living and largely intelligible history" (Pukui et al. 1974:xii). Several place names associated with the study area are listed in the book *Place Names of Hawaii* (Pukui et al. 1974), along with the meanings of the names and/or comments about the specific locales:

> Alakukui. Point near Wailua Bay, Kauaʻi. A *heiau* here was named Kūhua. *Lit.,* torch path. (Pukui et al. 1974:9)
>
> Kamoʻohoʻopulu. Ridge, Kawaihau district, Kauaʻi. *Lit.,* the wet ridge. (Pukui et al. 1974:82)
>
> Kapaʻa…Land section, town, ditch…Ka-wai-hau district, Kauaʻi…*Lit*., the solid *or* the closing…*Ka laulā mauka o Ka-paʻa ē, mai paʻa i ka leo*…the upland expanse of the closure, do not close your voice (an appeal for hospitality). (Pukui et al. 1974:86)
>
> Kūhhiō…named for Prince Jonah Kū-hiō Ka-lani-ana-ole (1871–1922), delegate to Congress and father of the Hawaiian Homes Commission Act… (Pukui et al. 1974:120)
>
> Nā ʻili a Kaʻauea. Lookout point, Kālepa Ridge Trail, Kālepa Forest Reserve, Līhuʻe district, Kauaʻi. (This name is sometimes spelled Nailiakuea.) *Lit.,* the pebbles of Kaʻauea. (Pukui et al. 1974:160)
>
> Nounou. Mountain (now known as Sleeping Giant), trail, and forest reserve, Kawaihau District, Kauaʻi. The tyrant ʻAikanaka made his last stand on the mountain against the invader Kawelo. Hula chant by Hiʻiaka; *Ālai ʻia aʻela e Nounou, nalo Kaipuhaʻa i ka laulā mauka o Kapaʻa,* Nounou is screened, The-low-clabash is lost in the wide expanse inland of Kapaʻa. *Lit.,* throwing. (Pukui et al. 1974:167)
>
> Olohena. Land division and ridge, Kawaihau district, Kauaʻi. A *heiau* for human sacrifices on the ridge was called Mahewalu, short for Māhelewalu, eight divisions. Olohena has no meaning, but may be cognate with Olosenga, an island in the Manuʻa group, Samoa. Other sources say the *heiau* was named Kukui. (Pukui et al. 1974:170)

> Wailua. State park, land division, river, falls, valley, town, and golf course, Līhuʻe qd., Kauaʻi. *Lit.,* two waters. (Pukui et al. 1974:224)
>
> Waipouli. Land division, beach, and village, Kawaihau district, Kauaʻi. *Lit.,* dark water. (Pukui et al. 1974:227)

Subsistence and Traditional Land Use

It is believed that the Puna district was first settled by a Marquesan, chief Punanuikaianaina in 1000–1100 AD (Fornander 1996:45, 46). The windward side of Kauaʻi with its large river valleys and fertile floodplains would have been ideal for habitation and agriculture in traditional times. One of the earliest documented habitation sites in the region, SIHP 50-30-11-01839, is located in the ahupuaʻa at the mouth of Hanamāʻulu Stream and dates to AD 1170–1400 (Walker et al. 1991).

There were five main areas on Kauaʻi where abundant food and fresh water resources led to larger concentrations of the population (Handy and Handy 1972:269). Among these is the Kapaʻa and Wailua area (Handy and Handy 1972:269):

> There was a highly developed irrigation system at Kapaʻa, halfway down the east coast. Adjoining Kapaʻa on the south is Wailua, distinguished by one of the largest networks of streams running down from the interior mountains, along which were cultivated taro and breadfruit in quantity. The Kapaʻa-Wailua area is the second which we would designate as notable for density of population. In this area are remains of ancient temples of worship, indicating politico-religious importance.

According to Handy and Handy (1972:425) the area was extremely fertile and the river produced large shrimp and fish:

> Undoubtedly much *wauke* and *olona* were grown, as well as yams, bananas, *pia* and all other cultivated plants. The streams and river were famous for shrimps and guppy fish, said to be the largest in the islands. And the forested interior was rich in all the trees and other plants treasured by Hawaiians: *koa*, sandalwood, fragrant *maile* and *mokihana* vines, and others.

The Wailua and Hanamāʻulu river valleys and the Nāwiliwili floodplain were the largest and most extensively cultivated regions on the island. A Kauaʻi aliʻi named Manokalanipō encouraged his people to cultivate the land around AD 1490. It is said that he "encouraged agriculture and industry, executed long and difficult works of irrigation, and thus brought fields of wilderness under cultivation" (Fornander 1996:93). The region's large river valleys were able to support extensive loʻi kalo that would have been supplemented by the collection of marine resources and aquaculture. Coconuts were planted in many areas across Kauaʻi and grew exceptionally well in Wailua, which was the location of a sacred grove that belonged to the aliʻi (Handy and Handy 1972:172). This grove was kapu since it was also where the aliʻi resided. Wailua is also one of only two main areas in the archipelago that ʻulu was extensively cultivated, the other being Kona on Hawaiʻi Island. According to Handy and Handy (1972:151, 284), Hawaiians preferred kalo and ʻuala, however ʻulu trees thrived in Wailua due to the slightly warmer temperatures. North and South Olohena Ahupuaʻa were also noted for having flourishing ʻulu trees. It is recounted that Kamalama, Kawelo's brother allocated these lands for settlement and cultivation:

> There the men received each portion and settled down to cultivate the land, while Ka-ma-la-ma turned toward the hills. The men made loʻi, or taro patches, and set out such food-plants as they thought would flourish in this new land. They planted twelve breadfruit trees, one for each taro-patch, and in order to have a name signifying unity, they called the place "The Twelve Breadfruit," because the trees all came from a single mother-plant…These trees were famous in ancient days and even now their report is in the mouths of men. (Green and Pukui 1936:86–88)

The region's accessible fishing grounds allowed residents to supplement their diet of kalo, ʻuala, ʻulu, and niu with seafood, limu, and other marine resources. There were also a number of fishponds located near and within the Wailua River, not far from the project area, and it is noted that some fish were put into the loʻi kalo for short periods (Bennett 1931:24). A major trail system ran through the region, giving the people of Puna access to the Kona and Koʻolau districts. This trail is noted in ʻōlelo noʻeau and can be seen on historic maps. A map from 1900 depicting the region also marks the trails of the area, one of which runs just makai of the project area or directly through it (see Figures 5 and 6). Two trails can be seen extending through Wailua Ahupuaʻa, one along the coast ending at the mouth of the Wailua River and a second that traverses inland and crosses the river at Waiʻehu Falls before continuing into Olohena and Kapaʻa. The Olohena trail goes to Lae ʻAlakukui (Alakukui Point) and passes through the coastal section. These trails would have provided access to a wide variety of resources from the river, forests, and coast. Due to this variety and abundance of terrestrial and marine resources as well as fresh water, the region would have had the potential to provide for a large population.

Kukui Heiau (SIHP 50-30-08-00108) is located in South Olohena at Lae ʻAlakukui, a headland at the southern extent of the ahupuaʻa (Bennett 1931:127). This heiau was constructed from unusually large rocks, some of which weighed a few tons each, and was used for navigation (Wichman 1998:82). Kukui Heiau had at least two lamps that were continuously lit on its makai wall that were used to guide canoes travelling at night, similar to a lighthouse (Carpenter and Yent 1997:8). Kukui Heiau is listed on the National Register of Historic Places and Hawaiʻi Register. A human sacrificial heiau named Mahewalu, said to be short for Māhele-walu, or "eight divisions," is also associated with Olohena (Pukui et al. 1974:170). The heiau is described as being on a ridge, however some sources say this is another name of Kukui Heiau (Pukui et al. 1974:170). Another heiau, Kaikihāunakā, was constructed by Kawelo after defeating ʻAikanaka. The name translates to "little striking blow" and is associated with Halepāiwi, a "house enclosed with bones" (Wichman 1998:82). Halepāiwi was a structure made for riddling and was surrounded by a fence of bones that were said to be made from those who lost the riddle game.

Moʻolelo

Moʻolelo and accounts of Olohena and nearby ahupuaʻa serve as testaments to the cultural significance of the region. Locations within the ahupuaʻa are noted in moʻolelo and played a role in the spiritual and religious realm of Hawaiian culture shown through the stories of supernatural beings, goddesses, and the mention of a heiau.

A wind chant was recorded in the legend of the wind gourd of Laʻamaomao (Nakuina 1992:46). The magic gourd was controlled by Kūapākaʻa, who recited the names of all the winds of Kauaʻi including that of nearby Wailua, Waipouli, and Kapaʻa, however Olohena was not mentioned:

> Waiʻōpua is of Wailua,
>
> Waiolohia is of Nahanahanai,
>
> Inuwai is of Waipouli,
>
> Hoʻolua is the wind of Makaīwa,
>
> Kēhau is of Kapaʻa...

A moʻolelo about Kalelealuaka mentions Kaikihāunakā Heiau in Olohena Ahupuaʻa, though the legend of Kawelo and ʻAikanaka that explains its origin describes it as being located in Wailua:

> After Kawelo defeated ʻAikanaka, he built a heiau in Olohena that he named Ka-iki-hāuna-kā, 'little striking blow.' It was built as a place to make an offering to his war god of the first enemy warrior to have been killed in battle. This would have been one of the warriors Kawelo killed as his canoe was carried onto shore. (Wichman 1998:81)

Kalelealuaka traveled from his home in Kauaʻi to Waialua on Oʻahu in search of a human sacrifice to bring back to "the temple of Kahikihaunaka at Wailua, on Kauaʻi" (Thrum 1906:77). He found the corpse of the hero Kaʻōpele and brought it to the poʻokanaka heiau on Kauaʻi, setting it on the altar next to another dead body. Other versions of the story say that it was not Kaikihāunakā Heiau, but rather Kukui Heiau where this occurred (Dickey 1917:19). In fact, Kaʻōpele was not dead, but unconscious and was able to recover soon after being laid on the altar. He returned to Oʻahu, got married, and had a son that was named Kalelealuaka, who went to Wailua and saw chiefs playing games. Kalelealuaka fought in a boxing match with the king and ended up killing him (Thrum 1906:83).

While the next legend speaks of Wailua, not Olohena, it does mention a famous riddler, as Olohena was known for riddles. It is said that there are marks that look like footprints on the banks of the Wailua River mouth. One moʻolelo associates them with a magician searching for the demigod Kamapuaʻa, while another version states that "a famous maker of riddles once stepped here on landing to match riddles with the people of Wailua" (Dickey 1917:20–21). This riddler was also mentioned by an informant in 1885, when speaking about important sites on Kauaʻi. He called the prints Kapuaʻi o Molohua, which translates to "footprints of Molohua" and explained that it was "a house for riddling champions" and a famous location in Wailua (Lahainaluna Students 1885:214). Because of its proximity to Halepāiwi, the riddling house in Olohena, it is possible the famous riddler also stopped there during his travels to the region.

One of the most famous moʻolelo of the region are those of Kanaka Nunui Moe, The Sleeping Giant (Wichman 1985:13–16). The giant was feared because of his size and the destruction he could cause with a single step, however he was loved by the people of the region since he was helpful and very friendly to all. Kanaka Nunui Moe is believed to have constructed Kukui Heiau in Olohena:

> The giant Nunui collected the stones and put them in position and gathered the *ʻohiʻa lehua* logs from the mountains to build all the structures within the walls. After it was built, he was tired and stretched out on the nearby hilltop, where he still sleeps. (Wichman 1988:82)

He is also associated with building a large heiau in Kapaʻa and for helping the villagers do their work much quicker. His massive footprints would be used to plant bananas, which was his favorite food. Kanaka Nunui Moe was always careful with his actions and slept in the hills behind Kapaʻa Town, flattening them down so the land could be cultivated. The giant was always sleepy and would stay awake for 100 years, then sleep for centuries at a time, which is how he got his name.

> When he slept, Nunui slept for hundreds of years while the winds blew dirt over him and seeds were dropped there by the birds. The gentle showers sent by Kahale-lehua, goddess of the gentle rains, fed these seeds and forests grew up over the giant. When Nunui awoke and stretched, the people of Kapaʻa fled in great fear, for what they had thought to be a hill had come alive.
>
> One time, while Nunui was still awake, the high chief of Kawaihau wanted to build a large heiau to honor one of his gods. This was to be no ordinary temple. The chief wanted water-polished rocks for the walls and hard koa wood from Kokee for the framework of the god's house.
>
> So the chief told the Kawaihau people what he wanted them to do. They must gather rocks from the golden brown waters of the Kokee streams and cut koa trees on the edges of Waimea canyon, and gather pili grass that grew at Mana. "All this must be done in the turn of one moon," he ordered.
>
> The unhappy people left their chief and silently returned to their village. The giant Nunui, stepping carefully among them, saw the long faces of the people.
>
> "What is wrong?" he asked.
>
> The Kapaʻa villagers told him what they must do within the impossibly short time. "This cannot be done," the people said in low, sad voices. "How can we go to Kokee and bring back stones

enough to build the walls in that time? And cut down the koa trees and bring the logs here and build the sacred house? And even if we do these things, who will cultivate our fields?"

Nunui smiled gently. "Tend to your fields," he said. "This work is nothing for me, and I'll gladly help you. Besides, it will give me something to do."

The giant went to Kokee and scooped up smooth, round boulders from the golden brown waters and brought them to Kapaʻa. "Chief," he called to the astonished ruler, "show me where you wish to build this heiau."

The amazed chief pointed out the place set aside for the temple. Nunui placed the rocks to form a wall, fitting them so closely together that not even a mouse could squeeze between the cracks. Within a week, he had built a strong, thick, handsome wall around the sacred place.

Nunui returned to the edge of Waimea Canyon and cut down koa trees and trimmed them into the shape he needed. He carried these back and made the framework of the house. He gathered pili grass from the wild and wrapped the stems into bundles, tied these bundles to the framework, and within half the time the chief had set, the heiau was finished.

Everyone was happy. The farmers had been able to keep up with their chores, the chief had his heiau, and Nunui had something to do. There was even time enough for a celebration. The chief ordered all his people to gather bananas and to pound sweet potatoes and taro into poi. Some people hurried to slaughter pigs and dogs to be cooked in the imu, while others paddled out to sea to fill their canoes with fish and sent their wives to gather seaweed and opihi from the reef. At last, enough food for everyone was ready, and the chief, the villagers, and Nunui sat down before the overflowing bowls and platters.

"Eat," said the chief to Nunui. "After the work you have done, you must be hungry."

The giant ate all the food that had been placed before him. When he was through, his stomach bulged and he was very sleepy. He chose a comfortable hill just a short distance above Kapaʻa town. Nunui stretched a last time, lay down along the top of the hill, and soon was sound asleep.

As he slept through the years, the winds blew dirt over him and the birds brought seeds. Ka-hale-lehua, goddess of the gentle rains, sent showers to water the plants that now covered the giant.

So Kanaka-nunui-moe sleeps and sleeps and has come to resemble a long hill with a lump at one end where his nose is and lumps at the other ends where his feet are. He no longer looks like a living being, but one day, perhaps soon, his eyes will open, he'll yawn and stretch his arms, and sit up. (Wichman 1985:13–16)

Nounou Mountain, situated in both Wailua and Olohena Ahupuaʻa just west (inland) of the current project area, is referred to as the Sleeping Giant since it resembles a figure laying down. Today, the ridge is a popular viewpoint and hiking trail.

Nounou Mountain is also mentioned in the epic tale of Hiʻiakaikapoliopele. At this point of the story, Pele's sister Hiʻiaka, the goddess of hula, goes to Kauaʻi with her friend, Wahineʻōmaʻo, to find Pele's lover, Lohiau and bring him back to her on Hawaiʻi Island. After crossing the island chain, the friends neared Kauaʻi's east shore, where they would land at the Kapaʻa coast. Prior to making landfall, they chanted Mele Kāhea, a chant asking permision to enter, which is still popular today:

Kūnihi ka mauna i ka laʻi ē
ʻO Waiʻaleʻale lā ē, i Wailua
Huki aʻela i luna ka papa o Anokawailani
Ālai ʻia aʻela e Nounou
Nalowale Kaipuhaʻa
Haʻa i ka laulā

Haʻa ka ipu, haʻa ma kai o Kapaʻa ē
Haʻa ka ipu, haʻa ma uka o Kapaʻa ē
Mai paʻa ka leo
Heʻole ka heahea mai.
(Hoʻoulumāhiehie 2008a:177–178)

Steep is the mountain in the calm
Waiʻaleʻale rises there, at Wailua
Pulled up heavenward is the bridge of Anokawailani
Blocked from view by Nounou Hill
Kaipuhaʻa disappears completely
Low-lying in its expanse
Shallow is the gourd, low-lying at the shore of Kapaʻa
Shallow is the gourd, low-lying at the shore of Kapaʻa
Do not restrain the voice
Leaving no beckoning call of welcome.
(Hoʻoulumāhiehie 2008b:166–167)

ʻŌlelo Noʻeau

Traditional proverbs and wise sayings, known as ʻōlelo noʻeau, are another means by which the history of Hawaiian places has been recorded. In 1983, Mary Kawena Pukui published a volume of close to 3,000 ʻōlelo noʻeau that she collected throughout the islands. The introductory chapter of that book reminds us that if we could understand these proverbs and wise sayings well, then we would understand Hawaiʻi well (Pukui 1983). While no ʻōlelo noʻeau are listed for Olohena, other sayings were found that mention nearby locales including Waipouli, Wailua, and the Puna district as a whole. They are listed below as recorded in Pukui's book:

He nani wale no o Puna mai ʻo a ʻo.
There is only beauty from one end of Puna to the other.
There is nothing to complain about-refers to Puna, Kauaʻi. (Pukui 1983:91)

Ka wai hālau o Wailua.
The expansive waters of Wailua.
Wailua, Kauaʻi, is the land of large streams. (Pukui 1983:178)

Na keiki o Waipouli me Honomaʻele.
Children of Waipouli and Honomaʻele.
A humorous reference to very dark people. A play on *pouli* (dark) in Waipouli and *ʻele* (black) in Honomaʻele. (Pukui 1983:245)

Historic South Olohena

It is generally accepted that in 1778 James Cook became the first Westerner to see the Hawaiian Islands, which at that time were not yet united under one sovereign. Following Cook, a wave of other foreign explorers landed on Hawaiʻi's shores. Around the same time as the arrival of the first Westerners to Hawaiʻi, many of the other islands were experiencing major political changes. It was during this time that Oʻahu's sovereignty ended with the invasion of the Maui chiefs, and the Maui rule was subsequently

overcome by the invasion of forces from Hawai‘i Island. Kaua‘i and Ni‘ihau were ruled by Kaumuali‘i who relinquished control in 1810 during peaceful negotiations with Kamehameha I, who then became the ruler of all the Hawaiian Islands.

Early Historic Accounts

The earliest historical accounts of Kaua‘i come from sea captains and missionaries who recorded several descriptions of the Wailua region, however there is almost no mention of Olohena. Captain George Vancouver, who had been to Kaua‘i during earlier voyages, tried and failed to land at Wailua in March 1793. Although he was not able to anchor due to harsh conditions, he did record descriptions about the region in his journals while offshore. At this time, Wailua was still the seat of the royals and the main population center on the island, which he described as an "extensive village" (Vancouver 1798:221–222).

> This part seemed to be very well watered, as three other rapid small streams were observed to flow into the sea within the limits above mentioned. This portion of Attouai, the most fertile and pleasant district of the island, is the principal residence of the King, or, in his absence, of the superior chief, who generally takes up his abode in an extensive village, about a league to the southward of the north-east point of the island. Here Enemo the regent, with the young prince Tamooerrie, were now living…(Vancouver 1798:221–222)

After Vancouver's attempted trip, few foreigners visited the vicinity of Olohena and instead made landfall in Waimea located on the island's southwest shore. Due to increasing trade opportunities with foreigners who preferred to harbor their ships there, the ali‘i of Kaua‘i would soon move the unofficial capital to Waimea, overshadowing the island's east coast (Lydgate 1920). It is likely that this shift in focus to Waimea meant that the Wailua region lost much of its traditional importance, especially when the kapu system was abolished in 1819 and Wailua's many heiau fell into disuse.

A detailed description of the region during this early historic period comes from sailors aboard the U.S. Exploring Expedition, who documented their travels in October 1840. It was recorded that only around 40 men lived in the entire district. During the expedition they met with Debora Kapule, who was the ex-wife of Kaumuali‘i. The fishponds described in expedition journals were located where the Coco Palms is today, less than 0.5 km southwest of the current study area. An excerpt from the expedition journals is as follows:

> The country on this route was uninteresting, until they reached Wailua, the residence of Deborah, a chief woman of the islands, readily known as such from her enormous size, and the cast of her countenance. She has a person living with her called Olivia Chapin, who speaks English, and has learned how to extort money. Deborah has about forty men in her district; but they were absent, being employed in the mountains for cutting timber to pay the tax to the king.
>
> Near Deborah's residence are extensive fishponds belonging to her, which have been made with great labour: they are of different degrees of saltiness. The fish are taken from the sea when young and put into the saltiest pond; as they grow larger, they are removed into one less salty, and are finally fattened in fresh water. While our gentlemen were there, Deborah received young fish in payment of the poll-tax, which were immediately transferred to her ponds.
>
> Wailua (two waters) was formerly a place of some importance. It is situated on a small stream of the same name, in a barren, sandy spot.
>
> Deborah furnished them with a double canoe, to carry them up the river to visit the falls. Taking the western branch, they ascended it for two and a half miles.
>
> There are many good taro-patches and sugar plantations on its banks. They landed in what appeared to have been an old crater, in front of a basin, with high producing bread-fruit, sugar-

cane, oranges, etc. The latter, however, are suffering from the blight, and some of the trees were covered with a black smut, produced by a species of aphis.

In ascending, an insulated black rock is passed, known as the "Muu," which has been detached from a high rocky bluff, that is remarkable for the dikes visible in it.

They afterwards ascended the bank, two hundred feet high, and crossed about half a mile to the falls, over a plain covered with grass and wild sugar-cane. The stream was very small, running sluggishly, and passed over a precipice of barren rocks, one hundred and sixty feet in height. Although there is neither tree nor shrub along the stream above the fall, the valley beneath is filled with them; the most conspicuous was the pandanus. The whole scene is picturesque. Below, the falls present a very curious appearance, the wind continually breaking and dispersing the water in heavy showers over a great variety of ferns, which are growing in the crevices of the rocks. The volume of water does not exceed ten hogsheads a minute. In the basin beneath were found many fine specimens of *Neritina granulate*, and two other species were found further down the stream, about four feet below the surface; these were procured by diving. Mr. Rich obtained specimens of the plants.

Mr. Peale found few birds; ducks were abundant on the river's banks, some of which were killed. Rushes were growing along the banks from eight to ten feet in length, four or five feet under the water; besides these, the banks were covered with hibiscus and ricinus (castor-oil trees), growing wild. (Wilkes 1846:IV:68–69)

South Olohena Changes in Land Tenure

The change in the traditional land tenure system in Hawai‘i began with the appointment of the Board of Commissioners to Quiet Land Titles by Kamehameha III in 1845. The Great Māhele took place during the first few months of 1848 when Kamehameha III and more than 240 of his chiefs worked out their interests in the lands of the Kingdom. This division of land was recorded in the Māhele Book. The king retained roughly a million acres as his own as Crown Lands, while approximately a million and a half acres were designated as Government Lands. The Konohiki Awards amounted to about a million and a half acres, however title was not awarded until the konohiki presented the claim before the Land Commission.

In the fall of 1850 legislation was passed allowing citizens to present claims before the Land Commission for lands that they were cultivating within the Crown, Government, or Konohiki lands. By 1855 the Land Commission had made visits to all the islands and had received testimony for about 12,000 land claims. Ultimately between 9,000 and 11,000 kuleana land claims were awarded to kama‘āina totaling only about 30,000 acres and recorded in ten large volumes. Land Commission Awards (LCA) generated during the Māhele offer valuable information regarding land use, traditional and historic boundaries and landmarks, as well as the natural resources of the area.

The entire ahupua‘a of South Olohena was given to Rufus P. Spalding under Grant 5264 for use under the Lihue Planation Co. This award totaled approximately 419 acres. No LCA parcels were awarded in South Olohena and just one LCA was claimed in the coastal region of North Olohena Ahupua‘a. It is not located near the current project area.

The Late 19th Century and Beyond

Sugarcane and rice cultivation drastically changed the landscape and livelihood of residents in the Puna District, particularly in Līhu‘e, but also in Wailua and Olohena. This new era saw a decline in the cultivation of kalo and the conversion of many unused lo‘i into rice paddies. Railroad tracks for transporting sugar and later, roads, were established to connect different parts of the island, and in the mid-20th century the Coco Palms Resort was established.

A map drawn in 1878 records the ahupuaʻa of Kauaʻi, significant landmarks and place names, and the major trails mentioned in early accounts (Figure 5). The project area is within Olohena, which had not yet been split into today's North and South Olohena Ahupuaʻa. A trail or road runs through the middle of the study lands. The Wailua trails are not depicted. Nearby geographical features and landmarks include the Wailua River, Nounou, and a large swamp in Waipouli and Kapaʻa. A 1900 map shows the same trail or road just makai of the project area (Figure 6).

Sugar and Rice Cultivation

The Lihue Plantation Co., Ltd. is one of the earliest sugar plantations in Hawaiʻi. It was founded in 1849 by William L. Lee, Chief Justice of the Kingdom of Hawaiʻi; Henry A. Pierce, a partner at Pierce & Brewer; and Charles Reed Bishop, a banker and husband to Princess Bernice Pauahi Bishop (Condé and Best 1974:165). William H. Rice would also become a partner in 1859. At one point, the Lihue Plantation produced nearly 25% of all the sugar on Kauaʻi and was also a major producer of electricity, which they sold to Kauaʻi Electric (Anonymous 1989:11-1).

To run their sugar operations, the Lihue Plantation Co. built a large water collection system with many miles of ditches and intakes throughout the region. The company had authority over water from the north and south intake ditches, the lower and upper Lihue ditches, Hanamāʻulu and Kapaia ditches, as well as the Waiahi-Iliiliula-North Wailua ditches (Wilcox 1997:68). A large pipe was used to divert water from the north fork of the Wailua River in 1895 and the Waiahi-Iliiliula-North Wailua ditches were constructed in 1926 to transport the water from the north fork of the Wailua River to the south fork (Wilcox 1997:70). The later project was partially funded by the Koloa Plantation, which was allotted one million gallons of water per day in return (Wilcox 1997:70). In 1931, the Wailua Reservoir was the largest owned by the Lihue Plantation Co., holding 242 million gallons of water (Wilcox 1997:73). Other sugar plantations such as Makee Sugar Company, Kealia Plantation, and Hui Kawaihai also had operations in the region. Only the Makee Sugar Company was still in business by 1935 and would later be acquired by the Lihue Plantation.

Throughout Hawaiʻi, many loʻi kalo were converted to rice paddies around the mid to late 19th century, which was also the case in Olohena, Wailua, Waipouli, and Kapaʻa. Despite Chinese rice farmers purchasing or leasing these well-watered lands, kalo was still grown until roughly the end of the century (Knudsen 1991:152). However by 1935 when Handy surveyed the island, he did not find any taro patches in cultivation (Handy 1940:67). Instead, the kalo terraces had been converted to fields of sugarcane, rice, and sweet potatoes, or filled in for use as pasture land. He wrote that:

> Waipouli, Olohena, and Wailua are ahupuaʻa with broad coastal plains bordering the sea, any part of which would be suitable for sweet potato plantings; presumably a great many used to be grown in this section. There are a few flourishing plantations in Wailua at the present time. (Handy 1940:153)

Ahukini Terminal and Railway Company

In 1920, the Ahukini Terminal and Railway Company (AT&R) was established under the parent company, Lihue Plantation, to transport sugar from the plantations to various points across the island. It would later be fully acquired by the Lihue Plantation Co. in 1934. The AT&R railroad track was built from 30-in gauge (35-lb) rail and passed through Anahola, Keālia, Kapaʻa, Olohena, and Wailua, ending at Ahukini Landing in Hanamāʻulu (Condé and Best 1974). AT&R also constructed various bridges including the Waikaʻea Railroad Bridge, the Mōʻīkeha Makai Railroad Bridge, and the Wailua Railroad Bridge (Hammatt 2017; Powell and Dega 2008). The first bridge to cross the Wailua River was the 1919

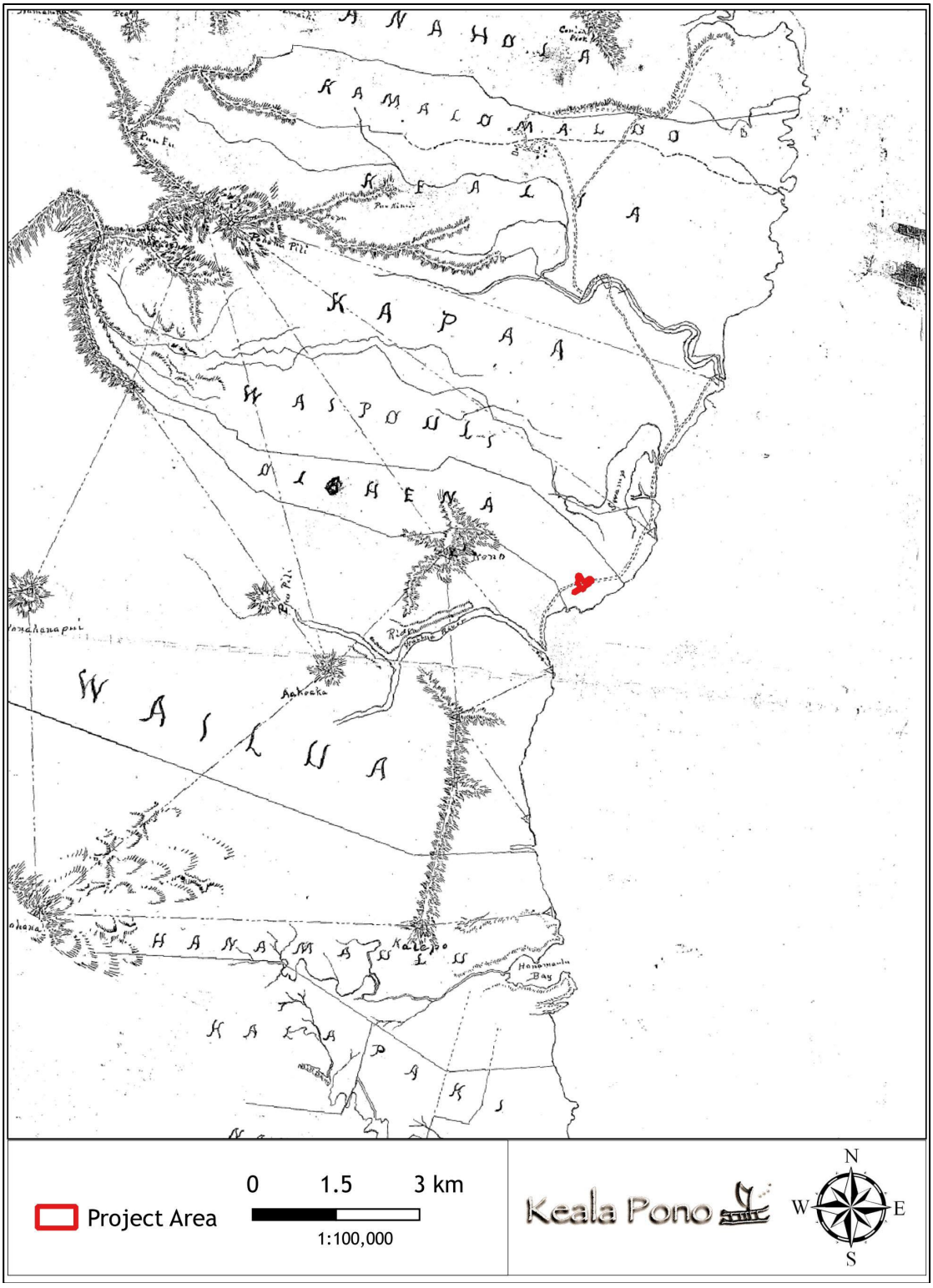


Figure 5. Portion of a map of the island of Kauaʻi (Kitteridge 1878).

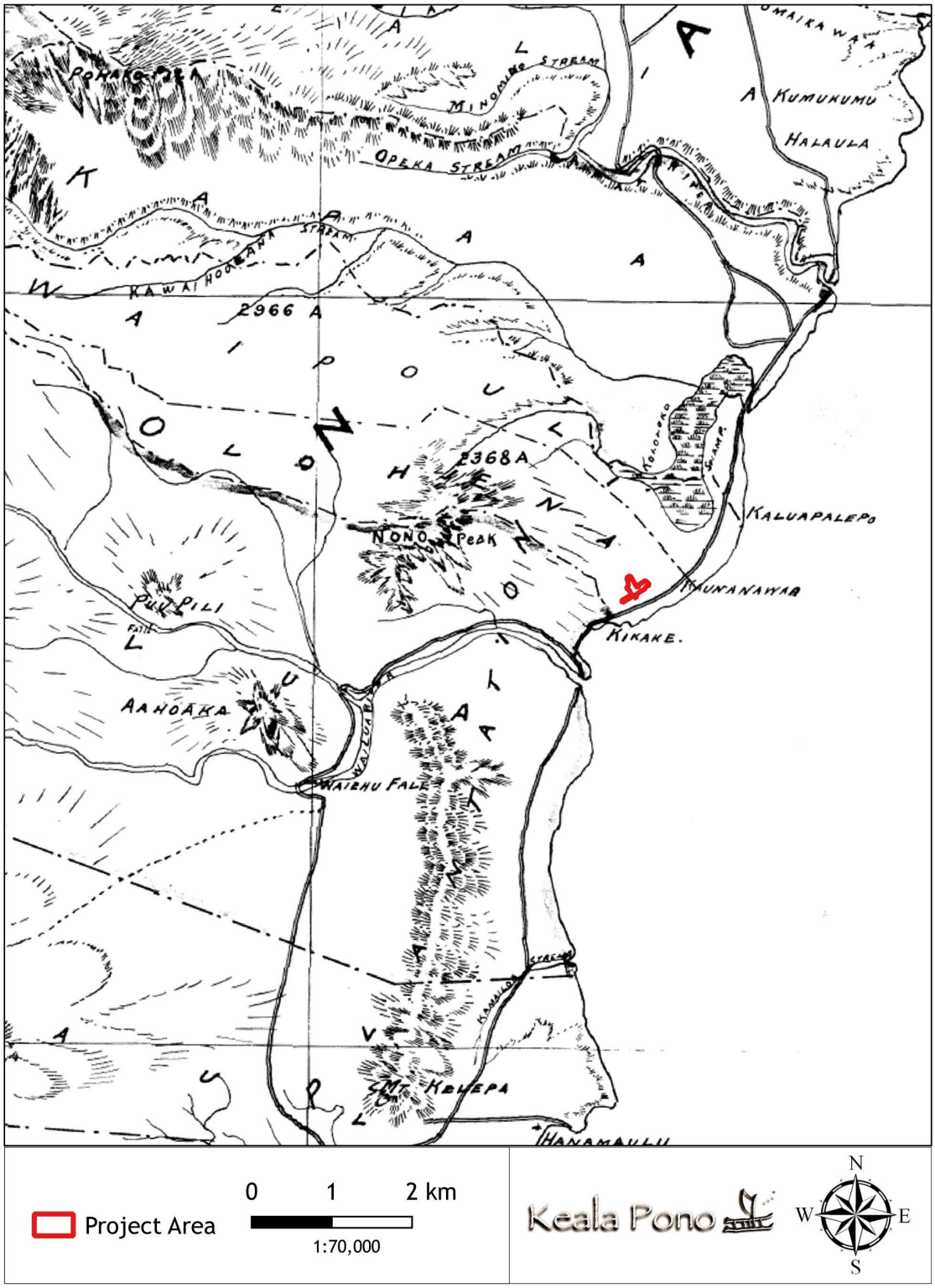


Figure 6. Portion of a Kaua‘i map showing trails and nearby ahupua‘a (Alexander 1900).

concrete arch bridge, which was later replaced by the highway bridge (Wailua River Bridge) in 1949 (Figure 7). Specifically designed for the AT&R railway, the Wailua Plantation Bridge opened in 1921, running parallel to the river bridge, and took just 10 months to complete (Condé and Best 1974:186).

By the early 1950s, the Lihue Plantation was having problems with its rail line. Brakemen, commonly sent out at intersections to warn vehicles of an oncoming train, reported being attacked by dogs and dealing with speeding drivers (*Garden Isle* in Condé and Best 1974:167). As railway transportation was taken over by roads and vehicles, the Wailua Plantation Bridge was soon renovated for use by automobiles and is just one of two standing plantation bridges that were converted for this use on the island (Powell and Dega 2008:5). "By 1957 the company [AT&R] was salvaging a part of their plantation railroad, which was being supplanted by roads laid out for the most part on or close to the old rail bed" (Condé and Best 1974:167). A map from 1954 illustrates the roadways and railway lines in place at the time (Figure 8). Several railroad lines ran along the coast and inland in Wailua, while the line within Olohena passed just mauka of the current study lands before returning to the coastline in Waipouli. A secondary line from Kapaʻa ran southwest, ending not far to the northwest of the project area. The Lihue Plantation Co. switched entirely from rail transportation to trucking in 1959, the last sugar plantation in Hawaiʻi to do so.

The Coco Palms Resort

The Coco Palms Resort (Figures 9 and 10) is located just north of the Wailua River mouth, less than 0.5 miles from the current study area, at the site of Debora Kapule's former residential complex. This is adjacent to the southern half of the current project area, off of the highway at 4-241 Kūhiō Highway. Around the mid-1890s, Ernst Lindeman leased the LCA parcel awarded to Kapule to start a coconut plantation for harvesting copra. Though the operation was unsuccessful, Lindeman is responsible for planting 2,000 nuts from Samoa, which would become the famous coconut tree grove the Coco Palms Resort was named for. He also built a plantation lodge on the property.

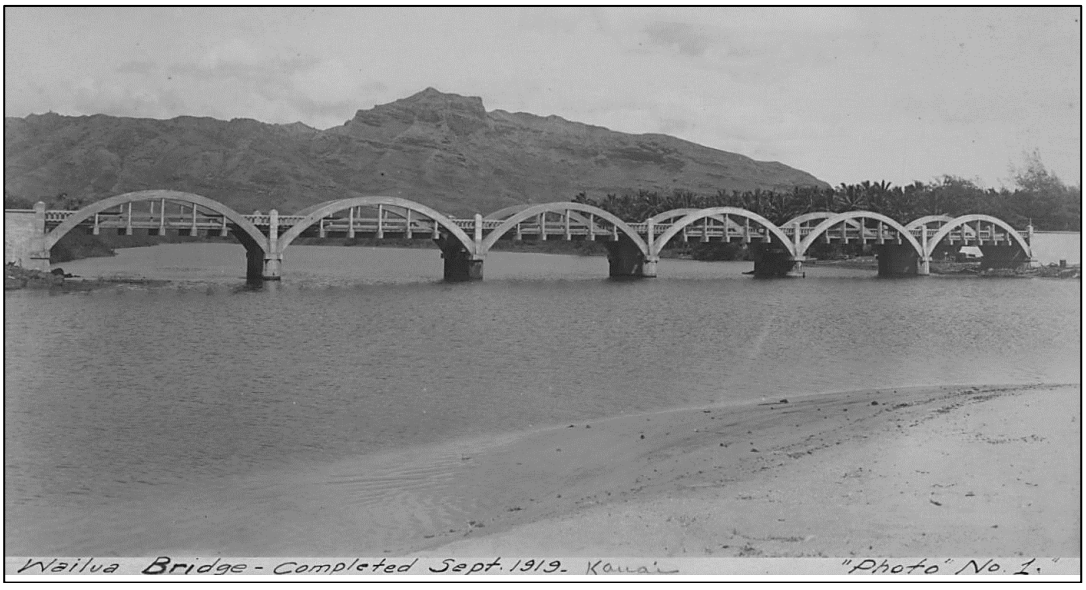


Figure 7. Photograph of the Wailua Concrete Arch Bridge, completed in 1919 (Hawaiʻi State Archives n.d.).



Figure 8. USGS map showing roads, landmarks, and railroad lines (USGS 1954).



Figure 9. Photograph of the Coco Palms sign and property in 1958 showing the railroad tracks, sign, and a rock wall in the foreground and the coconut grove and buildings in the background (in Hammatt 2017:37).



Figure 10. Ruins of the historic Coco Palms resort, facing north (Keala Pono 3/8/21). In the center left of the photo at the clump of coconut trees is the reinterment site for the Coco Palms burials (see Previous Archaeology section).

In the 1950s, tourists to Hawai‘i were just beginning to venture to Kaua‘i and the tourism industry was starting to take off. Lyle and Grace Guslander purchased the plantation from Lindeman in 1952 and converted the lodge into a small hotel with 24 rooms that opened the following year (Hammatt 2017). The Guslanders improved and expanded the hotel into a large and very popular 416-room resort. Many notable guests and celebrities such as Duke Kahanamoku, Rita Hayworth, Elvis Presly, and Frank Sinatra stayed at the Coco Palms. The hotel was featured in several movies such as “South Pacific” and the 1961 hit “Blue Hawai‘i,” where Elvis rode a canoe in the resort’s lagoon. In 1992, the Category 4 hurricane, Iniki, hit Hawai‘i with winds up to 145 mph and devastated the Coco Palms Resort buildings and grounds. The hotel has since stood empty, despite having changed hands multiple times.

While not a town with major development, many of the roads and subdivisions seen today in Wailua and Kapa‘a were in place by the mid- to late-20th century. A USGS map from the early 1960s shows the development in the area such as the Wailua House Lots (Wailua Homesteads), Kūhiō Highway, Papaloa Road, Kapa‘a Bypass Road, and an extension connecting the Kapa‘a Bypass Road to Haleilio Road (Figure 11). Several cultural and historical locations are also labeled nearby including Alakukui Point, the birthing stone, Malae Heiau, Hauola City of Refuge, Hikina o ka lā Heiau and a cemetery on the north bank of Wailua River. The buildings and lagoons of the Coco Palms Resort are also depicted. At this time, just a few structures are seen makai of the project area, with a few homes also in the coastal region near the boundary of Olohena and Wailua Ahupua‘a.

Today, this region is a major tourist destination on Kaua‘i. Since the construction of the airport not far away in Līhu‘e, the island sees many visitors from the other Hawaiian islands, across the U.S., and overseas. One of the main points of interest that draws tourists to the area is Wailua State Park with its waterfalls, kayaking, and river tours. Fans of Elvis Presley often make the journey to visit the remnants of the Coco Palms Resort, and the coastline is dotted with hotels and condominiums for overnight stays. Although the sugar industry in Hawai‘i has closed down completely, evidence of Wailua and South Olohena’s plantation past is still apparent.

Previous Archaeology

Previous archaeological studies offer significant information on traditional and historic land use. Several archaeological projects have been conducted within and near the current study lands (Figure 12 and Table 1). Archaeological sites in the vicinity with known locations are shown in Figure 13; State Inventory of Historic Places (SIHP) numbers are prefixed with 50-30-08 unless otherwise specified (Table 2). The following discussion summarizes the findings of archaeological studies within approximately 0.5 km of the subject property, based on reports found at the SHPD library in Kapolei, Hawai‘i.

The earliest archaeological survey on Kaua‘i is an island-wide study that documented Kukui Heiau in South Olohena Ahupua‘a, however it was recorded with the sites in Wailua (Bennett 1931). Kukui Heiau (SIHP 50-30-08-00108) is described as follows:

> **Kukui Heiau (Site 108)**
>
> Kukui heiau, on the shore north of Wailua River on a point named Lae Alakukui. This structure is a walled heiau of two divisions apparently an inclosure (sic) within an inclosure (sic). The walls are much reduced in size by the removal of rocks. The entire east end can only be determined by traces of the old walls on the inside. Remains of the walls of the eastern division indicate them to have had an original width of about 5 feet on all sides. The west end wall of this section is missing, though a stone or two indicates that it was there at one time. The house site and small wall built out to the west are probably later additions. The outer walls of this section are very thick, and apparently continue to include the east division, thus leaving a passageway 4 feet wide between the outside of the east section wall and the inside of the thick wall.



Figure 11. USGS map showing roads, landmarks, and important cultural sites (USGS 1963).

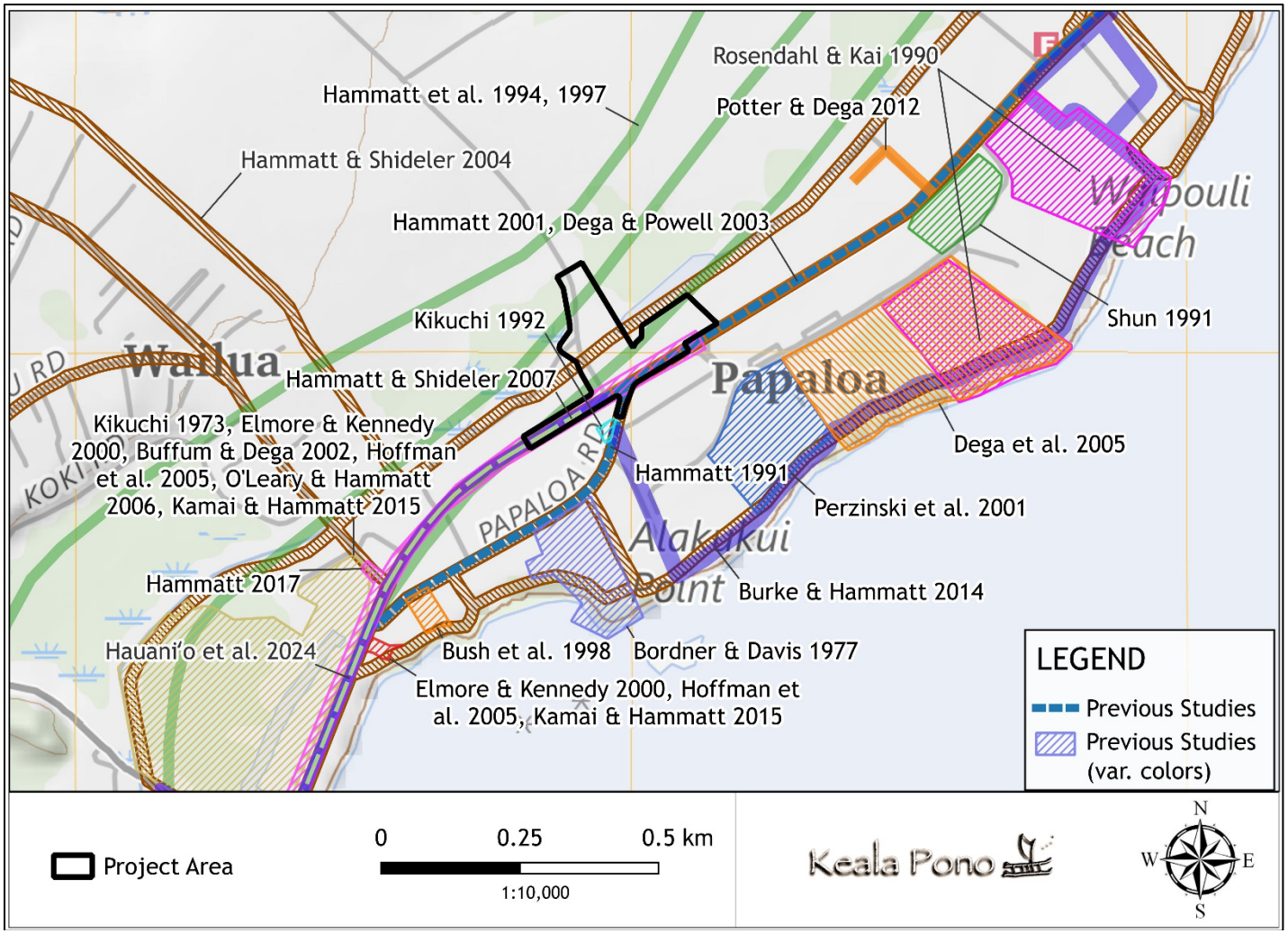


Figure 12. Previous archaeological studies within approximately 0.5 km of the project area.

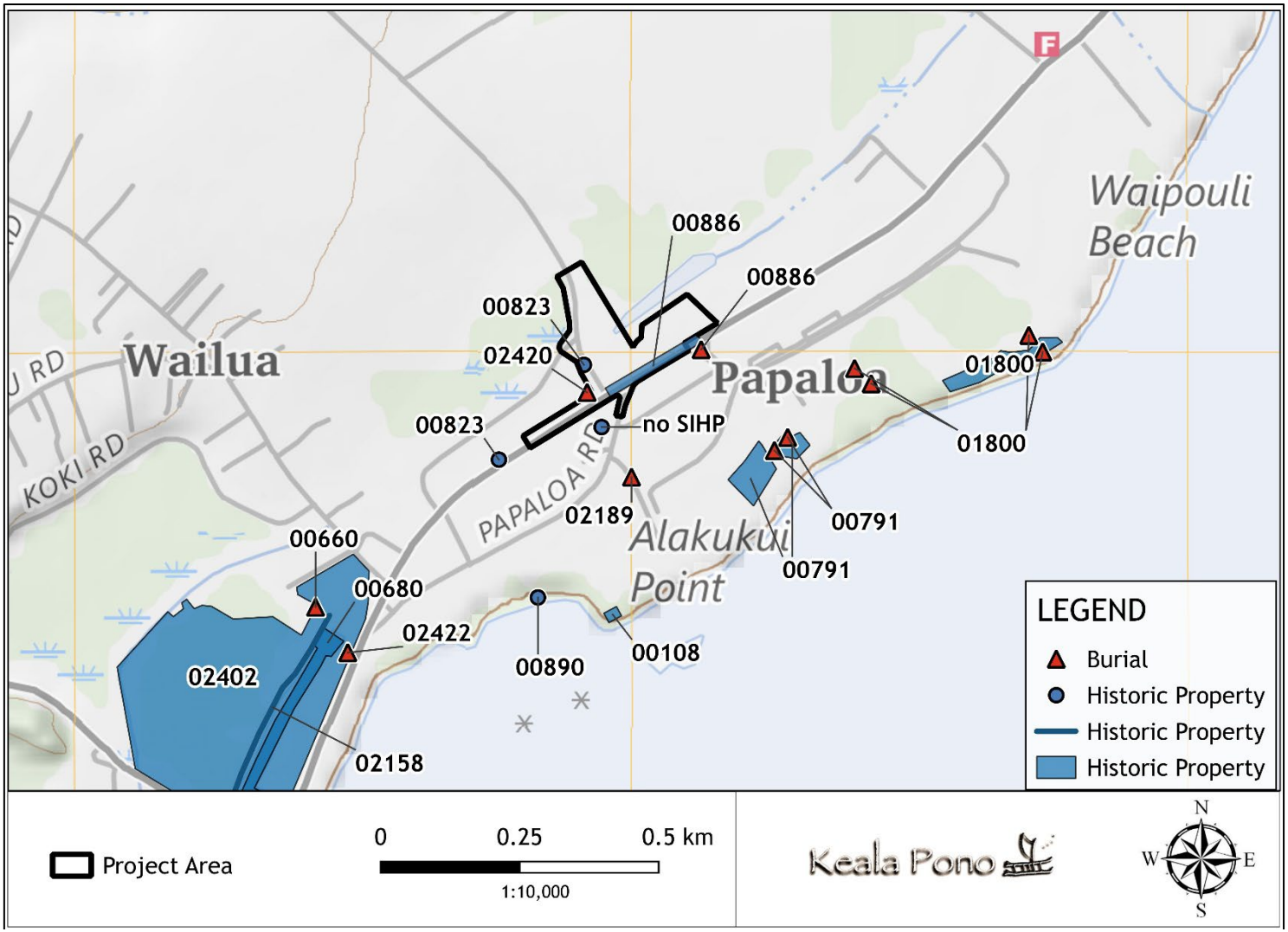


Figure 13. Previously recorded archaeological sites within 0.5 km of the project area with known locations. SIHP numbers are prefixed with 50-30-08.

Table 1. Previous Archaeological Studies in the Vicinity of the Project Area

Author/Year	Location	Work Completed	Findings
Bennett 1931	Island-wide	Archaeological Survey of Kaua‘i	Documented Kukui Heiau (SIHP 00108) in the vicinity of the current project area.
Kikuchi 1973	Coco Palms	Burial Report	Documented a burial ground; however this is not within 0.5 km of the current project area.
Bordner & Davis 1977	Kukui Heiau	Archaeological Investigation	Recorded the previously identified Kukui Heiau (SIHP 00108). No new historic properties identified.
Rosendahl & Kai 1990	Coastal area between Papaloa and Waipouli	Archaeological Inventory Survey	Recorded two cultural layers and three human burials (SIHP 01800) within 0.5 km of the current project area as well as cultural layers and burials not near the project area.
Shun 1991	Makai and just north of Aleka Lp.	Subsurface Testing	No historic properties identified.
Hammatt 1991	Kūhiō Hwy.	Subsurface Testing	No historic properties identified.
Kikuchi 1992	Papaloa Tract	Archaeological Inventory Survey	Identified three imu with blackened pipipi shell midden. No SIHP number was assigned.
Hammatt et al. 1994	Kūhiō Bypass Options	Literature Review and Archaeological Assessment	Noted the Coco Palms Resort (SIHP 02402) as well as two other sites that are not near the current project area.
Hammatt et al. 1997	Kūhiō Bypass Options	Archaeological Inventory Survey	Identified two sites not near the project area. Recommended archaeological monitoring near Wailua River and the Coco Palms Resort.
Bush et al. 1998	Makai of Papaloa Rd.	Archaeological Inventory Survey	No historic properties identified.
Elmore & Kennedy 2000	Coco Palms	Burial Report	Recorded a human burial (SIHP 00660) determined to be of Hawaiian ethnicity. Associated burial goods include glass beads and a coral abrader.
Perzinski et al. 2001	Makai of the south end of Aleka Lp.	Archaeological Monitoring	Documented a cultural layer, pit features, a hearth, and two human burials (SIHP 00791). Artifacts include fragmented fishhooks, cut shell, files, a coral manuport, and a fishhook preform.
Hammatt 2001	Kūhiō Hwy.	Archaeological Assessment	Determined that the current project area vicinity had a moderate potential for encountering subsurface historic properties due to the coastal region having high cultural use in traditional times and sandy soils.
Buffum & Dega 2002	Coco Palms	Archaeological Monitoring	Did not record any archaeological sites within 0.5 km of the current project area.
Dega & Powell 2003	Kūhiō Hwy.	Archaeological Monitoring	Documented SIHP 00886 (a hearth, ‘auwai, and iwi kūpuna) as well as several sites that are not near the current project area.

Table 1. (continued)

Author/Year	Location	Work Completed	Findings
Hammatt & Shideler 2004	Lydgate to Kapa‘a Bike and Pedestrian Paths	Archaeological Assessment	Documented a Railroad Culvert (SIHP 00823) and grinding stones (SIHP 00890) within 0.5 km of the current project area.
Hoffman et al. 2005	Coco Palms	Archaeological Inventory Survey	Identified two of Debora Kupule’s historic fishponds (SIHP 00680).
Dega et al. 2005	Makai of Aleka Lp.	Archaeological Inventory Survey	Did not record any archaeological sites within 0.5 km of the current project area.
O’Leary & Hammatt 2006	Coco Palms	Archaeological Inventory Survey Addendum	No new historic properties identified.
Hammatt & Shideler 2007	Kūhiō Hwy.	Archaeological Assessment	Did not record any archaeological sites within 0.5 km of the current project area.
Potter & Dega 2012	Fernandes and Lunalilo Rd.	Archaeological Inventory Survey	No historic properties identified.
Burke & Hammatt 2014	Alakukui Point to Waipouli	Archaeological Inventory Survey	Identified previously recorded cultural layers including SIHP 00791 and 01800, the latter of which included human burials. Also identified SIHP 02189, a partial human burial.
Kamai & Hammatt 2015	Coco Palms	Burial Site Component of an Archaeological Data Recovery Plan	Documented inadvertently discovered human skeletal fragments that were reburied in a burial platform in the Hawaiian Garden. The discovery was not near the current study area.
Hammatt 2017	Current Project	Archaeological Inventory Survey	Recorded one previously identified site (SIHP 00823) and a newly recorded ‘auwai (SIHP 02158) near the current project area. The historic ‘auwai runs through the Coco Palms Resort with a culvert at Kuamoʻo Road.
Hauaniʻo et al. 2024	Kūhiō Hwy.	Archaeological Monitoring	Identified three human burials, two of which are within 0.5 km of the current project area (SIHP 02420 and 2422) and a segment of the previously documented AT&R railroad (SIHP 00823).

Table 2. Known Archaeological Sites Within 0.5 km of the Project Area

SIHP 50-30-08-	Description	Author/Year
00108	Kukui Heiau	Bennett 1931; Bordner & Davis 1977
00660	Human burial	Elmore & Kennedy 2000
00680	Two of Debora Kupule's historic fishponds	Hoffman et al. 2005
00791	Cultural layer, pit features, a hearth, and two human burials	Perzinski et al. 2001; Burke & Hammatt 2014
00823	AT&R railroad bed	Hammatt & Shideler 2024; Hammatt 2017; Hauani'o et al. 2024
00886	Hearth, 'auwai, and human skeletal remains	Dega & Powell 2003
00890	Grinding stones	Hammatt & Shideler 2004
01800	Two cultural layers and three human burials	Rosendahl & Kai 1990; Burke & Hammatt 2014
02158	Post-contact 'auwai	Hammatt 2017
02189	Human burial	Burke and Hammatt 2014
02402	Coco Palms Resort	Hammatt et al. 1994
02420	Human burial	Hauani'o et al. 2024
02422	Human burial	Hauani'o et al. 2024
No SIHP	Three imu	Kikuchi 1992

> The thick north wall measures 11 feet across and is apparently in two steps of 6 feet and 5 feet respectively. The sea wall is 16 feet to 22 feet across, and is built up in tiers of great slabs of lava set on edge and filled around with smaller stone…On the north side of the north passageway the wall is made of 3 to 5-foot flat stones on edge, and the same was true of the south passageway…Today there is no paving, but Thrum says that there was one. (Bennett 1931:127)

The Coco Palms Resort (SIHP 50-30-08-02402) has been a focal point for archaeological studies in the greater area. Prior to any formal studies, an unknown number of human burials were found during initial construction of the hotel. The remains were reinterred at the front of the hotel near Kūhiō Highway (see Figure 10). Additional human remains were inadvertently encountered in sandy deposits during construction of a new wing of the hotel (Kikuchi 1973). In total, 34 individuals were recorded, however it is noted in later reports that the number could be as high as 85 individuals (e.g., Hoffman et al. 2005:26). The 1973 burials were reinterred with the earlier remains and marked with a boulder and plaque at the front of the hotel grounds. The burial ground is more than 0.5 km away from the current project area. During excavations of contaminated material near a diesel tank, human remains were again encountered (Elmore and Kennedy 2000). The burial (SIHP 50-30-08-00660) was discovered in sand deposits with glass beads and a coral abrader and was determined to be of Hawaiian ethnicity. The remains were reinterred in a burial platform at the north end of the property.

Installation of a perimeter fence encircling the Coco Palms property in 2002 required archaeological monitoring (Buffum and Dega 2002). A cultural layer was documented on the west side of the property, not in the vicinity of the current project area. Three years later, a series of 86 test trenches were excavated at the resort as part of an archaeological inventory survey (Hoffman et al. 2005). Two new sites were identified consisting of the remains of Debora Kapule's two historic fishponds listed under SIHP 50-30-08-00680 and considered significant under Criterion B. In 2006 an additional 13 trenches were excavated near the tennis courts as part of an archaeological inventory survey addendum to the Hoffman et al. study (O'Leary and Hammatt 2006). No new historic properties were identified. The most recent study at the Coco Palms Resort in 2015 inadvertently discovered human skeletal fragments during ground disturbance for the construction of dust fence postholes not in the vicinity of the current study area (Kamai and Hammatt 2015). The human remains were reburied in a burial platform located within the Hawaiian Garden to the west of Queen's Hall.

An archaeological inventory survey of two coastal parcels between Papaloa and Waipouli identified two cultural layers and three human burials (SIHP 50-30-08-01800) within 0.5 km of the current project area (Rosendahl and Kai 1990). One of the SIHP 01800 cultural layers consisted of shell midden, fish bone, charcoal fragments, ash, fire-cracked rock, pit features, and historic artifacts (ceramic sherds and glass shards), while the second cultural layer included much of the same material as well as flaked stone, modified bone, and cut shell. The three burials were found within the cultural layer near the shoreline and left in place. The site was interpreted as a recreation area or a place used for social gatherings. Radiocarbon analysis dated the site to AD 1270–1954, with volcanic glass hydration rind dating to between AD 1496–1556 (Rosendahl and Kai 1990:13).

Construction of a proposed dental office on Papaloa Road, very close the current study area, required an archaeological inventory survey (Kikuchi 1992). Five mechanically-excavated test pits were dug, which identified three shallow imu in the mauka portion of the parcel. Cooking stones and blackened pipipi shell midden was also observed. No SIHP number was designated. It was noted that the entire area was graded and used as a horse racing track, and then as an encampment during World War II.

In 1994, an archaeological literature review and assessment was completed for three routes to circumvent Kapaʻa Town for the Kūhiō Highway Bypass project (Hammatt et al. 1994). Archival research found no known archaeological sites located within the three alternate routes, however places of concern included the Wailua Complex of Heiau, possible human burials near the Wailua Golf Course and the Coco Palms Resort, as well as sites associated with former marshland areas. This work was followed by an archaeological inventory survey of the same three bypass options, which included core sampling and backhoe test trenches (Hammatt et al. 1997). The study documented two sites, a terrace possibly from the historic era and the Wailua wetland. Neither site is in proximity to the current project area.

During archaeological monitoring makai of Aleka Loop in South Olohena Ahupuaʻa, a cultural layer and two burials were identified and designated as SIHP 50-30-08-00791 (Perzinski et al. 2001). One human burial was in situ, while the second consisted of isolated remains. The cultural layer was comprised of pits, hearths, and a marine midden concentration. Artifacts recovered were fishhook fragments, cut shell, a sea urchin spine file, a coral file, a coral manuport, and a fragmented fishhook preform. Radiocarbon analysis dated the site to AD 1275–1645 and it was concluded that Site 00791 was possibly the location of an eating house or other structure.

An initial archaeological assessment was performed for a fiber optic cable project which spanned roughly 51 miles (82 km) of roads between Kekaha and Moloaʻa (Hammatt 2001). The study covered a 17-mile (27.4 km) portion of Kūhiō Highway from Līhuʻe to Moloaʻa, which included a portion of the current project area. The section encompassing the current study area, from Haleʻīlio Road to Waipouli Stream, was categorized as having moderate potential for encountering subsurface historic properties due to the coastal region exhibiting high cultural use and sandy soils. The assessment was followed by

archaeological monitoring for Phase I of the project, broken up into 10 segments from Moloaʻa to Anahola (Dega and Powell 2003). Of the 10 project segments, cultural deposits and/or human burials were encountered in five segments, with 10 archaeological sites documented, of which seven were previously identified. Within 0.5 km of the current project area, SIHP 50-30-08-00886 was recorded, consisting of a hearth, ʻauwai, and iwi kūpuna.

An archaeological assessment of a large area extended 1 km inland from the coast and from "Lydgate Park on the south side of the Wailua River mouth through Kapaʻa Town on the north" (Hammatt and Shideler 2004:1). A railroad culvert (SIHP 50-30-08-00823) and grinding stones (SIHP 50-30-08-00890) were identified within 0.5 km of the current project area. SIHP 00823 was composed of a stone and concrete culvert, SIHP 00890 includes "several large basalt boulders with both linear and circular worn depressions" (Hammatt and Shideler 2004:83).

Makai of Aleka Loop on a 20.81-acre parcel, an archaeological inventory survey identified additional features of a previously identified site not near the current project area (Dega et al. 2005). No archaeological sites were found within 0.5 km of the current project area.

In 2007, an archaeological inventory survey that included ten test trenches was performed between Kuamoʻo Road and the Kapaʻa Temporary Bypass Road, which includes the current project area (Hammatt and Shideler 2007). This study did not record any archaeological sites within 0.5 km of the current project area.

An archaeological inventory survey was conducted for an 8.6-acre area for a proposed bike and pedestrian path from Alakukui Point to Waipouli (Burke and Hammatt 2014). Two new archaeological sites were documented, both of which were human burials, however only one of these is within 0.5 km of the current project area (SIHP 50-30-08-02189). SIHP 02198 is just makai of the study lands within a parking lot off of Papaloa Road. The SIHP 02189 burial was previously disturbed by excavations for an old utility line. The partial human burial was encountered at 50 cm below surface (cmbs) and appeared to be a single adult from the pre-contact to early post-contact period. In addition to the burials, several cultural layers were observed and added to pre-existing site numbers depending on the location. Of these, SIHP 00791 and 01800 are within 0.5 km of the current project area.

In 2017, an archaeological inventory survey was completed for the current Kūhiō Highway Short-Term Improvements Project (Hammatt 2017). Three previously identified historic properties and one new archaeological site were documented. SIHP 50-30-08-02158 is a newly recorded post-contact ʻauwai measuring approximately 150 m that drains water from the Coco Palms Resort fishponds (SIHP 00680) into the Wailua River, intersecting Kuamoʻo Road. The ʻauwai is lined with three to four courses of basalt cobbles and boulders and has a concrete culvert at Kuamoʻo Road. It was evaluated as significant under Criteria A, D, and E and deemed to be eligible for inclusion on the Hawaiʻi and National Historic Registers. The previously documented sites are SIHP 00823, a portion of the AT&R railroad bed; and two cultural layers not in the vicinity of the current project area. Hammatt noted that "there was often little or no development of a railroad berm so that little trace would be expected to remain after the railroad rail sections and railroad ties were removed," which was probably the case when constructing Kūhiō Highway.

Archaeological monitoring was required for the Kūhiō Highway Short Term Improvements Project from Kuamoʻo Road to the Temporary Kapaʻa Bypass Road (Hauaniʻo et al. 2024). Two human burials were identified within 0.5 km of the current project area, one near the Coco Palms Resort (SIHP 50-80-08-02422), and the other at the boundary of the current project area (SIHP 50-80-08-02420) (see Figure 13). These two are in situ burials that were left in place. Also found was a segment of the previously documented AT&R railroad (SIHP 00823). A total of 67 artifacts and one dog bone were collected throughout the course of the monitoring, none of which were associated with the burials. Historic artifacts

consist of 38 glass bottles, four other glass items, one fragmented ceramic insulator, five miscellaneous items, and 19 metal pieces. The bottles range in age from 1932 to post-1960 and were mostly recreational beverages, in the form of soda and alcohol bottles. Many of the sodas were filled at soda works on Kauaʻi. Two traditional artifacts were a stirrup poi pounder and a cowry lūheʻe lure.

Several studies produced no new findings and did not encounter any historic properties. These include an archaeological investigation at Kukui Heiau (Bordner and Davis 1977), subsurface testing north of Aleka Loop (Shun 1991), subsurface testing on Kūhiō Highway (Hammatt 1991), an archaeological inventory survey makai of Papaloa Road (Bush et al. 1998), and an archaeological inventory survey at Fernandes and Lunalilo Roads (Potter and Dega 2012).

Summary of Background Research

The Puna district of Kauaʻi is thought to have been settled around AD 1000–1100 and the region from Kapaʻa to Wailua was said to be a dense population center. Pre-contact use of Olohena Ahupuaʻa would have centered around cultivation at the nearby Wailua River valley and floodplain. This was supplemented by marine and inland terrestrial resources. People traveled between the neighboring ahupuaʻa using the inland or coastal trail that passed through the district. Several prominent heiau are noted for the greater region, with Olohena known for a navigational heiau that was utilized in traditional times. Olohena was also known for Halepaiwi, where games of riddles were played and for the Sleeping Giant of Nounou Mountain.

The historic era saw widespread changes as early sugar plantations were established in the region. The Lihue Plantation Co. had interests in South Olohena and Grove Farm Plantation, Kealia Plantation, and Hui Kawaihai had operations nearby. Sugarcane and rice cultivation drastically changed the landscape and livelihood of residents, with a decline in the cultivation of native crops and the eventual conversion of many fallow loʻi into rice paddies. To support their operations, the plantations built many miles of ditches, irrigation systems, railroads, access roads, and mills to process the sugarcane. The AT&R constructed the Wailua Railroad Bridge, which allowed freight cars to cross the Wailua River. Roads were later established in place of railroad transportation to connect different parts of the island. Not far from the project area, the Coco Palms Resort was established in 1952 at the location of Debora Kapule's estate and subsequently closed down due to extensive hurricane damage in 1992.

Previous archaeological studies have recorded several historic properties in the project vicinity, although none have been found within the project area. However one human burial was found at the project area boundary (SIHP 02420). Other known historic properties in the vicinity include Kukui Heiau, a hearth, grinding stones, Debora Kupule's historic fishponds, the AT&R railroad bed, post-contact ʻauwai, imu, and historic structures of the Coco Palms Resort. A number of cultural layers and other iwi kūpuna burial sites have been found throughout the region and also near the project lands.

FIELD INSPECTION

A field visit was conducted on December 17, 2024 by Keala Pono archaeologists Tiffany Brown, BA and Jacob Flores, BA. The project area was walked to determine if there are any surface archaeological remains present and which areas of the property might have a likelihood of supporting archaeological features. One archaeological site with a total of 13 possible features was identified during the field inspection and each feature was given a temporary feature number (Figure 14 and Table 3). Note that all photos in this chapter were taken on December 17, 2024 and the red and white scale in all field photographs is marked in 10 cm increments. A sub-meter accurate Trimble DA2 receiver was used to collect GPS data.

The project area includes an equestrian and therapeutic riding center called Healing Horses Kauai (Figure 15), which is comprised of a tall grass field (Figure 16), two short grass horse pastures located to the northeast of the field (Figures 17 and 18), a dirt horse corral with sparse short grass to the north of the field (Figure 19), and two dirt riding trails, one southeast of the corral (Figure 20) and one along the northwest side of the pastures (Figure 21). The pastures are separated from the corral by a narrow, moderately dense forested area. The forest continues west of the corral until it meets Kapaʻa Bypass Road. The portion of Kapaʻa Bypass Road that runs along the Healing Horses property boundary is also within the project area, including the gravel shoulder located to the west of the bypass and a thin perimeter of forest along the western length of the bypass (Figure 22). The project area also extends southwestward, encompassing approximately 150 m (500 ft.) of Kūhiō Highway and a narrow perimeter of forest along the northwestern side of the highway (Figure 23). The project area also extends approximately 160 m (530 ft.) northeastward from the Kapaʻa Bypass down Kūhiō Highway (Figure 24) and includes roughly 45 m (150 ft.) of Papaloa Road (Figure 25), which is located across the highway from the entry to the Kapaʻa Bypass.

Grass and shrubs separate the southeast perimeter of the field and two pastures from Kūhiō Highway. A large, possibly historic concrete foundation extends through the tall grass field (Feature 1, Figure 26). Approximately 180 m (590 ft.) northeast of the foundation, along the Kūhiō Highway boundary, is a possibly historic basalt boulder alignment (Feature 2, Figure 27). Within the narrow forest which separates the pastures from the corral is a possibly historic v-lock concrete block (Feature 3, Figure 28). Roughly 25 m (82 ft.) southwest of the concrete block is a large, historic, oxidized iron railroad plate (Feature 4, Figure 29). The area separating the corral from Kapaʻa Bypass Road is a narrow strip of forest that is lined with tall grass, small palm trees, and other plants (Figure 30).

Across Kapaʻa Bypass Road, a modern wire fence meanders along the northern half of the gravel shoulder and along the forest, effectively separating the forest from the road. Behind the northernmost end of the wire fence, the terrain descends and becomes a steep cliffside which is held in place by a possibly historic basalt and mortar wall attached to a concrete wall (Feature 5, Figure 31). Southward, directly north of the shoulder, approximately 10 m (32 ft.) into the forest, are two possibly historic side by side wooden posts (Feature 6, Figure 32). Roughly 10 m (32 ft.) west of the center of the shoulder is a possibly historic wooden post protruding from the ground within the forest (Feature 7, Figure 33). Roughly 15 m (50 ft.) southeast of this is a portion of a possibly historic concrete post with a modern wire and metal fence attached to it (Feature 8, Figure 34). To the immediate southeast of the wooden post is a large, possibly historic concrete footing with two wooden posts attached to it with wire (Feature 9, Figure 35). Approximately 10 m (32 ft.) southeast of this large footing is a historic railroad track embedded within a concrete block (Feature 10, Figure 36). Farther southeastward, a possibly historic wire fence is attached to the tree line along the border between the forest and Kapaʻa Bypass Road. The wire fencing stretches southward for roughly 40 m (130 ft.), including a break in the fence. On the southern portion of the fence is a section which has a railroad track leaning against it (Feature 11, Figure 37).

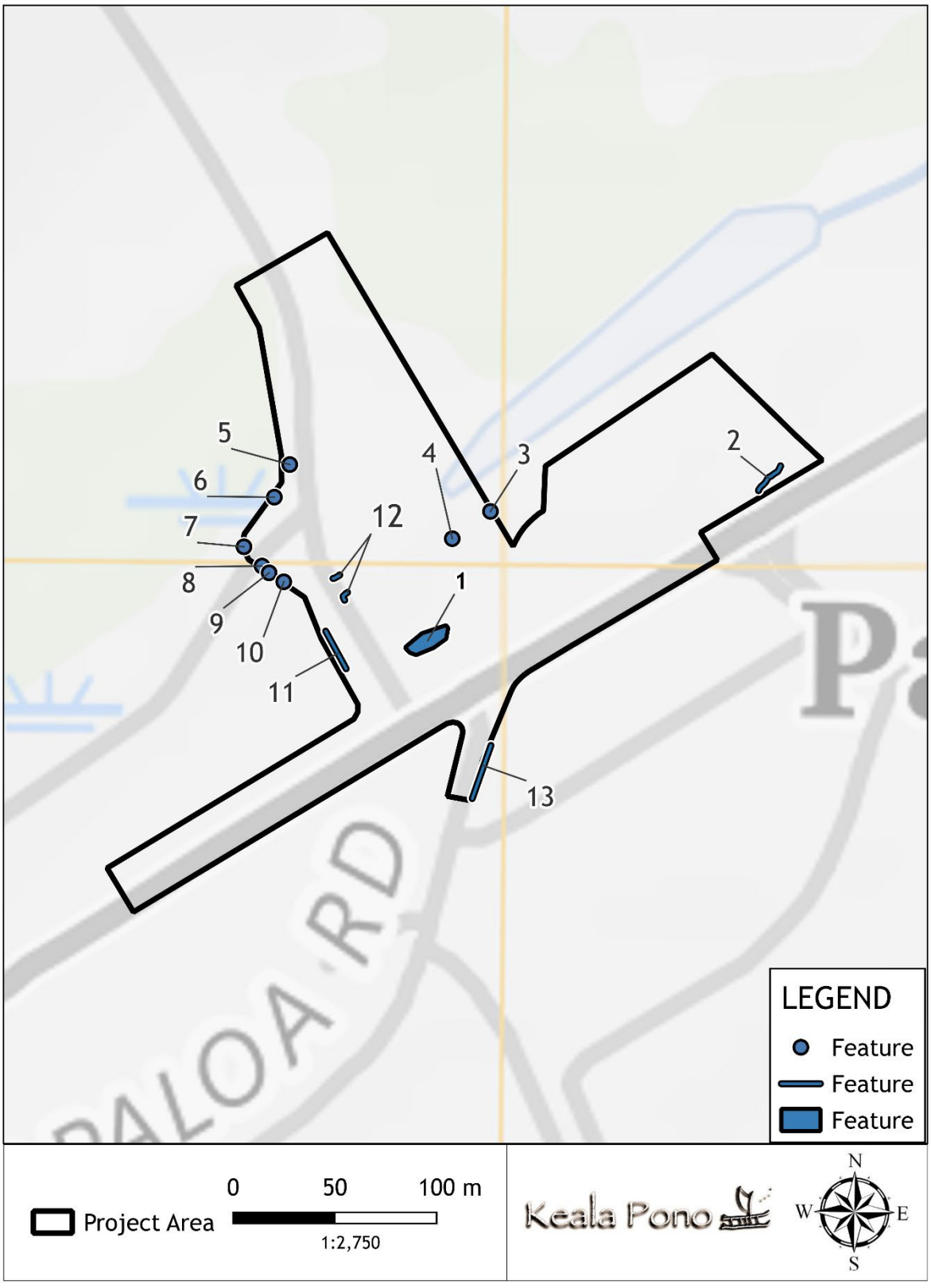


Figure 14. Location of possible archaeological features identified during the field inspection.

Table 3. Possible Archaeological Features Identified During the Field Inspection

Temporary Feature #	Location	Description	Age
1	Tall grass field	Concrete foundation	Possibly historic
2	Along Kuhio Hwy.	Boulder alignment	Possibly historic
3	Between pastures and corral	v-lock concrete block	Possibly historic
4	Between pastures and corral	Iron railroad plate	Historic
5	Cliffside across Kapa‘a Bypass Rd.	Mortared rock wall with attached concrete wall	Possibly historic
6	North of the Kapa‘a Bypass Rd. shoulder	Two wooden posts	Possibly historic
7	West of the Kapa‘a Bypass Rd. shoulder	Wooden post	Possibly historic
8	Southwest of the Kapa‘a Bypass Rd. shoulder	Concrete post	Possibly historic
9	Southwest of the Kapa‘a Bypass Rd. shoulder	Concrete footing with two wooden posts	Possibly historic
10	Southwest of the Kapa‘a Bypass Rd. shoulder	Railroad track within a concrete block	Historic
11	West of Kapa‘a Bypass Rd.	Railroad track and fence	Historic (track); Possibly historic (fence)
12	Entrance of Healing Horses	Mortared rock culvert	Possibly historic
13	Papaloa Rd.	Concrete sidewalk	Possibly historic

A possibly historic basalt boulder and mortar culvert runs beneath the entrance of Healing Horses Kauai, with one end at the northwest side of the entranceway (Feature 12, Figure 38) and one end at the northeast side of the entranceway (Figure 39).

Across Kūhiō Highway is Papaloa Road. The road is paved and has short grass along both its east and west sides. A possibly historic concrete sidewalk (Feature 13, Figure 40) runs along its eastern side; however, only the southernmost end of the sidewalk is within the project area.

In sum, the project area is a mostly built and landscaped environment with minimal to moderate forestation. No traditional surface archaeological features were identified; however, three historic and several possibly historic features were found, and they can be considered part of one historic infrastructure site. The exact age of the possibly historic features is undetermined and it is therefore unclear if they are more than 50 years old. Due to the historic and modern use of the property, it is unlikely that any traditional surface archaeological features remain. It is possible that subsurface features have survived the more recent disturbances. The integrity and significance of the site is evaluated in the following chapter.



Figure 15. Healing Horses Kaua‘i, facing north.



Figure 16. Tall grass field, facing east.



Figure 17. Southwest horse pasture, facing east.



Figure 18. Northeast horse pasture, facing south.



Figure 19. Dirt horse corral, facing north.



Figure 20. Corral riding trail, facing east-northeast.



Figure 21. Pasture riding trail, facing southwest.



Figure 22. Kapa‘a Bypass Road and dirt shoulder, facing north.



Figure 23. Kūhiō Highway, facing west-southwest.



Figure 24. Kūhiō Highway, facing northeast.



Figure 25. Papaloa Road, facing south-southwest.



Figure 26. Feature 1, a possibly historic concrete foundation, facing east.



Figure 27. Feature 2, a possibly historic boulder alignment, facing east.



Figure 28. Feature 3, a possibly historic v-lock concrete block, facing east-southeast.



Figure 29. Feature 4, a historic iron railroad plate, facing east-southeast.



Figure 30. Vegetation separating the corral area from Kapa‘a Bypass Road, facing northwest.



Figure 31. Feature 5, a possibly historic stone and mortar wall attached to a concrete wall, facing east-southeast.



Figure 32. Feature 6, two possibly historic wooden posts, facing northwest.



Figure 33. Feature 7, a possibly historic wooden post, facing north-northwest.



Figure 34. Feature 8, a possibly historic concrete post with modern wire fence attached, facing east-northeast.



Figure 35. Feature 9, a possibly historic concrete footing with two wooden posts, facing south-southwest.



Figure 36. Feature 10, a historic railroad track embedded in a concrete block, facing east.



Figure 37. Feature 11, a possibly historic wooden post and wire fence with a historic railroad track leaning against it, facing south.



Figure 38. The northwest end of Feature 12, a possibly historic boulder and mortar culvert, facing east.



Figure 39. The northeast end of Feature 12, a possibly historic basalt boulder and mortar culvert, facing north.



Figure 40. Feature 13, a possibly historic concrete sidewalk along Papaloa Road, facing south.

ASSESSMENT AND RECOMMENDATIONS

An archaeological literature review and field inspection was conducted in advance of proposed ground disturbing activities associated with the Kūhiō Highway Roundabout Project in South Olohena Ahupuaʻa in Puna District, on the island of Kauaʻi, Hawaiʻi. This is located on portions of TMKs: (4) 4-3-001:009, 999; 4-3-010:001, 005; and 4-3-002:999 within and adjacent to the Kūhiō Highway ROW. Several implications pertaining to the study area can be made based on the findings presented above. A brief field inspection identified 13 features that might be more than 50 years old. Sites identified in the vicinity include human burials and cultural layers, Kukui Heiau, historic fishponds, the AT&R railroad bed, post-contact ʻauwai, the Coco Palms Resort, and imu. These findings suggest the likelihood that iwi kūpuna may remain in the study area and the potential for encountering subsurface historic properties is high. Key data summarized below include information concerning traditional and historic land use, LCA records, historic maps, the results of previous archaeological work, and the results of the field inspection.

The literature review, which consists of archival research, has identified the region as rich in natural resources such as fresh water, coastal flora and fauna, and bountiful fishing grounds in traditional times, and the area was known for being a dense population center. Pre-contact use of Olohena would have centered around cultivation at the nearby Wailua River valley and floodplain. This was supplemented by harvesting of marine and inland terrestrial resources. People traveled between the neighboring ahupuaʻa using the inland or coastal trail that passed through the district and possibly through the project area itself. Several prominent heiau are noted for the greater region, with Olohena known for a navigational heiau that was utilized in traditional times. Olohena was also known for Halepaiwi, where games of riddles were played and for the Sleeping Giant of Nounou Mountain. In the historic period, sugarcane and rice cultivation dominated the region, with the Ahukini Terminal and Railway Company (AT&R) providing transportation for these endeavors.

Results of Historical Research on Land Use

In the historic era, Olohena was heavily impacted by sugarcane and rice operations, which included extensive sugarcane fields and infrastructure such as the AT&R railroad. This new era saw a decline in the cultivation of kalo and the conversion of many unused loʻi into rice paddies. Railroad tracks and bridges, such as the Wailua Railroad Bridge, for transporting sugar and later, roads, were established to connect different parts of the island, and in the mid-20th century the Coco Palms Resort was built, which drew tourists to the region.

Results of Land Commission Awards Search

During the 1848 Māhele, the ahupuaʻa of South Olohena went to Rufus P. Spalding (Grant 5264) for use under the Lihue Planation Co. This award totaled approximately 419 acres. There were no LCA awards granted within the South Olohena Ahupuaʻa. Only one LCA was awarded in coastal North Olohena and it is not near the project area.

Evidence from Historic Maps

Historic maps indicate that Olohena was very slow to be developed compared to Wailua and Kapaʻa. Initial development in the ahupuaʻa centered on Kūhiō Highway, which provided easier access into this section of the island. The Kapaʻa Bypass Road and Papaloa Road are other main roadways in the area. Rice paddies were located near Wailua River and a large swamp was at Kapaʻa. The AT&R railroad line was shown on two maps, one placing it makai of the study lands and the other just mauka. An 1878 historic map places a trail or road crossing through the project area, although it is shown makai of the

project area on a 1900 map. The main geographical features of Olohena are Nounou Mountain and Alakukui Point.

Knowledge from Previous Archaeological Studies

Several archaeological studies have been conducted in the vicinity of the study lands. The earliest of these recorded a navigational heiau (Kukui Heiau) at Alakukui Point. At the Coco Palms Resort, historic fishponds, post-contact ʻauwai, and human burials were documented in addition to the Coco Palms historic structures themselves. Nearby a hearth, grinding stones, the AT&R railroad bed, and imu have been found. A number of human burials and cultural layers have been identified in the region, with several located in the vicinity of the project area and one at the project area boundary (SIHP 02420).

Results of the Field Inspection

The field inspection identified 13 surface archaeological features (one of the features includes two components) that are all part of a historic infrastructure site. None of the features are pre-contact in age and all are either historic or possibly historic. The exact age of the possibly historic features is undetermined and it is therefore unclear if they are more than 50 years old. Due to the extensive historic and modern use of the project area, it is unlikely that any traditional surface archaeological features remain. It is possible that subsurface features have survived the more recent disturbances.

Site Significance Assessment

A significance assessment for the historic infrastructure site found during the field inspection was conducted following the criteria established in HAR §13-284-6. Once a site is evaluated as "significant," and the SHPD concurs, this suggests it is eligible for listing on the Hawaiʻi Register of Historic Places (HRHP). To be considered significant under HRS §6E-42, a cultural resource must meet at least one of the five following criteria of significance:

(1) Criterion "a". Be associated with events that have made an important contribution to the broad patterns of our history;

(2) Criterion "b". Be associated with the lives of persons important in our past;

(3) Criterion "c". Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

(4) Criterion "d". Have yielded, or is likely to yield, information important for research on prehistory of history; or

(5) Criterion "e". Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

In addition to meeting one of these five criteria, a historic property must possess material integrity to be considered significant. The aspects of integrity are location, design, setting, materials, workmanship, feeling, and association. Location refers to the place where an event occurred or a property was constructed. Design considers elements such as plan, form, and style of a property. Setting is the physical environment of the property. Materials refer to the physical elements used to construct the property. Workmanship refers to the craftsmanship of the creators of a property. Feeling is the property's ability to

convey its historic time and place. Association refers to the link between the property and a historic event or person.

The historic infrastructure site found during the field inspection consists of 13 features, some of which retain integrity of location, design, materials, workmanship, and feeling. Most of the features are in their original location. The design, materials, workmanship, and feeling of two of the features is also evident, particularly Features 5 and 12, the mortared rock structures. None of the 13 features retain integrity of setting or association, as the surrounding historic sugarcane plantation landscape around which these features were once situated is no longer present. The site as a whole does retain integrity, and can be considered significant under criterion d, as it may yield important information about plantation-era infrastructure such as water control. Features 5 and 12 are contributing features to the integrity and significance of the site. The other features do not retain enough integrity to be considered significant.

Summary and Recommendations

While not as well documented as other ahupuaʻa in the region, Olohena was an area rich in natural resources, relying on the nearby Wailua River and fertile floodplain. The region from Kapaʻa to Wailua provided an abundance of resources needed for a dense population. The presence of the navigational Kukui Heiau attests to the area's significance. In the historic period, sugarcane and rice cultivation were established in Olohena, including a plantation within the study lands which was part of Rufus P. Spalding's extensive Grant 5264, used for the Lihue Planation Co. Several human burials and cultural layers have been documented in the coastal region nearby, as well as many other sites. Because of the density of archaeological remains in the area, including iwi kūpuna at the project area boundary, archaeological monitoring is recommended for project-related ground disturbance to identify and properly treat any historic properties encountered. An archaeological monitoring plan should be prepared and accepted by the SHPD before ground disturbance relating to the project is initiated.

GLOSSARY

ahupua‘a Traditional Hawaiian land division usually extending from the uplands to the sea.

ali‘i Chief, chiefess, monarch.

‘auwai Ditch, often for irrigated agriculture.

bermuda grass The grass *Cynodon dactylon*, originally from the Middle East. This fast growing species is often used for turf grass.

Guinea grass The invasive *Megathyrsus maximus*, also known as green panic grass.

guava The invasive tree or shrub *Psidium guajava*, which forms dense thickets in disturbed areas.

heiau Place of worship and ritual in traditional Hawai‘i.

imu Underground pit or oven used for cooking.

iwi Bone.

Java plum Introduced tree or shrub of the genus *Eugenia* or *Sygyzium*, common in dry to mesic forests.

joee The oī, or blue rattail (*Stachytarpheta dichotoma*), a shrub bearing flowers that are usually blue to violet in color. The shrub invades disturbed areas and was naturalized in Hawai‘i by the year 1871.

kalo The Polynesian-introduced *Colocasia esculenta*, or taro, the staple of the traditional Hawaiian diet.

kama‘āina Native-born.

kapu Taboo, prohibited, forbidden.

kiawe The algaroba tree, *Prosopis* sp., a legume from tropical America, first planted in 1828 in Hawai‘i.

kikuyu The introduced grass *Pennisetum clandestinum*.

kīpuka A change in form, such as an area of vegetation in a lava bed.

klu *Acacia farnesiana*, a small branching shrub that is a pest in pastures, possibly introduced to Hawai‘i in the 1900s for perfume.

koa *Acacia koa*, the largest of the native forest trees, prized for its wood, traditionally fashioned into canoes, surfboards, and calabashes.

koa haole The small tree *Leucaena glauca*, historically-introduced to Hawai‘i.

konohiki The overseer of an ahupua‘a ranked below a chief; land or fishing rights under control of the konohiki; such rights are sometimes called konohiki rights.

kukui The candlenut tree, or *Aleurites moluccana*, the nuts of which were eaten as a relish and used for lamp fuel in traditional times.

kuleana Right, title, property, portion, responsibility, jurisdiction, authority, interest, claim, ownership.

kupuna Grandparent, ancestor; kūpuna is the plural form.

lantana The historically introduced shrub, *Lantana camara*.

limu Refers to all sea plants, such as algae and edible seaweed.

loʻi, loʻi kalo An irrigated terrace or set of terraces for the cultivation of taro.

lūheʻe Octopus lure.

Māhele The 1848 division of land.

maile *Alyxia olivaeformis*, a fragrant native shrub used for twining.

makai Toward the sea.

mauka Inland, upland, toward the mountain.

midden A heap or stratum of refuse normally found on the site of an ancient settlement. In Hawaiʻi, the term generally refers to food remains, whether or not they appear as a heap or stratum.

mokihana The *Pelea anisate* tree known to grow only on the Island of Kauaʻi. The fragrant green berries are used in leis.

moku District, island.

molasses grass The invasive mat grass, *Melinis minutiflora*, a common forage plant for grazing animals.

moʻolelo A story, myth, history, tradition, legend, or record.

Napier grass The invasive *Pennisetum purpureum*, also known as bana grass, elephant grass, king grass, or cane grass.

niu The Polynesian-introduced tree *Cocos nucifera*, or coconut.

ʻōhiʻa lehua The native tree *Metrosideros polymorpha*, the wood of which was utilized for carving images, as temple posts and palisades, for canoe spreaders and gunwales, and in musical instruments.

ʻōlelo noʻeau Proverb, wise saying, traditional saying.

olonā The native plant *Touchardia latifolia*, traditionally used for making cordage.

pia The Polynesian arrowroot *Tacca leontopetaloides*, traditionally cultivated for food and medicine.

pipipi A marine shell, *Nerita picea*, common in the intertidal zone.

poi A staple of traditional Hawaiʻi, made of cooked and pounded taro mixed with water to form a paste.

poʻokanaka Heiau of human sacrifice; literally translates to human head.

post-contact After AD 1778 and the first written records of the Hawaiian Islands made by Captain James Cook and his crew.

puʻuhonua Place of refuge.

pre-contact Prior to AD 1778 and the first written records of the Hawaiian Islands made by Captain James Cook and his crew.

puʻu Hill, mound, peak.

sandalwood ʻIliahi (*Santalum*), several varieties endemic to Hawaiʻi. Known for their aromatic wood and medicinal qualities. Heavily exported in the 1800s.

sugarcane The Polynesian-introduced *Saccharum officinarum*, or kō, a large grass traditionally used as a sweetener and for black dye.

‘uala The sweet potato, or *Ipomoea batatas*, a Polynesian introduction.

‘ulu The Polynesian-introduced tree *Artocarpus altilis*, or breadfruit.

wauke The paper mulberry, or *Broussonetia papyrifera*, which was made into tapa cloth in traditional Hawai‘i.

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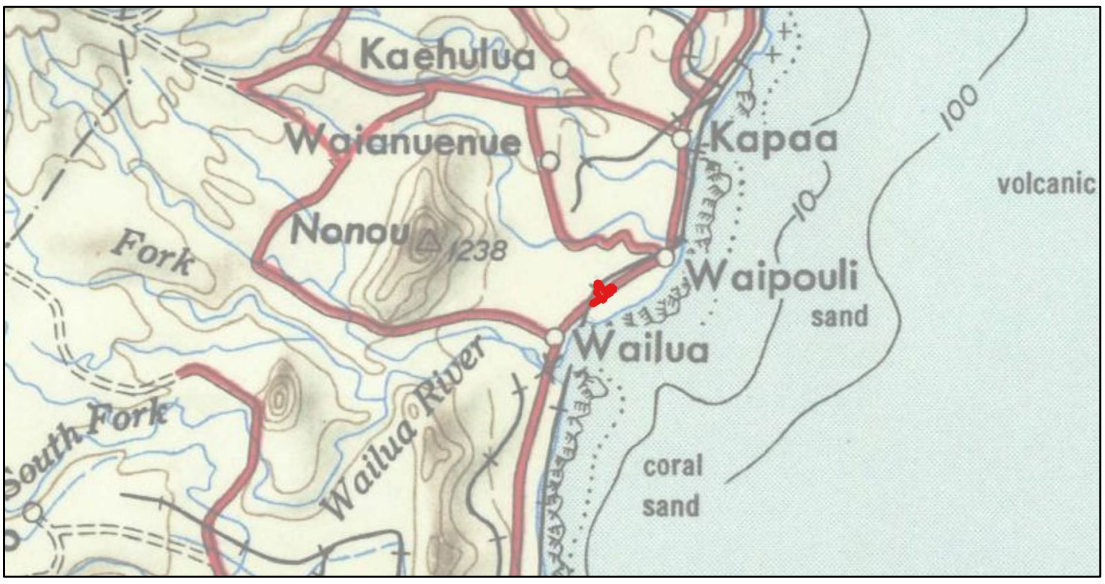
Appendix D Cultural Impact Assessment

DRAFT—Cultural Impact Assessment for the Kūhiō Highway, Intersection Improvements at Kapa‘a Bypass Road Project, South Olohena Ahupua‘a, Puna District, Island of Kaua‘i

TMKs: (4) 4-3-001:999; 4-3-010:001, 005; 4-3-002:999 por.



Prepared For:

Hawai‘i Department of Transportation
Kaua‘i District
1720 Haleukana St.
Lihue, HI 96766

March 2026

Keala Pono Archaeological Consulting, LLC ● 98-030 Hekaha St., Suite 31, Aiea, HI 96701 ● Phone 808.381.2361

DRAFT— Cultural Impact Assessment for the Kūhiō Highway, Intersection Improvements at Kapa‘a Bypass Road Project, South Olohena Ahupua‘a, Puna District, Island of Kaua‘i

TMKs: (4) 4-3-001:999; 4-3-010:001, 005; 4-3-002:999 por.

Prepared For:

Hawai‘i Department of Transportation
Kaua‘i District
1720 Haleukana St.
Lihue, HI 96766

Prepared By:

Dietrix J. Ulukoa Duhaylonsod, MA
Kālenalani McElroy, MA
and
Windy Keala McElroy, PhD

March 2026

Keala Pono Archaeological Consulting, LLC ● 98-030 Hekaha St., Suite 31, Aiea, HI 96701 ● Phone 808.381.2361

MANAGEMENT SUMMARY

Keala Pono Archaeological Consulting has prepared a Cultural Impact Assessment for the proposed Kūhiō Highway, Intersection Improvements at Kapa‘a Bypass Road Project in South Olohena Ahupua‘a in Puna District, on the island of Kaua‘i, Hawai‘i. This is located on portions of Tax Map Keys (TMKs): (4) 4-3-001:999; 4-3-010:001, 005; and 4-3-002:999 within and adjacent to the Kūhiō Highway Right-of-Way. The purpose of this study is to identify any traditional cultural resources or practices in the area, determine if the proposed project will impact any cultural resources or practices, and offer mitigation recommendations.

The current study took the form of background research and an ethnographic survey consisting of five interviews, which are included in this report. The background research synthesizes traditional and historic accounts and land use history for the Olohena area, which has identified the region as rich in natural resources such as fresh water, coastal flora and fauna, and bountiful fishing grounds in traditional times. The area was thus known for being a dense population center. Pre-contact use of Olohena would have centered around cultivation at the nearby Wailua River valley and floodplain. This was supplemented by marine and inland terrestrial resources. People traveled between the neighboring ahupua‘a using the inland or coastal trail that passed through the district. Several prominent heiau are noted for the greater region, with Olohena known for a navigational heiau that was utilized in traditional times. Olohena was also known for Halepaiwi, where games of riddles were played and for the Sleeping Giant of Nounou Mountain. No LCA awards were found within the entire South Olohena Ahupua‘a, which was granted to Rufus P. Spalding during the Māhele, under Grant 5264 for use under the Lihue Planation Co. In the historic period, sugarcane and rice cultivation dominated the region, with the Ahukini Terminal and Railway Company (AT&R) providing transportation for these endeavors. Previous archaeological studies have recorded several burials and cultural layers, Kukui Heiau, a hearth, grinding stones, Debora Kupule’s historic fishponds, the AT&R railroad bed, post-contact ‘auwai, imu, and historic structures of the Coco Palms Resort located within 0.5 km of the project area. No historic properties are known to be located within the current project area, although one of the human burials was documented at the project area boundary.

Consultations with individuals knowledgeable about Olohena Ahupua‘a discussed the natural environment around the project area, such as its flat, sandy floodplain and the traditional subsistence practices in the area. Interviewees also brought up a concern for iwi kūpuna to be disturbed during construction, as human burials have been found nearby. Other concerns that were voiced include the dangerous entrance/exit near Kintaro restaurant, that the roundabout would encourage development, and that the roundabout is not necessary. The interviewees recommended the following:

- Make the entrance/exit to Kintaro’s restaurant safer, perhaps by installing speed bumps on the main road coming from both sides.
- Require archaeological monitoring during the project.
- Make an early presentation to the Kaua‘i-Ni‘ihau Burial Council to build pilina.
- Withhold support for transportation projects on Kaua‘i because it justifies more cars and more houses for more people moving in from off island.
- Instead of spending on a roundabout, resources should be spent to help Hawaiians reclaim their identity.
- Keep the two lanes southbound on Kuhio Highway because it has alleviated traffic in the area.

CONTENTS

MANAGEMENT SUMMARY i
FIGURES iv
TABLES iv

INTRODUCTION 1
Project Location and Environment 1
The Project 5
BACKGROUND 7
South Olohena Ahupua‘a in the Pre-Contact Era 7
Place Names 7
Subsistence and Traditional Land Use 8
Mo‘olelo 9
‘Ōlelo No‘eau 12
Historic South Olohena 12
Early Historic Accounts 13
South Olohena Changes in Land Tenure 14
The Late 19th Century and Beyond 14
Previous Archaeology 21
Summary of Background Research 30
ETHNOGRAPHIC SURVEY 31
Methods 31
Interviewee Background 31
Milton Ching 31
Kenneth Ponce 32
Leilani Rivera 32
Rupert Rowe 33
Kaliko Santos 33
Topical Breakouts 33
Connections to Olohena and the Surrounding Area 33
The Natural Environment 33
Changes Through Time 34
Archaeological Sites and Cultural Practices 34
Concerns and Recommendations 34
Summary of Ethnographic Survey 35
SUMMARY AND RECOMMENDATIONS 37
Cultural Resources, Practices, and Beliefs Identified 37
Potential Effects of the Proposed Project 37
Confidential Information Withheld 38
Conflicting Information 38

Contents

Recommendations/Mitigations 38
Summary and Conclusion 38
GLOSSARY 39
REFERENCES 42
APPENDIX A: AGREEMENT TO PARTICIPATE 47
APPENDIX B: CONSENT FORM 51
APPENDIX C: WRITTEN RESPONSES FROM THE INTERVIEWEES 55
APPENDIX D: INTERVIEW WITH KENNETH PONCE 59

FIGURES

Figure 1. Location of the project area on a USGS topographic map (USGS 2022). 2
Figure 2. Project area on a TMK plat 4-3-02 (State of Hawai‘i 1984). 3
Figure 3. Western portion of the project area on a TMK plat 4-3-01 (State of Hawai‘i 1982). 4
Figure 4. Soils in the vicinity of the project area (data from Foote et al. 1972). 6
Figure 5. Portion of a map of the island of Kaua‘i (Kitteridge 1878). 16
Figure 6. Portion of a Kaua‘i map showing trails and nearby ahupua‘a (Alexander 1900). 17
Figure 7. Photograph of the Wailua Concrete Arch Bridge (Hawai‘i State Archives n.d.). 18
Figure 8. USGS map showing roads, landmarks, and railroad lines (USGS 1954). 19
Figure 9. Photograph of the Coco Palms sign and property in 1958 (in Hammatt 2017:37). 20
Figure 10. Ruins of the historic Coco Palms resort, facing north (Keala Pono 3/8/21). 20
Figure 11. USGS map showing roads, landmarks, and important cultural sites (USGS 1963) 22
Figure 12. Previous archaeological studies within approximately 0.5 km of the project area. 23
Figure 13. Previously recorded archaeological sites near the project area with known locations 24

TABLES

Table 1. Previous Archaeological Studies in the Vicinity of the Project Area 25
Table 2. Known Archaeological Sites Within 0.5 km of the Project Area 27
Table 3. List of Individuals Contacted 32

INTRODUCTION

At the request of WSP USA on behalf of the Hawai‘i Department of Transportation (HDOT) Kaua‘i District, Keala Pono Archaeological Consulting has prepared a Cultural Impact Assessment for the proposed Kūhiō Highway, Intersection Improvements at Kapa‘a Bypass Road Project in South Olohena Ahupua‘a in Puna District, on the island of Kaua‘i, Hawai‘i. This is located on portions of Tax Map Keys (TMKs): (4) 4-3-001:999; 4-3-010:001, 005; and 4-3-002:999 within and adjacent to the Kūhiō Highway Right-of-Way (ROW). The purpose of this study is to identify any traditional cultural resources or practices in the area, determine if the proposed project will impact any cultural resources or practices, or access to those resources and practices, and offer mitigation recommendations.

The report begins with a description of the study area and a historical overview of land use and archaeology in the area. The next section presents methods and results of the ethnographic survey. Results are summarized and recommendations are made in the final section. Hawaiian words, flora and fauna, and technical terms are defined in a glossary. Also included are appendices with documents relevant to the ethnographic survey.

Project Location and Environment

The project area is located on portions of TMKs: (4) 4-3-001:999; 4-3-010:001, 005; and 4-3-002:999 in South Olohena Ahupua‘a, Puna District on the island of Kaua‘i (Figures 1, 2, and 3). This is located at the intersection of Kūhiō Highway with Papaloa Road and Kapa‘a Bypass Road (Route 5600). The project lands are predominantly located within the Kūhiō Highway ROW with the mauka portion extending into privately owned land. The project area encompasses a total of 3.599 hectares (ha) [8.894 acres (ac.)]. TMKs: (4) 4-3-010:001 and 005 are agricultural parcels owned by My Kapaa LLC. TMKs: (4) 4-3-001:999 and 4-3-002:999 are the Kūhiō Highway ROW, owned by the Hawai‘i Department of Transportation.

The island of Kaua‘i was formed by a single shield volcano, Wai‘ale‘ale, which once had the largest caldera in the islands measuring roughly 15–20 kilometers (km) [9.3–12.4 miles (mi.)] in diameter and is 5,100 meters (m) [16,732.28 feet (ft.)] above the ocean floor (MacDonald et al. 1983:453). Based on predictive models of weathering and erosion, it is estimated that the Kaua‘i shield volcano became dormant roughly 1–2 million years ago or more; however, an alternative model predicts that the Kaua‘i volcano stopped building during the Pliocene epoch, roughly 4 million years ago (MacDonald et al. 1983:298–299). The project area is located within the Līhu‘e Basin, also called the Līhu‘e depression, which formed when the east side of the shield collapsed to create a 10–15 km (6.2–9.3 mi.) caldera (MacDonald et al. 1983:453). While the basin was never filled with lava from the shield volcano, it was later filled with rejuvenated period volcanics. The Līhu‘e Basin is one of only two flank calderas found in Hawai‘i. The project area’s volcanic history is further explained by MacDonald et al.:

> Lava flows of the Koloa Series cover about half of the surface of the eastern part of the island. They form the entire floor of the Līhu‘e Basin, except for two small kipuka of Waimea Canyon rocks (Aaohoaka Hill and Pu‘u Pilo), that protrude through them west of the gap through which the Wailua River crosses the Kālepa-Nounou Ridge…The greatest exposed thickness of Koloa lava is 650 meters, in the east wall of Hanalei Valley; but they may be even thicker in Līhu‘e Basin....(MacDonald et al. 1983:460–461)

Rainfall averages 118.62 centimeters (cm) [46.70 inches (in.)] per year, with June through September being the driest months and October to January receiving the most rain (Giambelluca et al. 2013). The wettest month of the year is November, which has 17.29 cm (6.81 in.) of rain on average. The nearest

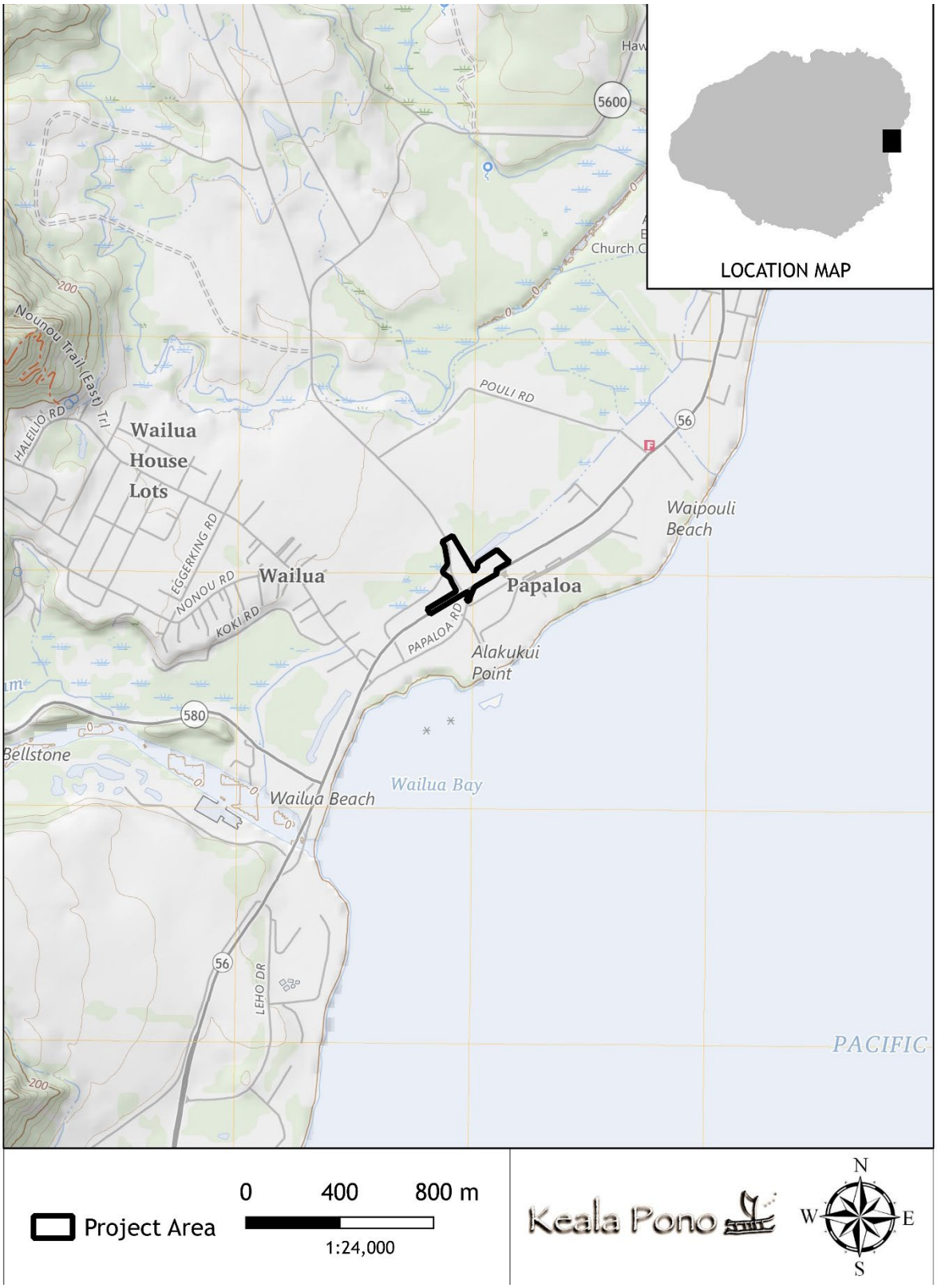


Figure 1. Location of the project area on a USGS topographic map (USGS 2022).

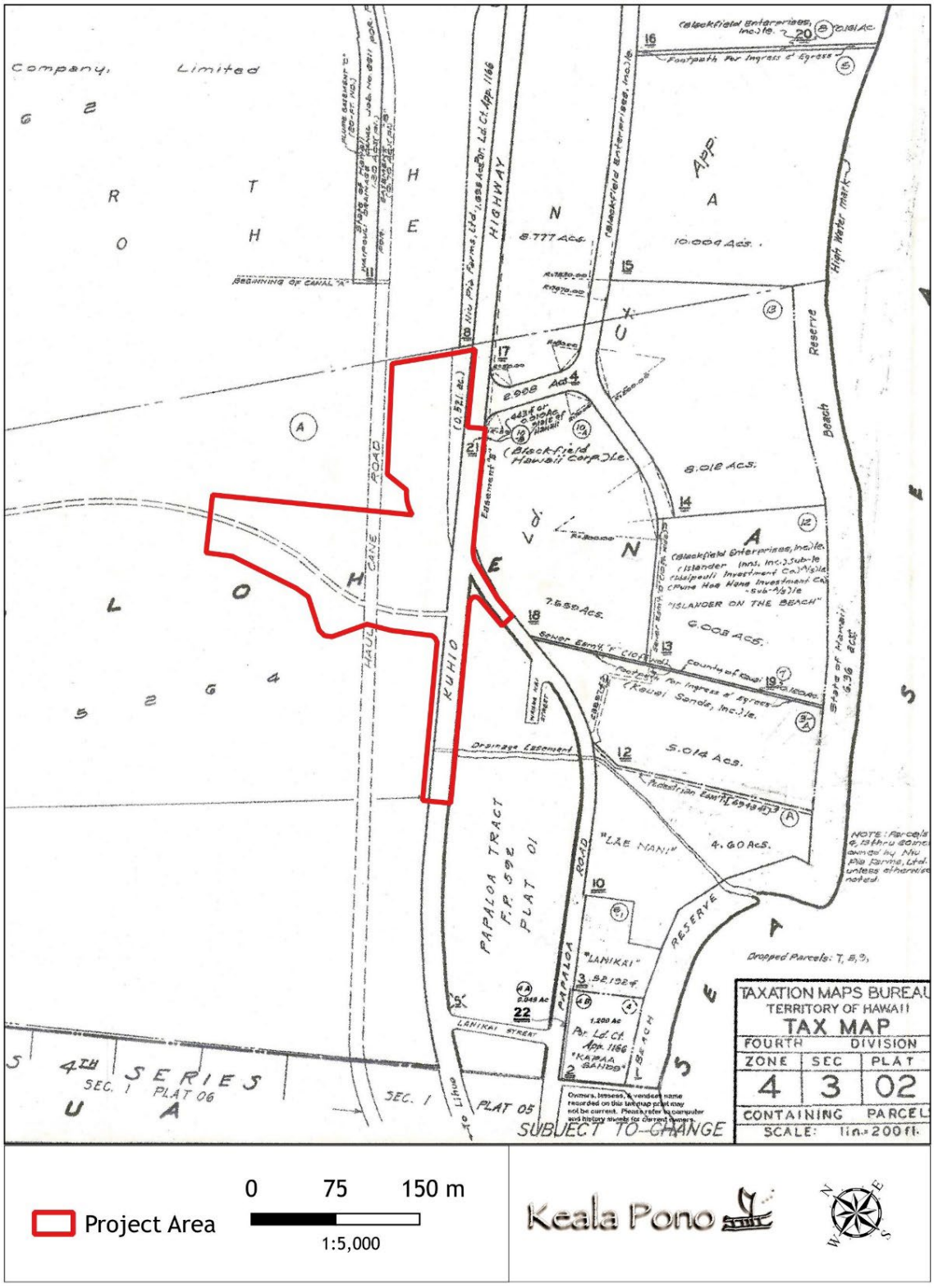


Figure 2. Project area on a TMK plat 4-3-02 (State of Hawai‘i 1984).

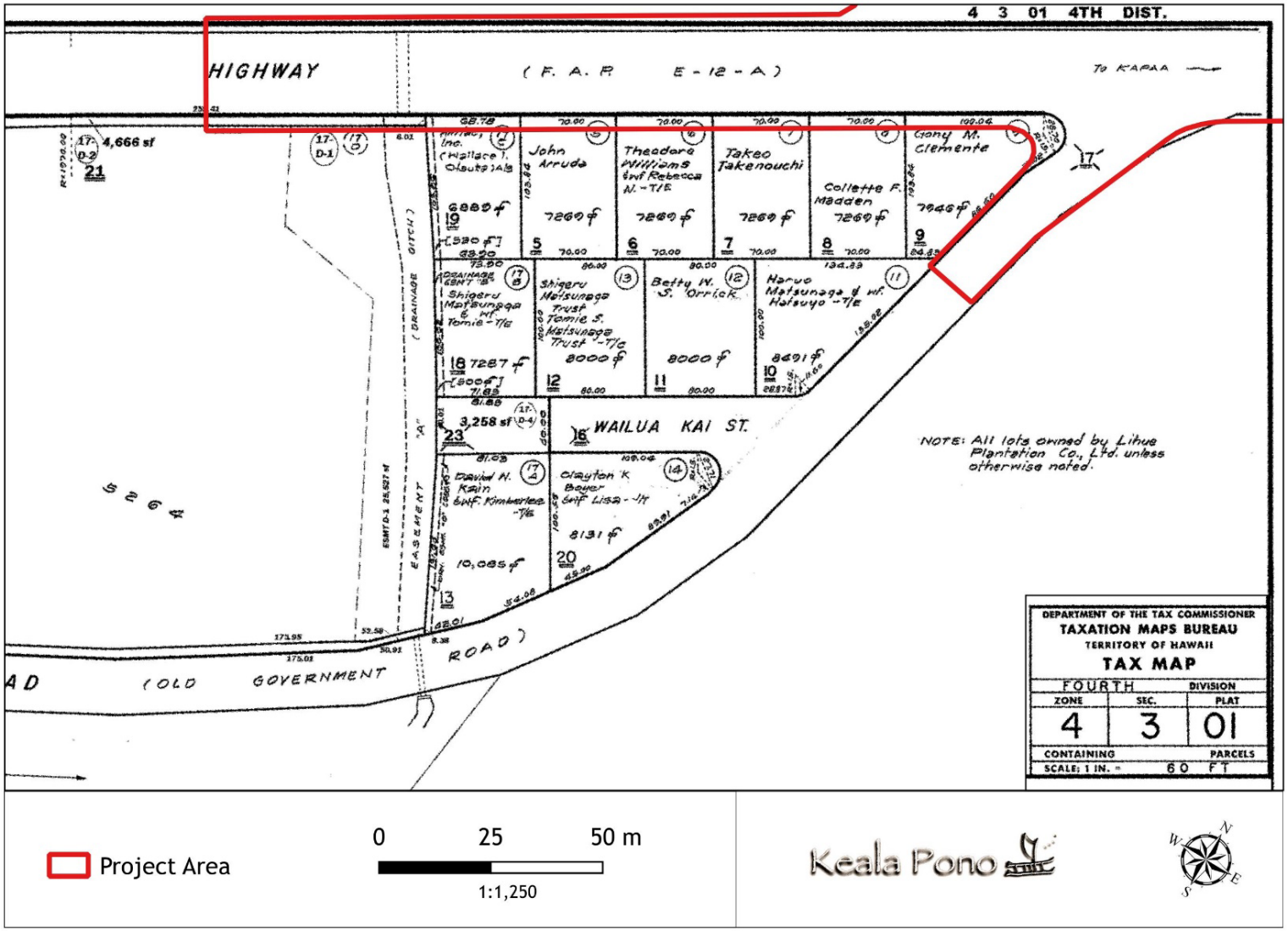


Figure 3. Western portion of the project area on a TMK plat 4-3-01 (State of Hawai‘i 1982).

major water source is Wailua River, which flows out to the ocean roughly 1.17 km (0.73 mi.) to the southwest of the project. Wailua River is the largest river in all of the Hawaiian Islands and is formed when the north and south fork meet to form the larger river. The project area is roughly 332.34 m (1,090.35 ft.) from the ocean at Waipouli Beach.

Soils of the project area consist predominantly of the Kaloko, Lihue, and Mokuleia series. The specific soils within these series are Lihue silty clay, 8–15% slopes (LhC) located in the northern portion of the study lands, Mokuleia fine sandy loam (Mr) at the eastern half, and Kaloko clay (Kfa) at the southwest end (Figure 4) (Foote et al. 1972). Soil series of the project area are described as follows:

Kaloko Series

This series consists of poorly drained soils on coastal plains on the islands of Kauai and Oahu. These soils developed in alluvium derived from basic igneous rock; the alluvium has been deposited over marly lagoon deposits. The soils are nearly level. Elevations range from sea level to 20 feet…Kaloko soils are geographically associated with Nohili soils on Kauai and with Keaau, Pearl Harbor, and Waialua soils on Oahu…These soils are used for irrigated sugarcane and pasture. The natural vegetations consist of kiawe, klu, bermudagrass, and annuals. (Foote et al. 1972:58)

Lihue Series

This series consists of well-drained soils on uplands on the island of Kauai. These soils developed in material weathered from basic igneous rock. They are gently sloping to steep. Elevations range from nearly sea level to 800 feet…Lihue soils are geographically associated with Ioleau and Puhi soils. These soils are used for irrigated sugarcane, pineapple, pasture, truck crops, orchards, wildlife habitat, woodland, and homesites. The natural vegetation consists of lantana, guava, koa haole, joee, kikuyugrass, molassesgrass, guineagrass, bermudagrass, and Java plum. (Foote et al. 1972:82)

Mokuleia Series

This series consists of well-drained soils along the coastal plains on the islands of Oahu and Kauai. These soils formed in recent alluvium deposited over coral sand. They are shallow and nearly level. Elevations range from nearly sea level to 100 feet…Mokuleia soils are geographically associated with Hanalei, Jaucas, and Keaau soils…These soils are used for sugarcane, truck crops, and pasture. The natural vegetation consists of kiawe, klu, koa haole, and bermudagrass in the drier areas and napiergrass, guava, and joee in the wetter areas. (Foote et al. 1972:95)

Other soils in the vicinity include Lihue silty clay, 0–8% slopes (LhB) in the uplands and to the southwest, as well as beaches (BS) along the coastline (Foote et al. 1972).

The Project

The HDOT is planning improvements to Kūhiō Highway at its intersections with Papaloa Road and Kapa‘a Bypass Road. The HDOT is currently evaluating realigning the southern terminus of Kapa‘a Bypass Road at Kūhiō Highway to intersect the existing intersection of Kūhiō Highway with Papaloa Road (North) near the Coconut Marketplace. The realignment will consolidate the two (2) existing T-intersections into a single full access intersection. In addition to consolidating the intersections, the realignment will provide the opportunity to allow left turns from Papaloa Road (North) onto Kūhiō Highway.

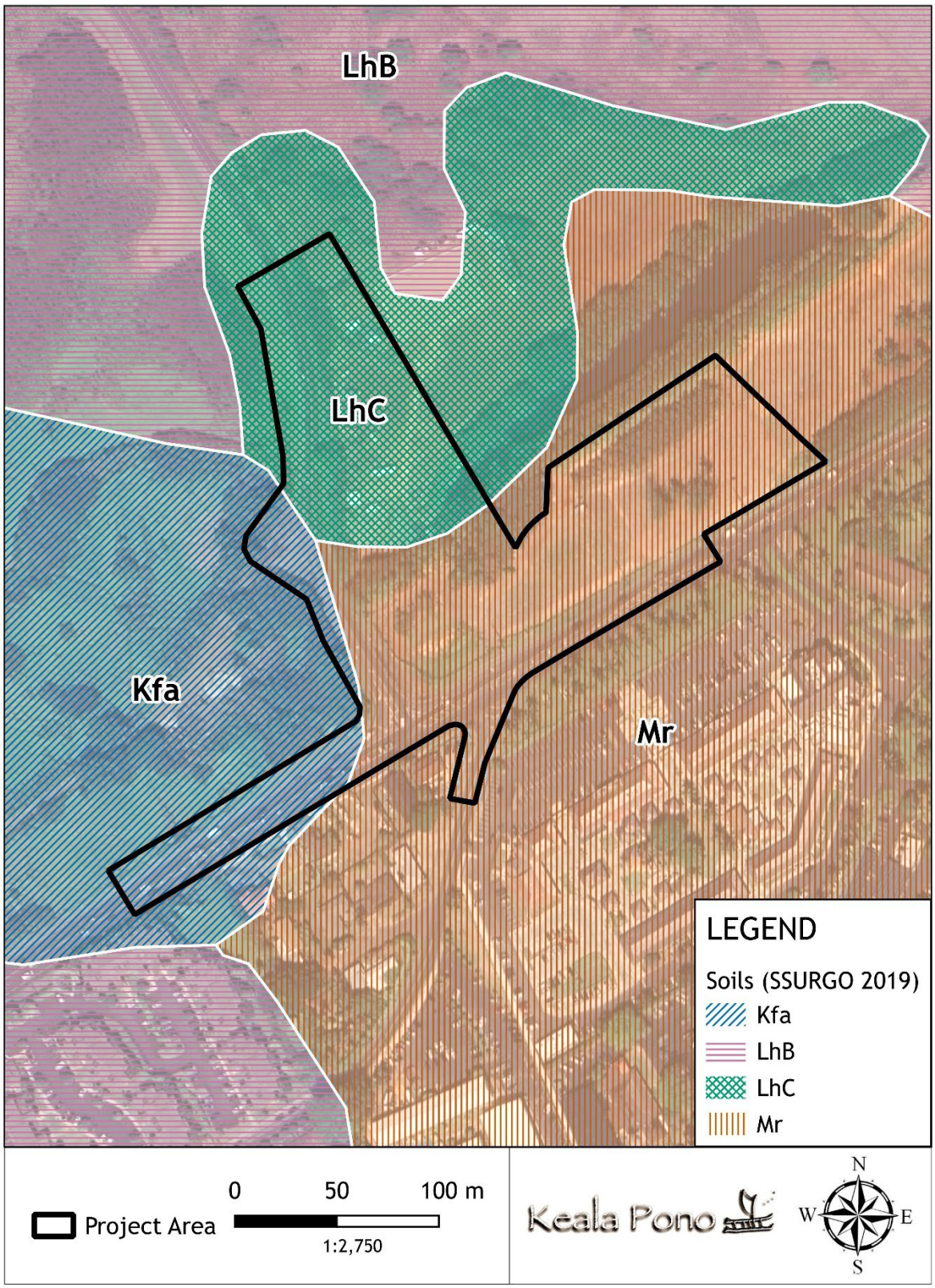


Figure 4. Soils in the vicinity of the project area (data from Foote et al. 1972).

BACKGROUND

A historic review of South Olohena Ahupuaʻa is provided below, to offer a better holistic understanding of the use and occupation of the project area. In the attempt to record and preserve both the tangible (e.g., traditional and historic archaeological sites) and intangible (e.g., moʻolelo, ʻōlelo noʻeau) culture, this research assists in the discussion of anticipated finds. Research was conducted at the Hawaiʻi State Library, the University of Hawaiʻi at Mānoa libraries, the State Historic Preservation Division (SHPD) library, and online on the Waihona ʻAina database and the State of Hawaiʻi Department of Accounting and General Services (DAGS) website. Historical maps, archaeological reports, Māhele data, and historical reference books were among the materials examined.

South Olohena Ahupuaʻa in the Pre-Contact Era

The island of Kauaʻi is split into five moku (traditional districts): Haleleʻa, Koʻolau, Puna, Kona, and Nā Pali. Wailua is the largest of the 13 ahupuaʻa within the Puna District on Kauaʻi's eastern shore. The Puna District is located between the Kona District, which encompasses the island's south shore, and the small Koʻolau District on the north shore. The project area is located in the coastal portion of the narrow South Olohena Ahupuaʻa. It is surrounded by North Olohena Ahupuaʻa to the north and Wailua Ahupuaʻa in the south.

Place Names

One often overlooked source of history is the information embedded in the Hawaiian landscape. Hawaiian place names "usually have understandable meanings, and the stories illustrating many of the place names are well known and appreciated…The place names provide a living and largely intelligible history" (Pukui et al. 1974:xii). Several place names associated with the study area are listed in the book *Place Names of Hawaii* (Pukui et al. 1974), along with the meanings of the names and/or comments about the specific locales:

> Alakukui. Point near Wailua Bay, Kauaʻi. A *heiau* here was named Kūhua. *Lit.,* torch path. (Pukui et al. 1974:9)
>
> Kamoʻohoʻopulu. Ridge, Kawaihau district, Kauaʻi. *Lit.,* the wet ridge. (Pukui et al. 1974:82)
>
> Kapaʻa…Land section, town, ditch…Ka-wai-hau district, Kauaʻi…*Lit*., the solid *or* the closing…*Ka laulā mauka o Ka-paʻa ē, mai paʻa i ka leo*…the upland expanse of the closure, do not close your voice (an appeal for hospitality). (Pukui et al. 1974:86)
>
> Kūhhiō…named for Prince Jonah Kū-hiō Ka-lani-ana-ole (1871–1922), delegate to Congress and father of the Hawaiian Homes Commission Act… (Pukui et al. 1974:120)
>
> Nā ʻili a Kaʻauea. Lookout point, Kālepa Ridge Trail, Kālepa Forest Reserve, Līhuʻe district, Kauaʻi. (This name is sometimes spelled Nailiakuea.) *Lit.,* the pebbles of Kaʻauea. (Pukui et al. 1974:160)
>
> Nounou. Mountain (now known as Sleeping Giant), trail, and forest reserve, Kawaihau District, Kauaʻi. The tyrant ʻAikanaka made his last stand on the mountain against the invader Kawelo. Hula chant by Hiʻiaka; *Ālai ʻia aʻela e Nounou, nalo Kaipuhaʻa i ka laulā mauka o Kapaʻa,* Nounou is screened, The-low-clabash is lost in the wide expanse inland of Kapaʻa. *Lit.,* throwing. (Pukui et al. 1974:167)
>
> Olohena. Land division and ridge, Kawaihau district, Kauaʻi. A *heiau* for human sacrifices on the ridge was called Mahewalu, short for Māhelewalu, eight divisions. Olohena has no meaning, but may be cognate with Olosenga, an island in the Manuʻa group, Samoa. Other sources say the *heiau* was named Kukui. (Pukui et al. 1974:170)

> Wailua. State park, land division, river, falls, valley, town, and golf course, Līhuʻe qd., Kauaʻi. *Lit.,* two waters. (Pukui et al. 1974:224)
>
> Waipouli. Land division, beach, and village, Kawaihau district, Kauaʻi. *Lit.,* dark water. (Pukui et al. 1974:227)

Subsistence and Traditional Land Use

It is believed that the Puna district was first settled by a Marquesan, chief Punanuikaianaina. in 1000–1100 AD (Fornander 1996:45, 46). The windward side of Kauaʻi with its large river valleys and fertile floodplains would have been ideal for habitation and agriculture in traditional times. One of the earliest documented habitation sites in the region, SIHP 50-30-11-1839, is located in the ahupuaʻa at the mouth of Hanamāʻulu Stream and dates to AD 1170–1400 (Walker et al. 1991).

There were five main areas on Kauaʻi where abundant food and fresh water resources led to larger concentrations of the population (Handy and Handy 1972:269). Among these is the Kapaʻa and Wailua area (Handy and Handy 1972:269):

> There was a highly developed irrigation system at Kapaʻa, halfway down the east coast. Adjoining Kapaʻa on the south is Wailua, distinguished by one of the largest networks of streams running down from the interior mountains, along which were cultivated taro and breadfruit in quantity. The Kapaʻa-Wailua area is the second which we would designate as notable for density of population. In this area are remains of ancient temples of worship, indicating politico-religious importance.

According to Handy and Handy (1972:425) the area was extremely fertile and the river produced large shrimp and fish:

> Undoubtedly much *wauke* and *olona* were grown, as well as yams, bananas, *pia* and all other cultivated plants. The streams and river were famous for shrimps and guppy fish, said to be the largest in the islands. And the forested interior was rich in all the trees and other plants treasured by Hawaiians: *koa*, sandalwood, fragrant *maile* and *mokihana* vines, and others.

The Wailua and Hanamāʻulu river valleys and the Nāwiliwili floodplain were the largest and most extensively cultivated regions on the island. A Kauaʻi aliʻi named Manokalanipō encouraged his people to cultivate the land around AD 1490. It is said that he "encouraged agriculture and industry, executed long and difficult works of irrigation, and thus brought fields of wilderness under cultivation" (Fornander 1996:93). The region's large river valleys were able to support extensive loʻi kalo that would have been supplemented by the collection of marine resources and aquaculture. Niu were planted in many areas across Kauaʻi and grew exceptionally well in Wailua, which was the location of a sacred grove that belonged to the aliʻi (Handy and Handy 1972:172). This grove was kapu since it was also where the aliʻi resided. Wailua is also one of only two main areas in the archipelago that ʻulu was extensively cultivated, the other being Kona on Hawaiʻi Island. According to Handy and Handy (1972:151, 284), Hawaiians preferred kalo and ʻuala, however ʻulu trees thrived in Wailua due to the slightly warmer temperatures. North and South Olohena Ahupuaʻa were also noted for having flourishing ʻulu trees. It is recounted that Kamalama, Kawelo's brother allocated these lands for settlement and cultivation:

> There the men received each portion and settled down to cultivate the land, while Ka-ma-la-ma turned toward the hills. The men made loʻi, or taro patches, and set out such food-plants as they thought would flourish in this new land. They planted twelve breadfruit trees, one for each taro-patch, and in order to have a name signifying unity, they called the place "The Twelve Breadfruit," because the trees all came from a single mother-plant…These trees were famous in ancient days and even now their report is in the mouths of men. (Green and Pukui 1936:86–88)

The region's accessible fishing grounds allowed residents to supplement their diet of kalo, ʻuala, ʻulu, and niu with seafood, limu, and other marine resources. There were also a number of fishponds located near and within the Wailua River, not far from the project area, and it is noted that some fish were put into the loʻi kalo for short periods (Bennett 1931:24). A major trail system ran through the region, giving the people of Puna access to the Kona and Koʻolau districts. This trail is noted in ʻōlelo noʻeau and can be seen on historic maps. A map from 1900 depicting the region also marks the trails of the area, one of which runs just makai of the project area or directly through it (see Figures 5 and 6). Two trails can be seen extending through Wailua Ahupuaʻa, one along the coast ending at the mouth of the Wailua River and a second that traverses inland and crosses the river at Waiʻehu Falls before continuing into Olohena and Kapaʻa. The Olohena trail goes to Lae ʻAlakukui (Alakukui Point) and passes through the coastal section. These trails would have provided access to a wide variety of resources from the river, forests, and coast. Due to this variety and abundance of terrestrial and marine resources as well as fresh water, the region would have had the potential to provide for a large population.

Kukui Heiau (SIHP 50-30-08-108) is located in South Olohena at Lae ʻAlakukui, a headland at the southern extent of the ahupuaʻa (Bennett 1931:127). This heiau was constructed from unusually large rocks, some of which weighed a few tons each, and was used for navigation (Wichman 1998:82). Kukui Heiau had at least two lamps that were continuously lit on its makai wall that were used to guide canoes travelling at night, similar to a lighthouse (Carpenter and Yent 1997:8). Kukui Heiau is listed on the National Register of Historic Places and Hawaiʻi Register. A human sacrificial heiau named Mahewalu, said to be short for Māhele-walu, or "eight divisions," is also associated with Olohena (Pukui et al. 1974:170). The heiau is described as being on a ridge, however some sources say this is another name of Kukui Heiau (Pukui et al. 1974:170). Another heiau, Kaikihāunakā, was constructed by Kawelo after defeating ʻAikanaka. The name translates to "little striking blow" and is associated with Halepāiwi, a "house enclosed with bones" (Wichman 1998:82). Riddling is mentioned occasionally in moʻolelo, as a way to demonstrate skill and intellect. Halepāiwi was a structure made for riddling and was surrounded by a fence of bones that were said to be made from those who lost the riddle game.

Moʻolelo

Moʻolelo and accounts of Olohena and nearby ahupuaʻa serve as testaments to the cultural significance of the region. Locations within the ahupuaʻa are noted in moʻolelo and played a role in the spiritual and religious realm of Hawaiian culture shown through the stories of supernatural beings, goddesses, and the mention of a heiau.

A wind chant was recorded in the legend of the wind gourd of Laʻamaomao (Nakuina 1992:46). The magic gourd was controlled by Kūapākaʻa, who recited the names of all the winds of Kauaʻi including that of nearby Wailua, Waipouli, and Kapaʻa, however Olohena was not mentioned:

> Waiʻōpua is of Wailua,
>
> Waiolohia is of Nahanahanai,
>
> Inuwai is of Waipouli,
>
> Hoʻolua is the wind of Makaīwa,
>
> Kēhau is of Kapaʻa...

Kalelealuaka was a renowned athlete and warrior of Kauaʻi. A moʻolelo about him mentions Kaikihāunakā Heiau in Olohena Ahupuaʻa, though the legend of Kawelo and ʻAikanaka that explains its origin describes it as being located in Wailua:

> After Kawelo defeated ʻAikanaka, he built a heiau in Olohena that he named Ka-iki-hāuna-kā, 'little striking blow.' It was built as a place to make an offering to his war god of the first enemy

> warrior to have been killed in battle. This would have been one of the warriors Kawelo killed as his canoe was carried onto shore. (Wichman 1998:81)

Kalelealuaka traveled from his home in Kauaʻi to Waialua on Oʻahu in search of a human sacrifice to bring back to "the temple of Kahikihaunaka at Wailua, on Kauaʻi" (Thrum 1906:77). He found the corpse of the hero Kaʻōpele and brought it to the poʻokanaka heiau on Kauaʻi, setting it on the altar next to another dead body. Other versions of the story say that it was not Kaikihāunakā Heiau, but rather Kukui Heiau where this occurred (Dickey 1917:19). In fact, Kaʻōpele was not dead, but unconscious and was able to recover soon after being laid on the altar.

While the next legend speaks of Wailua, not Olohena, it does mention a famous riddler, as Olohena was known for riddles. It is said that there are marks that look like footprints on the banks of the Wailua River mouth. One moʻolelo associates them with a magician searching for the demigod Kamapuaʻa, while another version states that "a famous maker of riddles once stepped here on landing to match riddles with the people of Wailua" (Dickey 1917:20–21). This riddler was also mentioned by an informant in 1885, when speaking about important sites on Kauaʻi. He called the prints Kapuaʻi o Molohua, which translates to "footprints of Molohua" and explained that it was "a house for riddling champions" and a famous location in Wailua (Lahainaluna Students 1885:214). Because of its proximity to Halepāiwi, the riddling house in Olohena, it is possible the famous riddler also stopped there during his travels to the region.

One of the most famous moʻolelo of the region are those of Kanaka Nunui Moe, The Sleeping Giant (Wichman 1985:13–16). The giant was feared because of his size and the destruction he could cause with a single step; however, he was loved by the people of the region since he was helpful and very friendly to all. Kanaka Nunui Moe is believed to have constructed Kukui Heiau in Olohena:

> The giant Nunui collected the stones and put them in position and gathered the *ʻohiʻa lehua* logs from the mountains to build all the structures within the walls. After it was built, he was tired and stretched out on the nearby hilltop, where he still sleeps. (Wichman 1988:82)

He is also associated with building a large heiau in Kapaʻa and for helping the villagers do their work much quicker. His massive footprints would be used to plant bananas, which was his favorite food. Kanaka Nunui Moe was always careful with his actions and slept in the hills behind Kapaʻa Town, flattening them down so the land could be cultivated. The giant was always sleepy and would stay awake for 100 years, then sleep for centuries at a time, which is how he got his name.

> When he slept, Nunui slept for hundreds of years while the winds blew dirt over him and seeds were dropped there by the birds. The gentle showers sent by Kahale-lehua, goddess of the gentle rains, fed these seeds and forests grew up over the giant. When Nunui awoke and stretched, the people of Kapaʻa fled in great fear, for what they had thought to be a hill had come alive.
>
> One time, while Nunui was still awake, the high chief of Kawaihau wanted to build a large heiau to honor one of his gods. This was to be no ordinary temple. The chief wanted water-polished rocks for the walls and hard koa wood from Kokee for the framework of the god's house.
>
> So the chief told the Kawaihau people what he wanted them to do. They must gather rocks from the golden brown waters of the Kokee streams and cut koa trees on the edges of Waimea canyon, and gather pili grass that grew at Mana. "All this must be done in the turn of one moon," he ordered.
>
> The unhappy people left their chief and silently returned to their village. The giant Nunui, stepping carefully among them, saw the long faces of the people.
>
> "What is wrong?" he asked.
>
> The Kapaʻa villagers told him what they must do within the impossibly short time. "This cannot be done," the people said in low, sad voices. "How can we go to Kokee and bring back stones

enough to build the walls in that time? And cut down the koa trees and bring the logs here and build the sacred house? And even if we do these things, who will cultivate our fields?"

Nunui smiled gently. "Tend to your fields," he said. "This work is nothing for me, and I'll gladly help you. Besides, it will give me something to do."

The giant went to Kokee and scooped up smooth, round boulders from the golden brown waters and brought them to Kapaʻa. "Chief," he called to the astonished ruler, "show me where you wish to build this heiau."

The amazed chief pointed out the place set aside for the temple. Nunui placed the rocks to form a wall, fitting them so closely together that not even a mouse could squeeze between the cracks. Within a week, he had built a strong, thick, handsome wall around the sacred place.

Nunui returned to the edge of Waimea Canyon and cut down koa trees and trimmed them into the shape he needed. He carried these back and made the framework of the house. He gathered pili grass from the wild and wrapped the stems into bundles, tied these bundles to the framework, and within half the time the chief had set, the heiau was finished.

Everyone was happy. The farmers had been able to keep up with their chores, the chief had his heiau, and Nunui had something to do. There was even time enough for a celebration. The chief ordered all his people to gather bananas and to pound sweet potatoes and taro into poi. Some people hurried to slaughter pigs and dogs to be cooked in the imu, while others paddled out to sea to fill their canoes with fish and sent their wives to gather seaweed and opihi from the reef. At last, enough food for everyone was ready, and the chief, the villagers, and Nunui sat down before the overflowing bowls and platters.

"Eat," said the chief to Nunui. "After the work you have done, you must be hungry."

The giant ate all the food that had been placed before him. When he was through, his stomach bulged and he was very sleepy. He chose a comfortable hill just a short distance above Kapaʻa town. Nunui stretched a last time, lay down along the top of the hill, and soon was sound asleep.

As he slept through the years, the winds blew dirt over him and the birds brought seeds. Ka-hale-lehua, goddess of the gentle rains, sent showers to water the plants that now covered the giant.

So Kanaka-nunui-moe sleeps and sleeps and has come to resemble a long hill with a lump at one end where his nose is and lumps at the other ends where his feet are. He no longer looks like a living being, but one day, perhaps soon, his eyes will open, he'll yawn and stretch his arms, and sit up. (Wichman 1985:13–16)

Nounou Mountain, situated in both Wailua and Olohena Ahupuaʻa just west (inland) of the current project area, is referred to as the Sleeping Giant since it resembles a figure laying down. Today, the ridge is a popular viewpoint and hiking trail.

Nounou Mountain is also mentioned in the epic tale of Hiʻiakaikapoliopele (Hiʻiaka), Pele's sister and the goddes of hula. At this point of the story, Hiʻiaka goes to Kauaʻi with her friend, Wahineʻōmaʻo, to find Pele's lover, Lohiau and bring him back to her on Hawaiʻi Island. After crossing the island chain, the friends neared Kauaʻi's east shore, where they would land at the Kapaʻa coast. Prior to making landfall, they chanted Mele Kāhea, a chant asking permision to enter, which is still popular today:

Kūnihi ka mauna i ka laʻi ē
ʻO Waiʻaleʻale lā ē, i Wailua
Huki aʻela i luna ka papa o Anokawailani
Ālai ʻia aʻela e Nounou
Nalowale Kaipuhaʻa
Haʻa i ka laulā

Haʻa ka ipu, haʻa ma kai o Kapaʻa ē
Haʻa ka ipu, haʻa ma uka o Kapaʻa ē
Mai paʻa ka leo
Heʻole ka heahea mai.
(Hoʻoulumāhiehie 2008a:177–178)

Steep is the mountain in the calm
Waiʻaleʻale rises there, at Wailua
Pulled up heavenward is the bridge of Anokawailani
Blocked from view by Nounou Hill
Kaipuhaʻa disappears completely
Low-lying in its expanse
Shallow is the gourd, low-lying at the shore of Kapaʻa
Shallow is the gourd, low-lying at the shore of Kapaʻa
Do not restrain the voice
Leaving no beckoning call of welcome.
(Hoʻoulumāhiehie 2008b:166–167)

ʻŌlelo Noʻeau

Traditional proverbs and wise sayings, known as ʻōlelo noʻeau, are another means by which the history of Hawaiian places has been recorded. In 1983, Mary Kawena Pukui published a volume of close to 3,000 ʻōlelo noʻeau that she collected throughout the islands. The introductory chapter of that book reminds us that if we could understand these proverbs and wise sayings well, then we would understand Hawaiʻi well (Pukui 1983). While no ʻōlelo noʻeau are listed for Olohena, other sayings were found that mention nearby locales including Waipouli, Wailua, and the Puna district as a whole. They are listed below as recorded in Pukui's book:

He nani wale no o Puna mai ʻo a ʻo.
There is only beauty from one end of Puna to the other.
There is nothing to complain about-refers to Puna, Kauaʻi. (Pukui 1983:91)

Ka wai hālau o Wailua.
The expansive waters of Wailua.
Wailua, Kauaʻi, is the land of large streams. (Pukui 1983:178)

Na keiki o Waipouli me Honomaʻele.
Children of Waipouli and Honomaʻele.
A humorous reference to very dark people. A play on *pouli* (dark) in Waipouli and *ʻele* (black) in Honomaʻele. (Pukui 1983:245)

Historic South Olohena

It is generally accepted that in 1778 James Cook became the first Westerner to see the Hawaiian Islands, which at that time were not yet united under one sovereign. Following Cook, a wave of other foreign explorers landed on Hawaiʻi's shores. Around the same time as the arrival of the first Westerners to Hawaiʻi, many of the other islands were experiencing major political changes. It was during this time that Oʻahu's sovereignty ended with the invasion of the Maui chiefs, and the Maui rule was subsequently

overcome by the invasion of forces from Hawai‘i Island. Kaua‘i and Ni‘ihau were ruled by Kaumuali‘i who relinquished control in 1810 during peaceful negotiations with Kamehameha I, who then became the ruler of all the Hawaiian Islands.

Early Historic Accounts

The earliest historical accounts of Kaua‘i come from sea captains and missionaries who recorded several descriptions of the Wailua region; however, there is almost no mention of Olohena. Captain George Vancouver, who had been to Kaua‘i during earlier voyages, tried and failed to land at Wailua in March 1793. Although he was not able to anchor due to harsh conditions, he did record descriptions about the region in his journals while offshore. At this time, Wailua was still the seat of the royals and the main population center on the island, which he described as an "extensive village" (Vancouver 1798:221–222).

> This part seemed to be very well watered, as three other rapid small streams were observed to flow into the sea within the limits above mentioned. This portion of Attouai, the most fertile and pleasant district of the island, is the principal residence of the King, or, in his absence, of the superior chief, who generally takes up his abode in an extensive village, about a league to the southward of the north-east point of the island. Here Enemo the regent, with the young prince Tamooerrie, were now living…(Vancouver 1798:221–222)

After Vancouver's attempted trip, few foreigners visited the vicinity of Olohena and instead made landfall in Waimea located on the island's southwest shore. Due to increasing trade opportunities with foreigners who preferred to harbor their ships there, the ali‘i of Kaua‘i would soon move the unofficial capital to Waimea, overshadowing the island's east coast (Lydgate 1920). It is likely that this shift in focus to Waimea meant that the Wailua region lost much of its traditional importance, especially when the kapu system was abolished in 1819 and Wailua's many heiau fell into disuse.

A detailed description of the region during this early historic period comes from sailors aboard the U.S. Exploring Expedition, who documented their travels in October 1840. It was recorded that only around 40 men lived in the entire district. During the expedition they met with Debora Kapule, who was the ex-wife of Kaumuali‘i. The fishponds described in expedition journals were located where the Coco Palms is today, less than 0.5 km southwest of the current study area. An excerpt from the expedition journals is as follows:

> The country on this route was uninteresting, until they reached Wailua, the residence of Deborah, a chief woman of the islands, readily known as such from her enormous size, and the cast of her countenance. She has a person living with her called Olivia Chapin, who speaks English, and has learned how to extort money. Deborah has about forty men in her district; but they were absent, being employed in the mountains for cutting timber to pay the tax to the king.
>
> Near Deborah's residence are extensive fishponds belonging to her, which have been made with great labour: they are of different degrees of saltiness. The fish are taken from the sea when young and put into the saltiest pond; as they grow larger, they are removed into one less salty, and are finally fattened in fresh water. While our gentlemen were there, Deborah received young fish in payment of the poll-tax, which were immediately transferred to her ponds.
>
> Wailua (two waters) was formerly a place of some importance. It is situated on a small stream of the same name, in a barren, sandy spot.
>
> Deborah furnished them with a double canoe, to carry them up the river to visit the falls. Taking the western branch, they ascended it for two and a half miles.
>
> There are many good taro-patches and sugar plantations on its banks. They landed in what appeared to have been an old crater, in front of a basin, with high producing bread-fruit, sugar-

cane, oranges, etc. The latter, however, are suffering from the blight, and some of the trees were covered with a black smut, produced by a species of aphis.

In ascending, an insulated black rock is passed, known as the "Muu," which has been detached from a high rocky bluff, that is remarkable for the dikes visible in it.

They afterwards ascended the bank, two hundred feet high, and crossed about half a mile to the falls, over a plain covered with grass and wild sugar-cane. The stream was very small, running sluggishly, and passed over a precipice of barren rocks, one hundred and sixty feet in height. Although there is neither tree nor shrub along the stream above the fall, the valley beneath is filled with them; the most conspicuous was the pandanus. The whole scene is picturesque. Below, the falls present a very curious appearance, the wind continually breaking and dispersing the water in heavy showers over a great variety of ferns, which are growing in the crevices of the rocks. The volume of water does not exceed ten hogsheads a minute. In the basin beneath were found many fine specimens of *Neritina granulate*, and two other species were found further down the stream, about four feet below the surface; these were procured by diving. Mr. Rich obtained specimens of the plants.

Mr. Peale found few birds; ducks were abundant on the river's banks, some of which were killed. Rushes were growing along the banks from eight to ten feet in length, four or five feet under the water; besides these, the banks were covered with hibiscus and ricinus (castor-oil trees), growing wild. (Wilkes 1846:IV:68–69)

South Olohena Changes in Land Tenure

The change in the traditional land tenure system in Hawai‘i began with the appointment of the Board of Commissioners to Quiet Land Titles (Land Commission) by Kamehameha III in 1845. The Great Māhele took place during the first few months of 1848 when Kamehameha III and more than 240 of his chiefs worked out their interests in the lands of the Kingdom. This division of land was recorded in the Māhele Book. The king retained roughly a million acres as his own as Crown Lands, while approximately a million and a half acres were designated as Government Lands. The Konohiki Awards amounted to about a million and a half acres, however title was not awarded until the konohiki presented the claim before the Land Commission.

In the fall of 1850 legislation was passed allowing citizens to present claims before the Land Commission for lands that they were cultivating within the Crown, Government, or Konohiki lands. By 1855 the Land Commission had made visits to all the islands and had received testimony for about 12,000 land claims. Ultimately between 9,000 and 11,000 kuleana land claims were awarded to kama‘āina totaling only about 30,000 acres and recorded in ten large volumes. Land Commission Awards (LCA) generated during the Māhele offer valuable information regarding land use, traditional and historic boundaries and landmarks, as well as the natural resources of the area.

The entire ahupua‘a of South Olohena was given to Rufus P. Spalding under Grant 5264 for use under the Lihue Planation Co. This award totaled approximately 419 acres. No LCA parcels were awarded in South Olohena and just one LCA was claimed in the coastal region of North Olohena Ahupua‘a. It is not located near the current project area.

The Late 19th Century and Beyond

Sugarcane and rice cultivation drastically changed the landscape and livelihood of residents in the Puna District, particularly in Līhu‘e, but also in Wailua and Olohena. This new era saw a decline in the cultivation of kalo and the conversion of many unused lo‘i into rice paddies. Railroad tracks for transporting sugar and later, roads, were established to connect different parts of the island, and in the mid-20th century the Coco Palms Resort was established.

A map drawn in 1878 records the ahupuaʻa of Kauaʻi, significant landmarks and place names, and the major trails mentioned in early accounts (Figure 5). The project area is within Olohena, which had not yet been split into today's North and South Olohena Ahupuaʻa. A trail or road runs through the middle of the study lands. The Wailua trails are not depicted. Nearby geographical features and landmarks include the Wailua River, Nounou, and a large swamp in Waipouli and Kapaʻa. A 1900 map shows the same trail or road just makai of the project area (Figure 6).

Sugar and Rice Cultivation

The Lihue Plantation Co., Ltd. is one of the earliest sugar plantations in Hawaiʻi. It was founded in 1849 by William L. Lee, Chief Justice of the Kingdom of Hawaiʻi; Henry A. Pierce, a partner at Pierce & Brewer; and Charles Reed Bishop, a banker and husband to Princess Bernice Pauahi Bishop (Condé and Best 1974:165). William H. Rice would also become a partner in 1859. At one point, the Lihue Plantation produced nearly 25% of all the sugar on Kauaʻi and was also a major producer of electricity, which they sold to Kauaʻi Electric (Anonymous 1989:11-1).

To run their sugar operations, the Lihue Plantation Co. built a large water collection system with many miles of ditches and intakes throughout the region. The company had authority over water from the north and south intake ditches, the lower and upper Lihue ditches, Hanamāʻulu and Kapaia ditches, as well as the Waiahi-Iliiliula-North Wailua ditches (Wilcox 1997:68). A large pipe was used to divert water from the north fork of the Wailua River in 1895 and the Waiahi-Iliiliula-North Wailua ditches were constructed in 1926 to transport the water from the north fork of the Wailua River to the south fork (Wilcox 1997:70). The later project was partially funded by the Koloa Plantation, which was allotted one million gallons of water per day in return (Wilcox 1997:70). In 1931, the Wailua Reservoir was the largest owned by the Lihue Plantation Co., holding 242 million gallons of water (Wilcox 1997:73). Other sugar plantations such as Makee Sugar Company, Kealia Plantation, and Hui Kawaihai also had operations in the region. Only the Makee Sugar Company was still in business by 1935 and would later be acquired by the Lihue Plantation.

Throughout Hawaiʻi, many loʻi kalo were converted to rice paddies around the mid to late 19th century, which was also the case in Olohena, Wailua, Waipouli, and Kapaʻa. Despite Chinese rice farmers purchasing or leasing these well-watered lands, kalo was still grown until roughly the end of the century (Knudsen 1991:152). However, by 1935 when Handy surveyed the island, he did not find any taro patches in cultivation (Handy 1940:67). Instead, the kalo terraces had been converted to fields of sugarcane, rice, and sweet potatoes, or filled in for use as pasture land. He wrote that:

> Waipouli, Olohena, and Wailua are ahupuaʻa with broad coastal plains bordering the sea, any part of which would be suitable for sweet potato plantings; presumably a great many used to be grown in this section. There are a few flourishing plantations in Wailua at the present time. (Handy 1940:153)

Ahukini Terminal and Railway Company

In 1920, the Ahukini Terminal and Railway Company (AT&R) was established under the parent company, Lihue Plantation, to transport sugar from the plantations to various points across the island. It would later be fully acquired by the Lihue Plantation Co. in 1934. The AT&R railroad track was built from 30-in gauge (35-lb) rail and passed through Anahola, Keālia, Kapaʻa, Olohena, and Wailua, ending at Ahukini Landing in Hanamāʻulu (Condé and Best 1974). AT&R also constructed various bridges including the Waikaʻea Railroad Bridge, the Mōʻīkeha Makai Railroad Bridge, and the Wailua Railroad Bridge (Hammatt 2017; Powell and Dega 2008). The first bridge to cross the Wailua River was the 1919

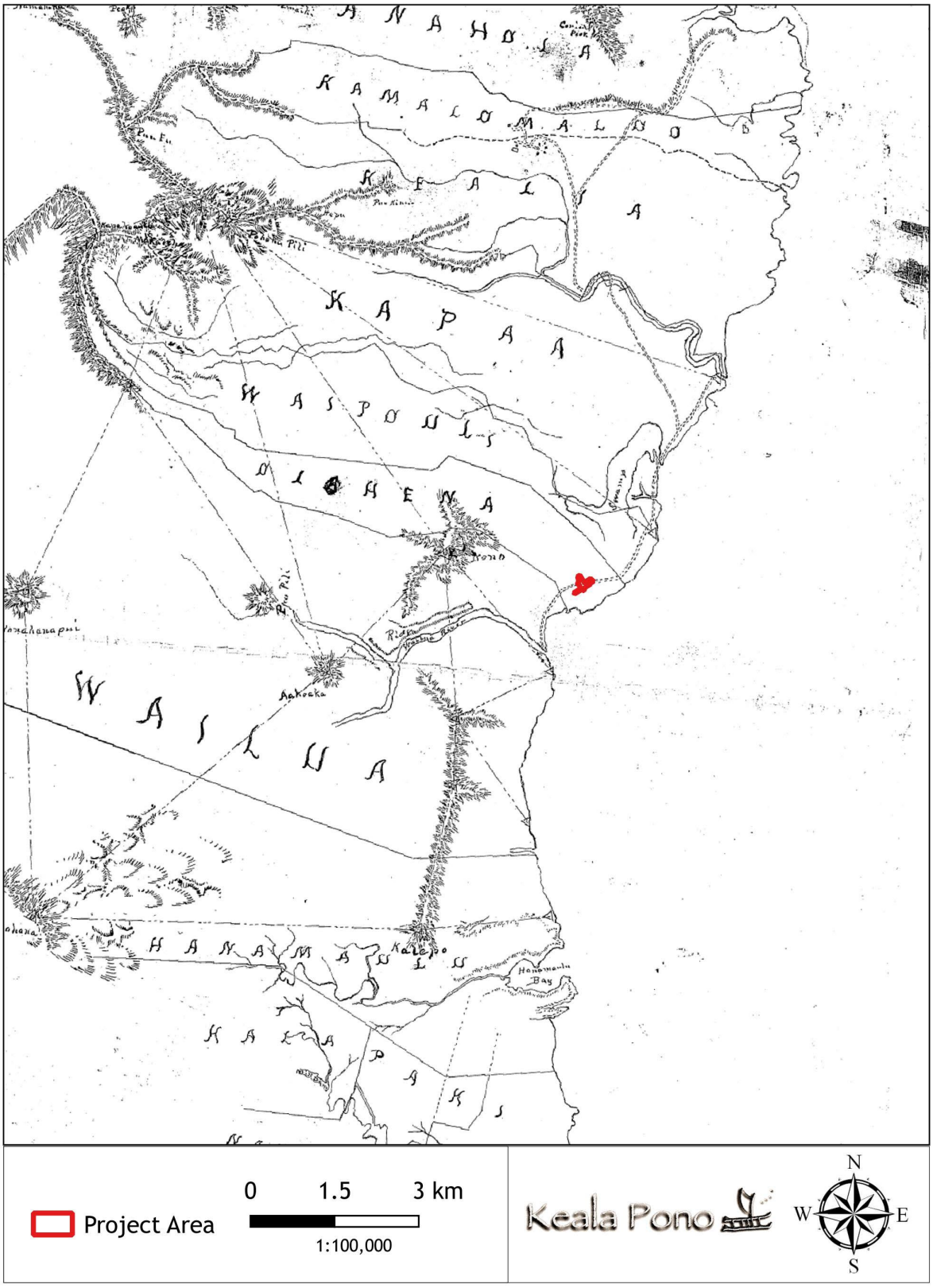


Figure 5. Portion of a map of the island of Kaua‘i (Kitteridge 1878).

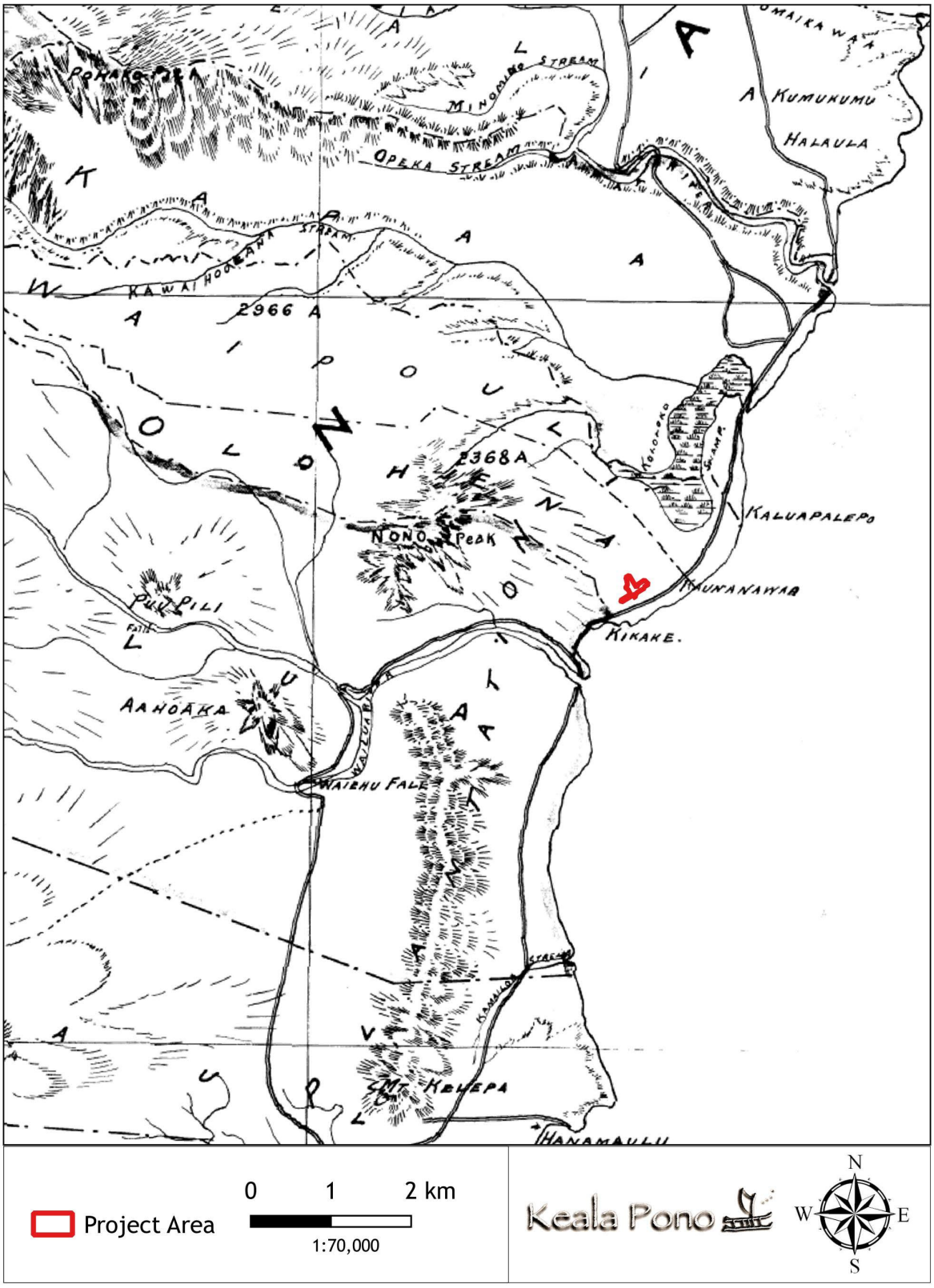


Figure 6. Portion of a Kaua‘i map showing trails and nearby ahupua‘a (Alexander 1900).

concrete arch bridge, which was later replaced by the highway bridge (Wailua River Bridge) in 1949 (Figure 7). Specifically designed for the AT&R railway, the Wailua Plantation Bridge opened in 1921, running parallel to the river bridge, and took just 10 months to complete (Condé and Best 1974:186).

By the early 1950s, the Lihue Plantation was having problems with its rail line. Brakemen, commonly sent out at intersections to warn vehicles of an oncoming train, reported being attacked by dogs and dealing with speeding drivers (*Garden Isle* in Condé and Best 1974:167). As railway transportation was taken over by roads and vehicles, the Wailua Plantation Bridge was soon renovated for use by automobiles and is just one of two standing plantation bridges that were converted for this use on the island (Powell and Dega 2008:5). "By 1957 the company [AT&R] was salvaging a part of their plantation railroad, which was being supplanted by roads laid out for the most part on or close to the old rail bed" (Condé and Best 1974:167). A map from 1954 illustrates the roadways and railway lines in place at the time (Figure 8). Several railroad lines ran along the coast and inland in Wailua, while the line within Olohena passed just mauka of the current study lands before returning to the coastline in Waipouli. A secondary line from Kapaʻa ran southwest, ending not far to the northwest of the project area. The Lihue Plantation Co. switched entirely from rail transportation to trucking in 1959, the last sugar plantation in Hawaiʻi to do so.

The Coco Palms Resort

The Coco Palms Resort (Figures 9 and 10) is located just north of the Wailua River mouth, less than 0.5 miles from the current study area, at the site of Debora Kapule's former residential complex. This is adjacent to the southern half of the current project area, off of the highway at 4-241 Kūhiō Highway. Around the mid-1890s, Ernst Lindeman leased the LCA parcel awarded to Kapule to start a coconut plantation for harvesting copra. Though the operation was unsuccessful, Lindeman is responsible for planting 2,000 nuts from Samoa, which would become the famous coconut tree grove the Coco Palms Resort was named for. He also built a plantation lodge on the property.

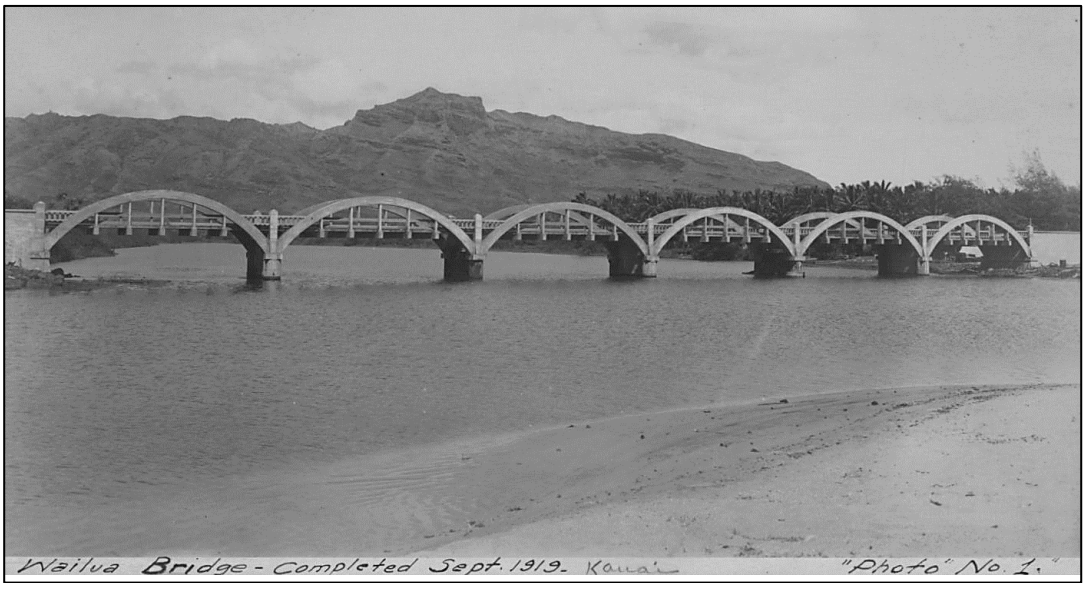


Figure 7. Photograph of the Wailua Concrete Arch Bridge, completed in 1919 (Hawaiʻi State Archives n.d.).

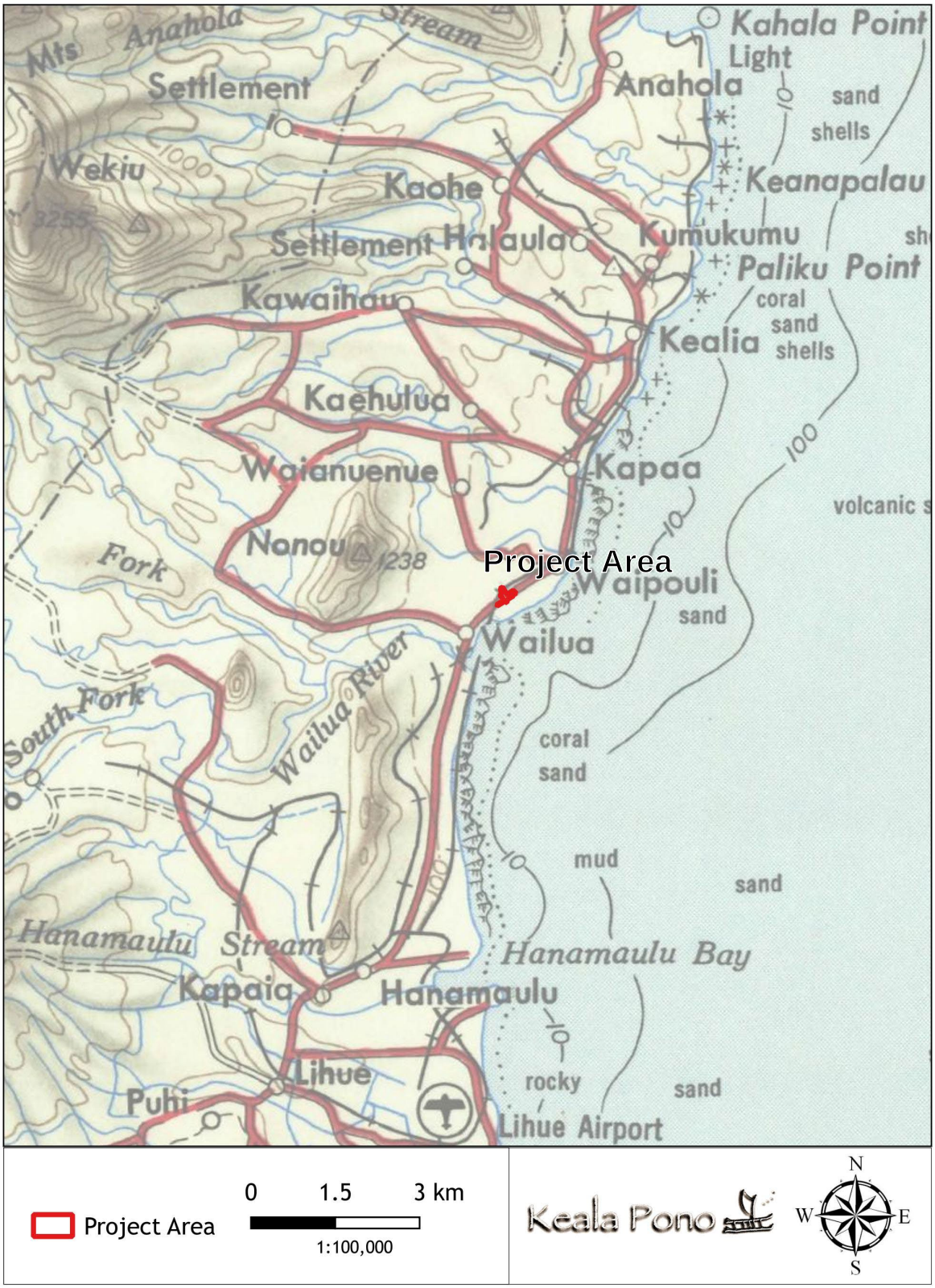


Figure 8. USGS map showing roads, landmarks, and railroad lines (USGS 1954).



Figure 9. Photograph of the Coco Palms sign and property in 1958 showing the railroad tracks, sign, and a rock wall in the foreground and the coconut grove and buildings in the background (in Hammatt 2017:37).



Figure 10. Ruins of the historic Coco Palms resort, facing north (Keala Pono 3/8/21). In the center left of the photo at the clump of coconut trees is the reinterment site for the Coco Palms burials (see Previous Archaeology section).

In the 1950s, tourists to Hawai‘i were just beginning to venture to Kaua‘i and the tourism industry was starting to take off. Lyle and Grace Guslander purchased the plantation from Lindeman in 1952 and converted the lodge into a small hotel with 24 rooms that opened the following year (Hammatt 2017). The Guslanders improved and expanded the hotel into a large and very popular 416-room resort. Many notable guests and celebrities such as Duke Kahanamoku, Rita Hayworth, Elvis Presly, and Frank Sinatra stayed at the Coco Palms. The hotel was featured in several movies such as “South Pacific” and the 1961 hit “Blue Hawai‘i,” where Elvis rode a canoe in the resort’s lagoon. In 1992, the Category 4 hurricane, Iniki, hit Hawai‘i with winds up to 145 mph and devastated the Coco Palms Resort buildings and grounds. The hotel has since stood empty, despite having changed hands multiple times.

While not a town with major development, many of the roads and subdivisions seen today in Wailua and Kapa‘a were in place by the mid- to late-20th century. A USGS map from the early 1960s shows the development in the area such as the Wailua House Lots (Wailua Homesteads), Kūhiō Highway, Papaloa Road, Kapa‘a Bypass Road, and an extension connecting the Kapa‘a Bypass Road to Haleilio Road (Figure 11). Several cultural and historical locations are also labeled nearby including Alakukui Point, the birthing stone, Malae Heiau, Hauola City of Refuge, Hikina o ka lā Heiau and a cemetery on the north bank of Wailua River. The buildings and lagoons of the Coco Palms Resort are also depicted. At this time, just a few structures are seen makai of the project area, with a few homes also in the coastal region near the boundary of Olohena and Wailua Ahupua‘a.

Today, this region is a major tourist destination on Kaua‘i. Since the construction of the airport not far away in Līhu‘e, the island sees many visitors from the other Hawaiian islands, across the U.S., and overseas. One of the main points of interest that draws tourists to the area is Wailua State Park with its waterfalls, kayaking, and river tours. Fans of Elvis Presley often make the journey to visit the remnants of the Coco Palms Resort, and the coastline is dotted with hotels and condominiums for overnight stays. Although the sugar industry in Hawai‘i has closed down completely, evidence of Wailua and South Olohena’s plantation past is still apparent.

Previous Archaeology

Previous archaeological studies offer significant information on traditional and historic land use. Several archaeological projects have been conducted within and near the current study lands (Figure 12 and Table 1). Archaeological sites in the vicinity with known locations are shown in Figure 13; State Inventory of Historic Places (SIHP) numbers are prefixed with 50-30-08 unless otherwise specified (Table 2). The following discussion summarizes the findings of archaeological studies within approximately 0.5 km of the subject property, based on reports found at the SHPD library in Kapolei, Hawai‘i.

The earliest archaeological survey on Kaua‘i is an island-wide study that documented Kukui Heiau in South Olohena Ahupua‘a, however it was recorded with the sites in Wailua (Bennett 1931). Kukui Heiau (SIHP 50-30-08-108) is described as follows:

> **Kukui Heiau (Site 108)**
>
> Kukui heiau, on the shore north of Wailua River on a point named Lae Alakukui. This structure is a walled heiau of two divisions apparently an inclosure (sic) within an inclosure (sic). The walls are much reduced in size by the removal of rocks. The entire east end can only be determined by traces of the old walls on the inside. Remains of the walls of the eastern division indicate them to have had an original width of about 5 feet on all sides. The west end wall of this section is missing, though a stone or two indicates that it was there at one time. The house site and small wall built out to the west are probably later additions. The outer walls of this section are very thick, and apparently continue to include the east division, thus leaving a passageway 4 feet wide between the outside of the east section wall and the inside of the thick wall.



Figure 11. USGS map showing roads, landmarks, and important cultural sites (USGS 1963).

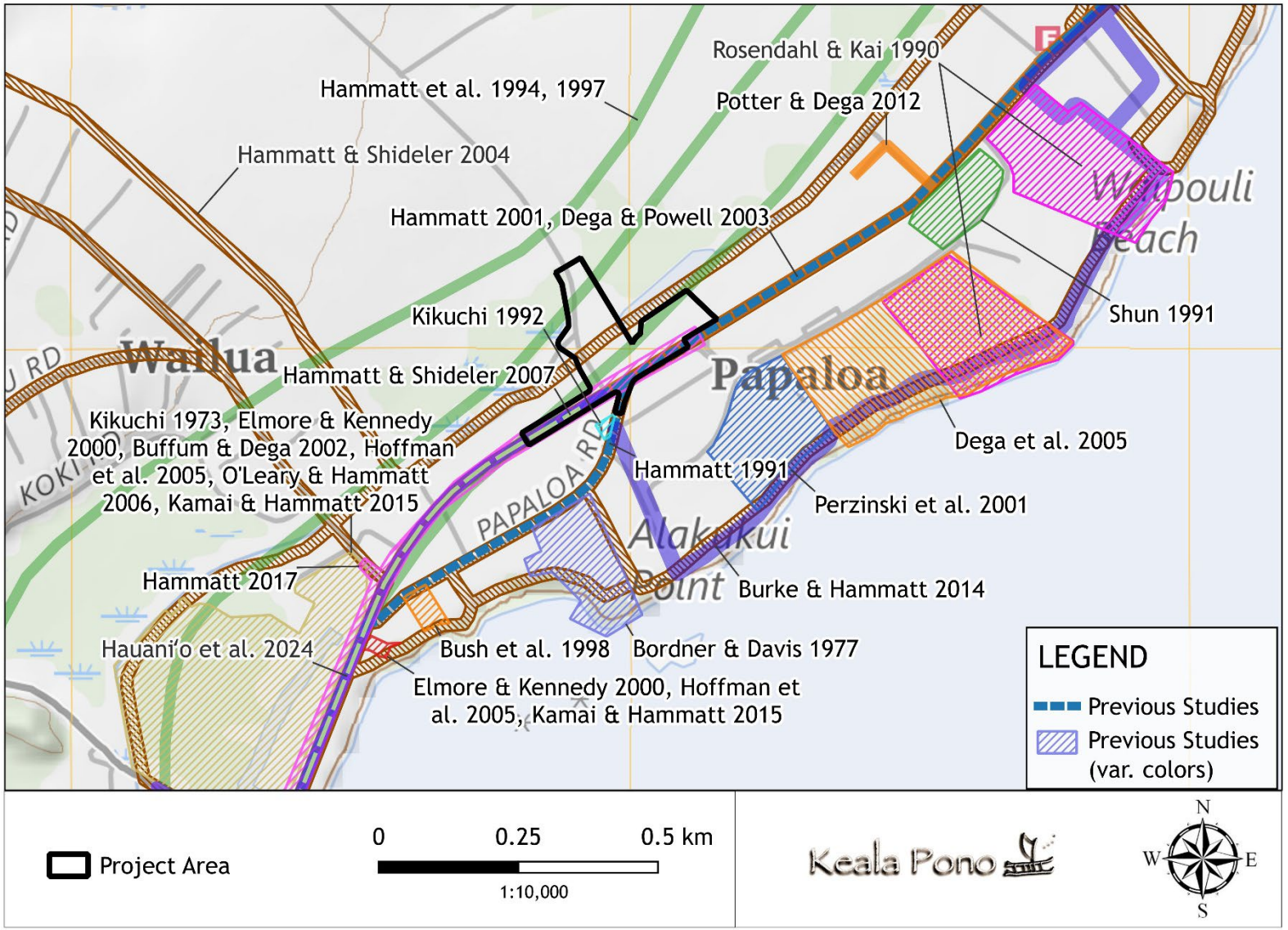


Figure 12. Previous archaeological studies within approximately 0.5 km of the project area.

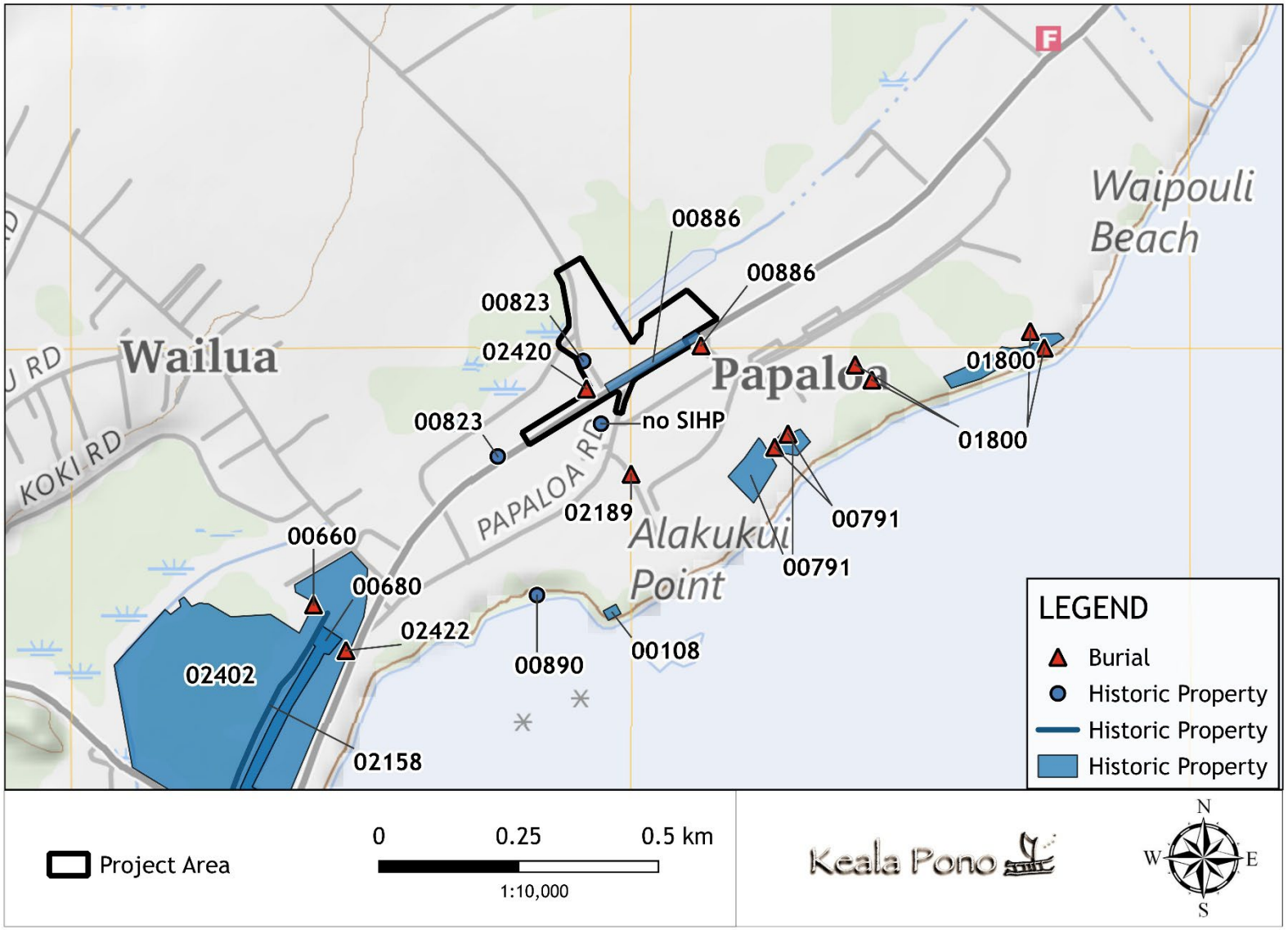


Figure 13. Previously recorded archaeological sites near the project area with known locations. SIHP numbers are prefixed with 50-30-08.

Table 1. Previous Archaeological Studies in the Vicinity of the Project Area

Author/Year	Location	Work Completed	Findings
Bennett 1931	Island-wide	Archaeological Survey of Kaua‘i	Documented Kukui Heiau (SIHP 00108) in the vicinity of the current project area.
Kikuchi 1973	Coco Palms	Burial Report	Documented a burial ground; however this is not within 0.5 km of the current project area.
Bordner & Davis 1977	Kukui Heiau	Archaeological Investigation	Recorded the previously identified Kukui Heiau (SIHP 00108). No new historic properties identified.
Rosendahl & Kai 1990	Coastal area between Papaloa and Waipouli	Archaeological Inventory Survey	Recorded two cultural layers and three human burials (SIHP 01800) within 0.5 km of the current project area as well as cultural layers and burials not near the project area.
Shun 1991	Makai and just north of Aleka Lp.	Subsurface Testing	No historic properties identified.
Hammatt 1991	Kūhiō Hwy.	Subsurface Testing	No historic properties identified.
Kikuchi 1992	Papaloa Tract	Archaeological Inventory Survey	Identified three imu with blackened pipipi shell midden. No SIHP number was assigned.
Hammatt et al. 1994	Kūhiō Bypass Options	Literature Review and Archaeological Assessment	Noted the Coco Palms Resort (SIHP 02402) as well as two other sites that are not near the current project area.
Hammatt et al. 1997	Kūhiō Bypass Options	Archaeological Inventory Survey	Identified two sites not near the project area. Recommended archaeological monitoring near Wailua River and the Coco Palms Resort.
Bush et al. 1998	Makai of Papaloa Rd.	Archaeological Inventory Survey	No historic properties identified.
Elmore & Kennedy 2000	Coco Palms	Burial Report	Recorded a human burial (SIHP 00660) determined to be of Hawaiian ethnicity. Associated burial goods include glass beads and a coral abrader.
Perzinski et al. 2001	Makai of the south end of Aleka Lp.	Archaeological Monitoring	Documented a cultural layer, pit features, a hearth, and two human burials (SIHP 00791). Artifacts include fragmented fishhooks, cut shell, files, a coral manuport, and a fishhook preform.
Hammatt 2001	Kūhiō Hwy.	Archaeological Assessment	Determined that the current project area vicinity had a moderate potential for encountering subsurface historic properties due to the coastal region having high cultural use in traditional times and sandy soils.
Buffum & Dega 2002	Coco Palms	Archaeological Monitoring	Did not record any archaeological sites within 0.5 km of the current project area.
Dega & Powell 2003	Kūhiō Hwy.	Archaeological Monitoring	Documented SIHP 00886 (a hearth, ‘auwai, and iwi kūpuna) as well as several sites that are not near the current project area.

Table 1. (continued)

Author/Year	Location	Work Completed	Findings
Hammatt & Shideler 2004	Lydgate to Kapa‘a Bike and Pedestrian Paths	Archaeological Assessment	Documented a Railroad Culvert (SIHP 00823) and grinding stones (SIHP 00890) within 0.5 km of the current project area.
Hoffman et al. 2005	Coco Palms	Archaeological Inventory Survey	Identified two of Debora Kupule’s historic fishponds (SIHP 00680).
Dega et al. 2005	Makai of Aleka Lp.	Archaeological Inventory Survey	Did not record any archaeological sites within 0.5 km of the current project area.
O’Leary & Hammatt 2006	Coco Palms	Archaeological Inventory Survey Addendum	No new historic properties identified.
Hammatt & Shideler 2007	Kūhiō Hwy.	Archaeological Assessment	Did not record any archaeological sites within 0.5 km of the current project area.
Potter & Dega 2012	Fernandes and Lunalilo Rd.	Archaeological Inventory Survey	No historic properties identified.
Burke & Hammatt 2014	Alakukui Point to Waipouli	Archaeological Inventory Survey	Identified previously recorded cultural layers including SIHP 00791 and 01800, the latter of which included human burials. Also identified SIHP 02189, a partial human burial.
Kamai & Hammatt 2015	Coco Palms	Burial Site Component of an Archaeological Data Recovery Plan	Documented inadvertently discovered human skeletal fragments that were reburied in a burial platform in the Hawaiian Garden. The discovery was not near the current study area.
Hammatt 2017	Current Project	Archaeological Inventory Survey	Recorded one previously identified site (SIHP 00823) and a newly recorded ‘auwai (SIHP 02158) near the current project area. The historic ‘auwai runs through the Coco Palms Resort with a culvert at Kuamoʻo Road.
Hauaniʻo et al. 2024	Kūhiō Hwy.	Archaeological Monitoring	Identified three human burials, two of which are within 0.5 km of the current project area (SIHP 02420 and 2422) and a segment of the previously documented AT&R railroad (SIHP 00823).

Table 2. Known Archaeological Sites Within 0.5 km of the Project Area

SIHP 50-30-08-	Description	Author/Year
00108	Kukui Heiau	Bennett 1931; Bordner & Davis 1977
00660	Human burial	Elmore & Kennedy 2000
00680	Two of Debora Kupule's historic fishponds	Hoffman et al. 2005
00791	Cultural layer, pit features, a hearth, and two human burials	Perzinski et al. 2001; Burke & Hammatt 2014
00823	AT&R railroad bed	Hammatt & Shideler 2024; Hammatt 2017; Hauani'o et al. 2024
00886	Hearth, 'auwai, and human skeletal remains	Dega & Powell 2003
00890	Grinding stones	Hammatt & Shideler 2004
01800	Two cultural layers and three human burials	Rosendahl & Kai 1990; Burke & Hammatt 2014
02158	Post-contact 'auwai	Hammatt 2017
02189	Human burial	Burke and Hammatt 2014
02402	Coco Palms Resort	Hammatt et al. 1994
02420	Human burial	Hauani'o et al. 2024
02422	Human burial	Hauani'o et al. 2024
No SIHP	Three imu	Kikuchi 1992

> The thick north wall measures 11 feet across and is apparently in two steps of 6 feet and 5 feet respectively. The sea wall is 16 feet to 22 feet across, and is built up in tiers of great slabs of lava set on edge and filled around with smaller stone…On the north side of the north passageway the wall is made of 3 to 5-foot flat stones on edge, and the same was true of the south passageway…Today there is no paving, but Thrum says that there was one. (Bennett 1931:127)

The Coco Palms Resort (SIHP 50-30-08-02402) has been a focal point for archaeological studies in the greater area. Prior to any formal studies, an unknown number of human burials were found during initial construction of the hotel. The remains were reinterred at the front of the hotel near Kūhiō Highway (see Figure 10). Additional human remains were inadvertently encountered in sandy deposits during construction of a new wing of the hotel (Kikuchi 1973). In total, 34 individuals were recorded, however it is noted in later reports that the number could be as high as 85 individuals (e.g., Hoffman et al. 2005:26). The 1973 burials were reinterred with the earlier remains and marked with a boulder and plaque at the front of the hotel grounds. The burial ground is more than 0.5 km away from the current project area. During excavations of contaminated material near a diesel tank, human remains were again encountered (Elmore and Kennedy 2000). The burial (SIHP 50-30-08-00660) was discovered in sand deposits with glass beads and a coral abrader and was determined to be of Hawaiian ethnicity. The remains were reinterred in a burial platform at the north end of the property.

Installation of a perimeter fence encircling the Coco Palms property in 2002 required archaeological monitoring (Buffum and Dega 2002). A cultural layer was documented on the west side of the property, not in the vicinity of the current project area. Three years later, a series of 86 test trenches were excavated at the resort as part of an archaeological inventory survey (Hoffman et al. 2005). Two new sites were identified consisting of the remains of Debora Kapule's two historic fishponds listed under SIHP 50-30-08-00680 and considered significant under Criterion B. In 2006 an additional 13 trenches were excavated near the tennis courts as part of an archaeological inventory survey addendum to the Hoffman et al. study (O'Leary and Hammatt 2006). No new historic properties were identified. The most recent study at the Coco Palms Resort in 2015 inadvertently discovered human skeletal fragments during ground disturbance for the construction of dust fence postholes not in the vicinity of the current study area (Kamai and Hammatt 2015). The human remains were reburied in a burial platform located within the Hawaiian Garden to the west of Queen's Hall.

An archaeological inventory survey of two coastal parcels between Papaloa and Waipouli identified two cultural layers and three human burials (SIHP 50-30-08-01800) within 0.5 km of the current project area (Rosendahl and Kai 1990). One of the SIHP 01800 cultural layers consisted of shell midden, fish bone, charcoal fragments, ash, fire-cracked rock, pit features, and historic artifacts (ceramic sherds and glass shards), while the second cultural layer included much of the same material as well as flaked stone, modified bone, and cut shell. The three burials were found within the cultural layer near the shoreline and left in place. The site was interpreted as a recreation area or a place used for social gatherings. Radiocarbon analysis dated the site to AD 1270–1954, with volcanic glass hydration rind dating to between AD 1496–1556 (Rosendahl and Kai 1990:13).

Construction of a proposed dental office on Papaloa Road, very close the current study area, required an archaeological inventory survey (Kikuchi 1992). Five mechanically-excavated test pits were dug, which identified three shallow imu in the mauka portion of the parcel. Cooking stones and blackened pipipi shell midden was also observed. No SIHP number was designated. It was noted that the entire area was graded and used as a horse racing track, and then as an encampment during World War II.

In 1994, an archaeological literature review and assessment was completed for three routes to circumvent Kapaʻa Town for the Kūhiō Highway Bypass project (Hammatt et al. 1994). Archival research found no known archaeological sites located within the three alternate routes, however places of concern included the Wailua Complex of Heiau, possible human burials near the Wailua Golf Course and the Coco Palms Resort, as well as sites associated with former marshland areas. This work was followed by an archaeological inventory survey of the same three bypass options, which included core sampling and backhoe test trenches (Hammatt et al. 1997). The study documented two sites, a terrace possibly from the historic era and the Wailua wetland. Neither site is in proximity to the current project area.

During archaeological monitoring makai of Aleka Loop in South Olohena Ahupuaʻa, a cultural layer and two burials were identified and designated as SIHP 50-30-08-00791 (Perzinski et al. 2001). One human burial was in situ, while the second consisted of isolated remains. The cultural layer was comprised of pits, hearths, and a marine midden concentration. Artifacts recovered were fishhook fragments, cut shell, a sea urchin spine file, a coral file, a coral manuport, and a fragmented fishhook preform. Radiocarbon analysis dated the site to AD 1275–1645 and it was concluded that Site 00791 was possibly the location of an eating house or other structure.

An initial archaeological assessment was performed for a fiber optic cable project which spanned roughly 51 miles (82 km) of roads between Kekaha and Moloaʻa (Hammatt 2001). The study covered a 17-mile (27.4 km) portion of Kūhiō Highway from Līhuʻe to Moloaʻa, which included a portion of the current project area. The section encompassing the current study area, from Haleʻīlio Road to Waipouli Stream, was categorized as having moderate potential for encountering subsurface historic properties due to the coastal region exhibiting high cultural use and sandy soils. The assessment was followed by

archaeological monitoring for Phase I of the project, broken up into 10 segments from Moloaʻa to Anahola (Dega and Powell 2003). Of the 10 project segments, cultural deposits and/or human burials were encountered in five segments, with 10 archaeological sites documented, of which seven were previously identified. Within 0.5 km of the current project area, SIHP 50-30-08-00886 was recorded, consisting of a hearth, ʻauwai, and iwi kūpuna.

An archaeological assessment of a large area extended 1 km inland from the coast and from "Lydgate Park on the south side of the Wailua River mouth through Kapaʻa Town on the north" (Hammatt and Shideler 2004:1). A railroad culvert (SIHP 50-30-08-00823) and grinding stones (SIHP 50-30-08-00890) were identified within 0.5 km of the current project area. SIHP 00823 was composed of a stone and concrete culvert, SIHP 00890 includes "several large basalt boulders with both linear and circular worn depressions" (Hammatt and Shideler 2004:83).

Makai of Aleka Loop on a 20.81-acre parcel, an archaeological inventory survey identified additional features of a previously identified site not near the current project area (Dega et al. 2005). No archaeological sites were found within 0.5 km of the current project area.

In 2007, an archaeological inventory survey that included ten test trenches was performed between Kuamoʻo Road and the Kapaʻa Temporary Bypass Road, which includes the current project area (Hammatt and Shideler 2007). This study did not record any archaeological sites within 0.5 km of the current project area.

An archaeological inventory survey was conducted for an 8.6-acre area for a proposed bike and pedestrian path from Alakukui Point to Waipouli (Burke and Hammatt 2014). Two new archaeological sites were documented, both of which were human burials, however only one of these is within 0.5 km of the current project area (SIHP 50-30-08-02189). SIHP 02198 is just makai of the study lands within a parking lot off of Papaloa Road. The SIHP 02189 burial was previously disturbed by excavations for an old utility line. The partial human burial was encountered at 50 cm below surface (cmbs) and appeared to be a single adult from the pre-contact to early post-contact period. In addition to the burials, several cultural layers were observed and added to pre-existing site numbers depending on the location. Of these, SIHP 00791 and 01800 are within 0.5 km of the current project area.

In 2017, an archaeological inventory survey was completed for the current Kūhiō Highway Short-Term Improvements Project (Hammatt 2017). Three previously identified historic properties and one new archaeological site were documented. SIHP 50-30-08-02158 is a newly recorded post-contact ʻauwai measuring approximately 150 m that drains water from the Coco Palms Resort fishponds (SIHP 00680) into the Wailua River, intersecting Kuamoʻo Road. The ʻauwai is lined with three to four courses of basalt cobbles and boulders and has a concrete culvert at Kuamoʻo Road. It was evaluated as significant under Criteria A, D, and E and deemed to be eligible for inclusion on the Hawaiʻi and National Historic Registers. The previously documented sites are SIHP 00823, a portion of the AT&R railroad bed; and two cultural layers not in the vicinity of the current project area. Hammatt noted that "there was often little or no development of a railroad berm so that little trace would be expected to remain after the railroad rail sections and railroad ties were removed," which was probably the case when constructing Kūhiō Highway.

Archaeological monitoring was required for the Kūhiō Highway Short Term Improvements Project from Kuamoʻo Road to the Temporary Kapaʻa Bypass Road (Hauaniʻo et al. 2024). Two human burials were identified within 0.5 km of the current project area, one near the Coco Palms Resort (SIHP 50-80-08-02422), and the other at the boundary of the current project area (SIHP 50-80-08-02420) (see Figure 13). These two are in situ burials that were left in place. Also found was a segment of the previously documented AT&R railroad (SIHP 00823). A total of 67 artifacts and one dog bone were collected throughout the course of the monitoring, none of which were associated with the burials. Historic artifacts

consist of 38 glass bottles, four other glass items, one fragmented ceramic insulator, five miscellaneous items, and 19 metal pieces. The bottles range in age from 1932 to post-1960 and were mostly recreational beverages, in the form of soda and alcohol bottles. Many of the sodas were filled at soda works on Kauaʻi. Two traditional artifacts were a stirrup poi pounder and a cowry lūheʻe lure.

Several studies produced no new findings and did not encounter any historic properties. These include an archaeological investigation at Kukui Heiau (Bordner and Davis 1977), subsurface testing north of Aleka Loop (Shun 1991), subsurface testing on Kūhiō Highway (Hammatt 1991), an archaeological inventory survey makai of Papaloa Road (Bush et al. 1998), and an archaeological inventory survey at Fernandes and Lunalilo Roads (Potter and Dega 2012).

Summary of Background Research

The Puna district of Kauaʻi is thought to have been settled around AD 1000–1100 and the region from Kapaʻa to Wailua was said to be a dense population center. Pre-contact use of Olohena Ahupuaʻa would have centered around cultivation at the nearby Wailua River valley and floodplain. This was supplemented by marine and inland terrestrial resources. People traveled between the neighboring ahupuaʻa using the inland or coastal trail that passed through the district. Several prominent heiau are noted for the greater region, with Olohena known for a navigational heiau that was utilized in traditional times. Olohena was also known for Halepaiwi, where games of riddles were played and for the Sleeping Giant of Nounou Mountain.

The historic era saw widespread changes as early sugar plantations were established in the region. The Lihue Plantation Co. had interests in South Olohena and Grove Farm Plantation, Kealia Plantation, and Hui Kawaihai had operations nearby. Sugarcane and rice cultivation drastically changed the landscape and livelihood of residents, with a decline in the cultivation of native crops and the eventual conversion of many fallow loʻi into rice paddies. To support their operations, the plantations built many miles of ditches, irrigation systems, railroads, access roads, and mills to process the sugarcane. The AT&R constructed the Wailua Railroad Bridge, which allowed freight cars to cross the Wailua River. Roads were later established in place of railroad transportation to connect different parts of the island. Not far from the project area, the Coco Palms Resort was established in 1952 at the location of Debora Kapule's estate and subsequently closed down due to extensive hurricane damage in 1992.

Previous archaeological studies have recorded several historic properties in the project vicinity, although none have been found within the project area. However one human burial was found at the project area boundary (SIHP 02420). Other known historic properties in the vicinity include Kukui Heiau, a hearth, grinding stones, Debora Kupule's historic fishponds, the AT&R railroad bed, post-contact ʻauwai, imu, and historic structures of the Coco Palms Resort. A number of cultural layers and other iwi kūpuna burial sites have been found throughout the region and also near the project lands.

ETHNOGRAPHIC SURVEY

Not all information is found in the archives, in textbooks, or at the library. Rather, it is in the stories, knowledge and experiences of our kamaʻāina and kūpuna, that important information is kept. Through ethnographic research we are able to better understand the past and plan for our future. With the goal to identify and understand the importance of, and potential impacts to, traditional Hawaiian and/or historic cultural resources and traditional cultural practices of the project area in the ahupuaʻa of Olohena, Puna, Kauaʻi, ethnographic interviews were conducted with community members who are knowledgeable about the area.

Methods

This Cultural Impact Assessment was conducted through a multi-phase process between January and July 2025. Guiding documents for this work include The Hawaiʻi Environmental Council's Guidelines for Assessing Cultural Impacts, A Bill for Environmental Impact Statements, and Act 50 (State of Hawaiʻi). Personnel involved with this study include Windy McElroy, PhD, Principal Investigator of Keala Pono Archaeological Consulting and Dietrix Duhaylonsod, MA, Ethnographer.

Interviewees were selected because they met one or more of the following criteria: 1) was referred by Keala Pono Archaeological Consulting or SHPD; 2) had/has ties to the project area or vicinity; 3) is known to be knowledgeable about Hawaiian cultural resources; 4) is a known Hawaiian traditional practitioner; or 5) was referred by other cultural resource professionals. Five individuals participated in the current study. Manaʻo and ʻike shared during these interviews are included in this report.

Four of the five interviewees wanted to participate without being formally interviewed. Three of the interviewees requested to submit their responses to the interview questions in writing. The fourth interviewee requested that a summary be written about our talk story session. The fifth interviewee participated in a formal oral interview. Each person was provided with a map or aerial photograph of the subject property, the Agreement to Participate (Appendix A), and Consent Form (Appendix B), and briefed on the purpose of the Cultural Impact Assessment. Research categories were addressed in the form of open questions which allowed the interviewee to answer in the manner that he/she was most comfortable. Follow-up questions were asked based on the interviewee's responses or to clarify what was said.

Several potential interviewees were contacted, resulting in the five interviews (Table 3). The ethnographic analysis process consisted of examining each response and organizing information into research themes, or categories. Research topics include connections to the project lands, the natural environment, changes through time, archaeological sites and cultural practices, and concerns and recommendations for the project. The interviewees' written statements are presented in Appendix C in their entirety, with one oral interview in Appendix D.

Interviewee Background

The following section includes background information for each interviewee, in their own words. This includes information on the interviewee's ʻohana and where the interviewee was born and raised. The interviewees are Milton Ching, Kenneth Ponce, Leilani Rivera, Rupert Rowe, and Kaliko Santos.

Milton Ching

> I am Milton K.C. Ching, ma Kapaʻa, District of Kawaihau, County of Kauaʻi. I am a resident of Kapaʻa since 1957, my parents also resided in Kapaʻa since the 1940s as well as my

grandparents since the early 1920s. I am part Hawaiian, retired since 2012, I am currently an Archaeologist Monitor, employed by an Archaeologist Company.

Table 3. List of Individuals Contacted

Name and Connection	Method of Contact	Result of Contact
Milton Ching (Lineal descendant of the area)	Email, phone, in-person	Interview completed
Bridget Hammerquist (Friends of Mahaʻulepu)	Email, phone	Recommended Rupert Rowe and Liko Martin
Kehaulani Kekua (Palaihiwa O Kapiuwai)	Email, phone	No interview scheduled
Liko Martin (Cultural descendant of the area)	Email, phone	No interview scheduled
Fern Merle-Jones (Hālau Hula Nā Lei Kupua)	Email, phone	No interview scheduled
Beverly Muraoka (Healani's Hula Hālau)	Email, phone	No interview scheduled
Queen Kapule Hawaiian Civic Club	Email	No interview scheduled
Kenneth Ponce (Kupuna from Kapaʻa)	Email, phone	Interview completed
Leilani Rivera (Hālau Hula O Leilani)	Email, phone	Interview completed
Rupert Rowe (Lineal descendant of the area)	Email, phone	Interview completed
Kaliko Santos (Nā Kuleana O Kānaka ʻŌiwi)	Email, phone, in-person	Interview completed
Franz Schmutzer (Kauaʻi Historical Society)	Email, phone	No interview scheduled
Kamika Smith (Smith family lūʻau at Wailua)	Email, phone	No interview scheduled

Kenneth Ponce

My name is Kenneth Ponce. I was born on Kauaʻi in Līhuʻe at Wilcox Hospital. And I been living all my life and grew up in Kapaʻa, down in Waipouli. And then my family moved up to the Kapaʻa homestead next to Kapaʻa School. So I went to grade school in Kapaʻa Elementary. Then I switched over at third grade to St. Catherine's School here, up in Kapaʻa Homestead. And then I went to high school, after 8th grade, from 3rd grade to 8th grade, I was attending St. Catherine's Catholic school. Then after the 8th grade, I went to Kapaʻa High School, where I graduated in 1967.

Leilani Rivera

[Ethnographer's note] Leilani Rivera is a Kumu Hula from Kauaʻi and a former entertainer at a show at Kauaʻi's Coco Palms, headlined by her father, Larry Rivera. She took Hawaiian studies classes at Kauaʻi Community College and worked at the Coco Palms hotel as a hula dancer and in Guest Relations educating guests about Hawaiian culture, history, and arts.

Rupert Rowe

[Ethnographer's note] Kupuna Rupert Rowe is an 83 year old lineal descendant from the Coco Palms area of Kauaʻi with ties connected to Kauaʻi's aliʻi. He is a caretaker of the cultural resources of the area.

Kaliko Santos

My name is Donna Kaliko Santos and I am the president of the Native Hawaiian Organization (NHO), Nā Kuleana O Kānaka ʻŌiwi. I am also the poʻo for the Puna Moku with the Aha Moku Advisory Committee (AMAC) here on the island.

Topical Breakouts

The following sections are extended quotations from the interviews, organized by topic. Interviewees provided information on connections to the project lands; the natural environment; changes through time; and the archaeological sites and cultural practices connected to the area. They also shared their concerns and recommendations for the proposed project.

Connections to Olohena and the Surrounding Area

Kupuna Rupert Rowe is an 83-year old lineal descendant from the Coco Palms area of Kauaʻi with ties connected to Kauaʻi's aliʻi. [Ethnographer's note]

Leilani Rivera grew up on Kauaʻi and was influenced by her father, Larry Rivera, who performed at the Coco Palms Hotel since the 1950s. At age 13 she became his lead hula dancer. She also worked in Guest Services at the Coco Palms Hotel and learned from kūpuna there about Hawaiian culture and the history of the area. [Ethnographer's note]

My children and wife are recognized Descendants from the ahupuaa of Waipouli by State Historic Preservation Division (SHPD) under the Department of Land and Natural Resources (DLNR). Census records for 1900 list 4th great grandfather J. Kauhoe (k.), for 1910 census lists 3rd great grandmother, E. Pipili (w.), for 1930 census lists great grandfather Willie Hepa. [Milton Ching]

I am the president of NHO--Na Kuleana O Kanaka Oiwi. I am also the poʻo for the Puna Moku with the Aha Moku (AMAC) here on the island. [Kaliko Santos]

I've been here for almost 76 years. I'll be 76, December of this year, of 2025. So, this is where I grew up all my life. I'm familiar with all the plantation camps that the people were living in, up in the Olohena Bypass, and further down towards the Kapaʻa Bypass, there was another camp on that bypass road up mauka of the road. [Kenneth Ponce]

The Natural Environment

Our native Hawaiian ancestors continued their daily lives, catching marine life, growing taro and other fruits and plants for subsistence as part of their Traditional Gathering Rights. [Milton Ching]

Kupuna Rowe mentioned that the area of the proposed Kapaʻa roundabout is in a natural floodplain. [Ethnographer's note]

People used to tell me that makai of the bypass road there were rice paddies in that area, between that road and Kapaʻa town, but way back when, back in the early 1900s up to the mid-1900s, I guess, I don't really know, but it was gone when I was born, but people used to talk about rice paddies being up there. [Kenneth Ponce]

Changes Through Time

The plantation homes? Where the roundabout is going to be developed, it's about maybe more than a quarter of a mile, maybe half a mile from that area, up mauka, right up the haul cane road. There used to be, underneath, an old haul cane road before it was the Kapa'a Bypass. They used it to alleviate the traffic through Kapa'a town… people couldn't go on the road because, like I said, it was usually for the haul cane trucks that used to transport the sugar on that road. [Kenneth Ponce]

There were camps all over in that area, up mauka. Yeah, there's like at least four camps that I can think of all in the area. There were camps above that specific area next to the haul cane road, "35 Camp." And there was also another camp nearby the Kapa'a Middle School, there was a camp above the Kapa'a Middle School, so I can remember at least about four plantation camps in that area… I just remember, some of them were Filipinos, and some of them were Japanese, but I guess it was all pretty mixed. [Kenneth Ponce]

Archaeological Sites and Cultural Practices

As for the Kapaa Bypass Project, be aware that iwi kupuna has come up in the area under previous construction/development projects. I believe under the Kuhio Hwy Short Term Improvement project along Kuhio Hwy (by the corner area of where the bypass is now and across the highway makai like the Coconut Marketplace area & also where the "Bike Path" runs along the coastline. The entire area, due to its sandy composition and relative flatness--where we call sandy areas, are known to bring up iwi kupuna now and then. [Kaliko Santos]

During my employment as Archaeologist Monitor, I encountered an "Inadvertent" Burial at the corner of the Kapaa Bypass Road and Kuhio Highway (SW) intersection. [Milton Ching]

Concerns and Recommendations

Basically, the roundabout is not necessary. What needs to be addressed more than anything else on the road is the speeding, and perhaps speed bumps in the area could help. Of particular concern is the entrance/exit by Kintaro Restaurant, which is at such a bad location, it is an accident waiting to happen. DOT should take a look at that and see how they could make it safer there. [Leilani Rivera]

A speed bump should be placed just before Kintaro Restaurant to slow down the oncoming traffic with a more directive visible way to come out of Kintaro entrance/exit. Also add a speed bump from the north side before Kintaro entrance/exit because either way going north or south, it's difficult and frightening for especially kupuna or young drivers to make a correct decision going into the main road. [Leilani Rivera]

It is our practice to require that any work in the area requires "archaeological monitoring" due to past inadvertent discoveries and continued consultation throughout the project life as the area can be controversial (eg. nearby Coco Palms hotel rebuild). It is also recommended that early pilina and presentation be made to the Kauai-Niihau Islands Burial Council. [Kaliko Santos]

Kupuna Rowe shared a lot of powerful personal reflection, never losing sight of his own kupuna's words to him long ago: "One day when you come of my age, you will deliver what I tell to you." And indeed, Kupuna Rowe does carry on the torch like a true kia'i: "Development on this island cannot continue because there's no end point. How much people do we plan to put on this island? I no can support any more development, including transportation [such as the Kapa'a roundabout]." [Ethnographer's note]

Kupuna Rowe pointed out that the roundabout will only justify more cars, more houses, and more people moving in. He said that instead, resources should be spent helping Hawaiians to reclaim their identity, and in fact, he had just testified about it at an OHA meeting earlier in the

day, where he told them, “How do you protect your past? If you lose your past, you lose your future.” [Ethnographer’s note]

This proposed project would pose a potential encounter for “Inadvertent Burials”, the Coconut Marketplace, located across the intersection on the east of Kuhio Highway and Papaloa Road, was monitored by me, and the project encountered numerous burials at different depths, from six inches to one meter plus. [Milton Ching]

So many years ago, very recently, they had two lanes going from north to south to the Wailua Bridge, and that really helped alleviate the traffic, people coming from the Kapaʻa Bypass Road and people coming through Kūhiō Highway from Kapaʻa town, going towards the south, towards Līhuʻe. And our concern is if the traffic is going to flow into the two lanes going south… I hope they don’t change that because it would really change the flow of traffic. Right now it flows really good. And people that I talk to, this guy that I talked to said that if it’s a roundabout, it might impact, you know, it might back up traffic again. But I told him that if they keep the flow constant where we can just flow the Kapaʻa traffic and just merge with the Kapaʻa Bypass, and flow into the two lanes, to me, it would be good. So that’s one of our concerns, ‘cause before it was just one lane going towards the bridge. Now it’s two lanes. So we just have to see how they’re gonna configure this roundabout, converging into the two lanes going south. [Kenneth Ponce]

It was just one lane going south… Then they widened the road and made it two lanes, which really alleviated the traffic, ‘cause we could flow from the Kapaʻa Bypass, right onto the two-lane highway. And the people from Kapaʻa town could just, ‘cause now they made two lanes, so they would take the other lane, and so the traffic flow would be constant instead of backing up, ‘cause so many years ago, I don’t know, 3, 4, 5 years ago before these changes, it was horrendous. [Kenneth Ponce]

I’m pretty sure these planners are gonna figure this out, but yeah, we’ll see. I guess that’s a main concern, not backing up the traffic… ‘Cause right now it’s working real well… So the northbound traffic is not that much of a concern… It’s the traffic that’s going from Kapaʻa, from the north, coming south, everything coming through Kapaʻa town. [Kenneth Ponce]

Summary of Ethnographic Survey

All of the interviewees know about Olohena and its surrounding area through familial connections. Two of the interviewees are lineal descendants of the area, and at least one of them has genealogical ties to Kauaʻi’s aliʻi. All of the interviewees give back to their community in many ways, from taking care of cultural sites to working as a culturally sensitive archaeological monitor, to keeping the community safe as a lifelong firefighter. One interviewee is the Kumu Hula of a long-established hālau in the area. Another interviewee serves the community as a member of the Native Hawaiian Organization, Nā Kuleana O Kānaka ʻŌiwi and as a Puna District member of the Aha Council’s Advisory Committee.

The interviewees pointed out some unique details about the natural environment around the project area, such as its natural setting as a flat, sandy floodplain. The bounty of the region, as in other areas of Kauaʻi, allowed the native population to practice a traditional subsistence living through the cultivation of taro and other fruits as well as the harvesting of marine life. These practices are a part of native Hawaiian traditional gathering rights today.

In time, Hawaiʻi became transformed by western governance and economic systems, introducing the sugarcane industry to Kauaʻi. The Kapaʻa Bypass Road was initially an important artery used to transport sugarcane from the fields. Along that road or within a short radius inland, plantation camps were set up to house the sugarcane workers and their families. Many of the irrigated taro fields were also used for rice cultivation.

When reflecting on the archaeological sites and cultural practices associated with the area, the interviewees emphasized the presence of iwi kūpuna. Interviewees pointed out specific locales where iwi kūpuna had been inadvertently disturbed during previous projects such as near the intersection of the Kapaʻa Bypass Road and Kuhio Highway, as well as along the coastline where the bike path is situated.

Finally, the interviewees shared their concerns and recommendations pertaining to the proposed project. For concerns, they articulated the following:

- The entrance/exit near Kintaro restaurant is very dangerous because of its bad location.
- Development on Kauaʻi cannot continue as it has.
- The roundabout is not necessary.
- This project has a high potential to uncover iwi kūpuna.

The interviewees recommended the following:

- Make the entrance/exit to Kintaro's restaurant safer, perhaps by installing speed bumps on the main road coming from both sides.
- Require archaeological monitoring during the project.
- Make an early presentation to the Kauaʻi-Niʻihau Burial Council to build pilina.
- Withhold support for transportation projects on Kauaʻi because it justifies more cars and more houses for more people moving in from off island.
- Instead of spending on a roundabout, resources should be spent to help Hawaiians reclaim their identity.
- Keep the two lanes going south on Kuhio Highway because it has alleviated the traffic coming from Kapaʻa town and Kapaʻa Bypass Road.

SUMMARY AND RECOMMENDATIONS

Kauaʻi's district of Puna has supported a healthy Native Hawaiian population from traditional times, and today there are still descendant families lineally connected to the Olohena area. These families lived a traditional subsistence lifestyle, harvesting from both the land and sea. Today these cultural practices are protected as traditional gathering rights. Archival research indicates that pre-contact use of Olohena would have centered around cultivation at the nearby Wailua River valley and floodplain. This was supplemented by marine and inland terrestrial resources. People traveled between the neighboring ahupuaʻa using the inland or coastal trail that passed through the district. Several prominent heiau are noted for the greater region, with Olohena known for a navigational heiau that was utilized in traditional times. Olohena was also known for Halepaiwi, where games of riddles were played and for the Sleeping Giant of Nounou Mountain.

The historic era saw widespread changes as early sugar plantations were established in the region. The Lihue Plantation Co. had interests in South Olohena and Grove Farm Plantation, Kealia Plantation, and Hui Kawaihai had operations nearby. Sugarcane and rice cultivation drastically changed the landscape and livelihood of residents, with a decline in the cultivation of native crops and the eventual conversion of many fallow loʻi into rice paddies. To support their operations, the plantations built many miles of ditches, irrigation systems, railroads, access roads, and mills to process the sugarcane. The AT&R constructed the Wailua Railroad Bridge, which allowed freight cars to cross the Wailua River. Roads were later established in place of railroad transportation to connect different parts of the island. Not far from the project area, the Coco Palms Resort was established in 1952 at the location of Debora Kapule's estate and subsequently closed down due to extensive hurricane damage in 1992.

Previous archaeological studies have recorded several historic properties in the project vicinity, although none have been found within the project area. However one human burial was found at the project area boundary (SIHP 02420). Other known historic properties in the vicinity include Kukui Heiau, a hearth, grinding stones, Debora Kupule's historic fishponds, the AT&R railroad bed, post-contact ʻauwai, imu, and historic structures of the Coco Palms Resort. A number of cultural layers and other iwi kūpuna burial sites have been found throughout the region and also near the project lands.

Discussions with community members uncovered opposition to the construction of the roundabout. One interviewee asserted that it is not needed. Another interviewee was particularly concerned that the roundabout would justify more cars on the road and more houses to be built in the area for people moving in. This interviewee pointed out that the money budgeted for the roundabout would be better spent helping Native Hawaiians reclaim their identity and heritage. Other interviewees emphasized that if a roundabout is built, then an archaeological monitor must be present at all times in case iwi kūpuna are inadvertently discovered.

Cultural Resources, Practices, and Beliefs Identified

As mentioned previously, the ahupuaʻa of Olohena, like other areas, traditionally supported land and sea subsistence activities. The sandy nature of the project area was also conducive to native Hawaiian burial practices. There are many instances where iwi kūpuna have been inadvertently disturbed during past projects in the area, and it is likely that human burials will be found within the project area.

Potential Effects of the Proposed Project

As noted above, the proposed project has a high potential to uncover iwi kūpuna, as the area has been known for human burials in the past. In addition, a concern noted in the ethnographic survey is that the

construction of the roundabout could justify the construction of more homes in the area, bringing in more people.

Confidential Information Withheld

During the course of researching the present report and conducting the ethnographic survey program, no information was withheld in confidentiality.

Conflicting Information

No conflicting information was obvious in analyzing the ethnographic interviews. On the contrary, a number of themes were repeated and information was generally confirmed by independent sources.

Recommendations/Mitigations

Recommendations and mitigations for this project voiced in the interviews include the following:

- Make the entrance/exit to Kintaro's restaurant safer, perhaps by installing speed bumps on the main road coming from both sides.
- Require archaeological monitoring during the project.
- Make an early presentation to the Kauaʻi-Niʻihau Burial Council to build pilina.
- Withhold support for transportation projects on Kauaʻi because it justifies more cars and more houses for more people moving in from off island.
- Instead of spending on a roundabout, resources should be spent to help Hawaiians reclaim their identity.
- Keep the two lanes southbound on Kuhio Highway because it has alleviated traffic in the area.

Summary and Conclusion

All of the interviewees for this Cultural Impact Assessment care deeply for their communities in the Puna district of Kauaʻi. They emphasized the need for advance presentation with the Kauaʻi-Niʻihau Burial Council as well as an archaeological monitor to be present at all times during construction. Two of the five interviewees expressed that the roundabout is not needed and/or not wanted. The community should be kept informed on the construction plans, and their concerns and recommendations should be considered during all phases of the proposed work.

GLOSSARY

ahupua‘a Traditional Hawaiian land division usually extending from the uplands to the sea.

ali‘i Chief, chiefess, monarch.

‘auwai Ditch, often for irrigated agriculture.

bermuda grass The grass *Cynodon dactylon*, originally from the Middle East. This fast growing species is often used for turf grass.

Guinea grass The invasive *Megathyrsus maximus*, also known as green panic grass.

guava The invasive tree or shrub *Psidium guajava*, which forms dense thickets in disturbed areas.

hālau Meeting house for hula instruction or long house for canoes.

heiau Place of worship and ritual in traditional Hawai‘i.

hula The hula (traditional Hawaiian dance), a hula dancer; to dance the hula.

‘ike To see, know, feel; knowledge, awareness, understanding.

imu Underground pit or oven used for cooking.

iwi Bone.

iwi kupuna Ancestral remains; iwi kūpuna is plural.

Java plum Introduced tree or shrub of the genus *Eugenia* or *Sygyzium*, common in dry to mesic forests.

joee The oī, or blue rattail (*Stachytarpheta dichotoma*), a shrub bearing flowers that are usually blue to violet in color. The shrub invades disturbed areas and was naturalized in Hawai‘i by the year 1871.

kalo The Polynesian-introduced *Colocasia esculenta*, or taro, the staple of the traditional Hawaiian diet.

kama‘āina Native-born.

kapu Taboo, prohibited, forbidden.

kia‘i Guard, caretaker; to watch or guard; to overlook, as a bluff.

kiawe The algaroba tree, *Prosopis* sp., a legume from tropical America, first planted in 1828 in Hawai‘i.

kikuyu The introduced grass *Pennisetum clandestinum*.

kīpuka A change in form, such as an area of vegetation in a lava bed.

klu *Acacia farnesiana*, a small branching shrub that is a pest in pastures, possibly introduced to Hawai‘i in the 1900s for perfume.

koa *Acacia koa*, the largest of the native forest trees, prized for its wood, traditionally fashioned into canoes, surfboards, and calabashes.

koa haole The small tree *Leucaena glauca*, historically-introduced to Hawai‘i.

konohiki The overseer of an ahupua‘a ranked below a chief; land or fishing rights under control of the konohiki; such rights are sometimes called konohiki rights.

kukui The candlenut tree, or *Aleurites moluccana*, the nuts of which were eaten as a relish and used for lamp fuel in traditional times.

kuleana Right, title, property, portion, responsibility, jurisdiction, authority, interest, claim, ownership.

kumu Teacher.

kumu hula Hula teacher/master.

kupuna Grandparent, ancestor; kūpuna is the plural form.

lantana The historically introduced shrub, *Lantana camara*.

limu Refers to all sea plants, such as algae and edible seaweed.

loʻi, loʻi kalo An irrigated terrace or set of terraces for the cultivation of taro.

lūʻau Hawaiian feast, named for the taro tops always served at one; this is not an ancient name, but goes back to at least 1856.

lūheʻe Octopus lure.

ma At, on, in, along, beside, through; according to, in behalf of, because of.

Māhele The 1848 division of land.

maile *Alyxia olivaeformis*, a fragrant native shrub used for twining.

makai Toward the sea.

manaʻo Thoughts, opinions, ideas.

mauka Inland, upland, toward the mountain.

midden A heap or stratum of refuse normally found on the site of an ancient settlement. In Hawaiʻi, the term generally refers to food remains, whether or not they appear as a heap or stratum.

mokihana The *Pelea anisate* tree known to grow only on the Island of Kauaʻi. The fragrant green berries are used in leis.

moku District, island.

molasses grass The invasive mat grass, *Melinis minutiflora*, a common forage plant for grazing animals.

moʻolelo A story, myth, history, tradition, legend, or record.

Napier grass The invasive *Pennisetum purpureum*, also known as bana grass, elephant grass, king grass, or cane grass.

niu The Polynesian-introduced tree *Cocos nucifera*, or coconut.

ʻōhiʻa lehua The native tree *Metrosideros polymorpha*, the wood of which was utilized for carving images, as temple posts and palisades, for canoe spreaders and gunwales, and in musical instruments.

ʻōlelo noʻeau Proverb, wise saying, traditional saying.

olonā The native plant *Touchardia latifolia*, traditionally used for making cordage.

pia The Polynesian arrowroot *Tacca leontopetaloides*, traditionally cultivated for food and medicine.

pilina Relationship, connection, association, meeting, union, fitting, adhering, joining.

pipipi A marine shell, *Nerita picea*, common in the intertidal zone.

poi A staple of traditional Hawai‘i, made of cooked and pounded taro mixed with water to form a paste.

po‘o Head; summit; director of an organization.

po‘okanaka Heiau of human sacrifice; literally translates to human head.

post-contact After AD 1778 and the first written records of the Hawaiian Islands made by Captain James Cook and his crew.

pre-contact Prior to AD 1778 and the first written records of the Hawaiian Islands made by Captain James Cook and his crew.

pu‘u Hill, mound, peak.

pu‘uhonua Place of refuge.

sandalwood ‘Iliahi (*Santalum*), several varieties endemic to Hawai‘i. Known for their aromatic wood and medicinal qualities. Heavily exported in the 1800s.

sugarcane The Polynesian-introduced *Saccharum officinarum*, or kō, a large grass traditionally used as a sweetener and for black dye.

‘uala The sweet potato, or *Ipomoea batatas*, a Polynesian introduction.

‘ulu The Polynesian-introduced tree *Artocarpus altilis*, or breadfruit.

wauke The paper mulberry, or *Broussonetia papyrifera*, which was made into tapa cloth in traditional Hawai‘i.

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APPENDIX A: AGREEMENT TO PARTICIPATE

Agreement to Participate in the Cultural Impact Assessment for the Kapa‘a Roundabout Project
Ulukoa Duhaylonsod, Ethnographer, Keala Pono Archaeological Consulting

You are invited to participate in a Cultural Impact Assessment (CIA) for the Kapa‘a Roundabout Project, which will be located along Kuhio Highway and Kapa‘a Bypass Road, Olohena Ahupua‘a, on Kaua‘i (herein referred to as “the Project”). The Assessment is being conducted by Keala Pono Archaeological Consulting (Keala Pono), a cultural resource management firm, at the request of the Hawai‘i Department of Transportation (HI DOT). The ethnographer will explain the purpose of the Assessment, the procedures that will be followed, and the potential benefits and risks of participating. A brief description of the Assessment is written below. Feel free to ask the ethnographer questions if the procedures need further clarification. If you decide to participate, please sign the attached Consent Form. A copy of this form will be provided for you to keep.

Description of the Project

This CIA is being conducted to collect information about the Project in Olohena Ahupua‘a, through interviews with individuals who are knowledgeable about this area, and/or about information including (but not limited to) cultural practices and beliefs, mo‘olelo, mele, or oli associated with this area. The goal of this Assessment is to identify and understand the importance of any traditional Hawaiian and/or historic cultural resources, or traditional cultural practices within the Project. This Assessment will also attempt to identify any effects that the proposed development may have on cultural resources present, or once present within the Project area.

Procedures

After agreeing to participate in the Assessment and signing the Consent Form, the ethnographer will digitally record your interview and it may be transcribed in part or in full. The transcript may be sent to you for editing and final approval. Data from the interview will be used as part of the ethno-historical report for this Project and transcripts may be included in part or in full as an appendix to the report. The ethnographer may take notes and photographs and ask you to spell out names or unfamiliar words.

Discomforts and Risks

Possible risks and/or discomforts resulting from participation in this Assessment may include, but are not limited to the following: being interviewed and recorded; having to speak loudly for the recorder; providing information for reports which may be used in the future as a public reference; your uncompensated dedication of time; possible misunderstanding in the transcribing of information; loss of privacy; and worry that your comments may not be understood in the same way you understand them. It is not possible to identify all potential risks, although reasonable safeguards have been taken to minimize them.

Benefits

This Assessment will give you the opportunity to express your thoughts and opinions and share your knowledge, which will be considered, shared, and documented for future generations. Your sharing of knowledge may be instrumental in the preservation of cultural resources, practices, and information.

Confidentiality

Your rights of privacy, confidentiality and/or anonymity will be protected upon request. You may request, for example, that your name and/or sex not be mentioned in the Assessment material, such as in written notes, on tape, and in reports; or you may request that some of the information you provide remain off-the-record and not be recorded in any way. To ensure protection of your privacy, confidentiality and/or anonymity, you should immediately inform the ethnographer of your requests. The archaeologist will ask you to specify the method of protection and note it on the attached Consent Form.

Refusal/Withdrawal

At any time during the interview process, you may choose to not participate any further and ask the archaeologist for the tape and/or notes. If the transcription of your interview is to be included in the report, you will be given an opportunity to review your transcript, and to revise or delete any part of the interview.

Confidentiality

Your rights of privacy, confidentiality and/or anonymity will be protected upon request. You may request, for example, that your name and/or sex not be mentioned in the Analysis material, such as in written notes, on tape, and in reports; or you may request that some of the information you provide remain off-the-record and not be recorded in any way. To ensure protection of your privacy, confidentiality and/or anonymity, you should immediately inform the ethnographer of your requests. The archaeologist will ask you to specify the method of protection and note it on the attached Consent Form.

Refusal/Withdrawal

At any time during the interview process, you may choose not to participate any further and ask the archaeologist for the tape and/or notes. If the transcription of your interview is to be included in the report, you will be given an opportunity to review your transcript, and to revise or delete any part of the interview.

APPENDIX B: CONSENT FORM

Consent Form

I, _____, am a participant in the Cultural Impact Assessment (Assessment) for the Kapa‘a Roundabout Project (herein referred to as “the Project”). I understand that the purpose of the Assessment is to conduct oral history interviews with individuals knowledgeable about the Project and the surrounding ahupua‘a in an effort to identify and protect traditional cultural practices and cultural resources.

_____ I understand that Keala Pono Archaeological Consulting (Keala Pono) and/or HDOT (the client) will retain the product of my participation (digital recording, transcripts of interviews, etc.) as part of their permanent collection and that these materials will only be used for scholarly, educational, and/or land management purposes.

_____ I hereby grant to Keala Pono and the client the right to use the property that is the product of my participation (e.g., my interview, written materials, and any other materials I provide) for the Assessment as stated above. By giving permission, I understand that I do not give up any copyright or performance rights that I may hold.

_____ I also grant to Keala Pono and the client my consent for any photographs provided by me or taken of me in the course of my participation in the Assessment to be used, published, and copied by Keala Pono and/or the client and its assignees in any medium for purposes of the Assessment.

_____ I agree that Keala Pono and the client may use my name, photographic image, biographical information, statements, and voice reproduction for this Assessment without further approval on my part.

_____ If transcriptions are to be included in the report, I understand that I will have the opportunity to review and edit my transcripts to ensure that they accurately depict what I meant to convey. I understand I have the power to delete any information I deem too sensitive and/or too personal for publication from the transcript. I also understand that if I do not return the revised transcripts after two weeks from the date of receipt, my signature below will indicate my release of information for the draft Assessment, although I will still have the opportunity to make revisions during the draft review process.

_____ I further understand that not giving my consent to any portion of the above listed items will not prevent my mana‘o being included in the Assessment. For example, I may decline Keala Pono or their client permission to use my photographic image or biographical information but by signing this Consent Form, still grant my permission for my mana‘o to be included in the text of the Assessment.

By signing this consent form, I am acknowledging that I have been informed about the purpose of this Assessment, the procedure, how the data will be gathered, and how the data will be used. I understand that my participation is strictly voluntary, and that I may withdraw from participation at any time without consequence.

Consultant Signature **Date**

Print Name **Phone**

Address

Thank you for participating in this valuable study.

APPENDIX C: WRITTEN RESPONSES FROM THE INTERVIEWEES

Three of the five participants for this Cultural Impact Assessment preferred to give written responses in lieu of being interviewed. One person requested to have a conversation from which a summary could be written and included in this report, and another person completed a formal interview. The submissions of all five participants are included in this appendix.

Milton Ching

> I am Milton K.C. Ching ma Kapaa, District of Kawaihau, County of Kauai. I am a resident of Kapaa since 1957, my parents also resided in Kapaa since the 1940s as well as my grandparents since the early 1920s. I am part Hawaiian, retired since 2012, I am currently an Archaeologist Monitor, employed by an Archaeologist Company.
>
> My children and wife are recognized Descendants from the ahupuaa of Waipouli by State Historic Preservation Division (SHPD) under the Department of Land and Natural Resources (DLNR). Census records for 1900 list 4th great grandfather J. Kauhoe (k.), for 1910 census lists 3rd great grandmother, E. Pipili (w.), for 1930 census lists great grandfather Willie Hepa.
>
> Our native Hawaiian ancestors continued their daily lives, catching marine life, growing taro and other fruits and plants for subsistence as part of their Traditional Gathering Rights.
>
> During my employment as Archaeologist Monitor, I encountered an "Inadvertent" Burial at the corner of the Kapaa Bypass Road and Kuhio Highway (SW) intersection.
>
> This proposed project would pose a potential encounter for "Inadvertent Burials", the Coconut Marketplace, located across the intersection on the east of Kuhio Highway and Papaloa Road, was monitored by me, and the project encountered numerous burials at different depths, from six inches to one meter plus.

Leilani Rivera

> Basically, the roundabout is not necessary. What needs to be addressed more than anything else on the road is the speeding, and perhaps speed bumps in the area could help. Of particular concern is the entrance/exit by Kintaro Restaurant, which is at such a bad location, it is an accident waiting to happen. DOT should take a look at that and see how they could make it safer there.
>
> A speed bump should be placed just before Kintaro Restaurant to slow down the oncoming traffic with a more directive visible way to come out of Kintaro entrance/exit. Also add a speed bump from the north side before Kintaro entrance/exit because either way going north or south, it's difficult and frightening for especially kupuna or young drivers to make a correct decision going into the main road.

Rupert Rowe

> On Wednesday, July 16, 2025, Ulukoa Duhaylonsod of Kaʻuikokapō was able to talk story with Kupuna Rupert Rowe over the phone. Kupuna Rowe is an 83 year old lineal descendant from the Coco Palms area of Kapaʻa with ties connected to Kauaʻi's aliʻi. Kupuna Rowe graciously allowed Ulukoa to summarize their conversation and include it in Keala Pono's Cultural Impact Assessment for the Department of Transportation's proposed Kapaʻa roundabout.
>
> Kupuna Rowe shared a lot of powerful personal reflection, never losing sight of his own kupuna's words to him long ago: "One day when you come of my age, you will deliver what I tell to you." And indeed, Kupuna Rowe does carry on the torch like a true kiaʻi:
>
> "Development on this island cannot continue because there's no end point. How much people do we plan to put on this island? I no can support any more development, including transportation [such as the Kapaʻa roundabout]."

Kupuna Rowe pointed out that the roundabout will only justify more cars, more houses, and more people moving in. He said that instead, resources should be spent helping Hawaiians to reclaim their identity, and in fact, he had just testified about it at an OHA meeting earlier in the day, where he told them, “How do you protect your past? If you lose your past, you lose your future.”

Kupuna Rowe shared other insightful manaʻo, but these were his main thoughts regarding the proposed Kapaʻa roundabout. Mahalo to Kupuna Rowe for taking to time to talk story about this project.

Kaliko Santos

My name is Donna Kaliko Santos and I am the president of NHO--Na Kuleana O Kanaka Oiwi. I am also the poʻo for the Puna Moku with the Aha Moku (AMAC) here on the island.

As for the Kapaa Bypass Project, be aware that iwi kupuna has come up in the area under previous construction/development projects. I believe under the Kuhio Hwy Short Term Improvement project along Kuhio Hwy (by the corner area of where the bypass is now and across the highway makai like the Coconut Marketplace area & also where the "Bike Path" runs along the coastline. The entire area, due to its sandy composition and relative flatness--where we call sandy areas, are known to bring up iwi kupuna now and then.

It is our practice to require that any work in the area require "archaeological monitoring" due to past inadvertent discoveries and continued consultation throughout the project life as the area can be controversial (eg. nearby Coco Palms hotel rebuild). It is also recommended that early pilina and presentation be made to the Kauai-Niihau Islands Burial Council.

APPENDIX D: INTERVIEW WITH KENNETH PONCE

TALKING STORY WITH
KENNETH PONCE (KP)
Oral History for the Kapaʻa Roundabout (KR) project by Dietrix Jon Ulukoa Duhaylonsod (DD)
For Keala Pono 8/8/2025

DD: Today is Friday, August 8, 2025, and we're doing a telephone interview for the proposed Kapaʻa roundabout, a Department of Transportation project. We're gonna be doing an impact assessment about this roundabout, and we're gonna be talking story with Kenneth Ponce over the telephone. I'm on Oʻahu, and he's on Kauaʻi. And before we go any further, just wanna mahalo Kenneth for taking the time this Friday to talk story about this. And so mahalo and aloha, Kenneth. So if we can start, maybe if you don't mind telling us your name, where/when you were born, where you grew up, and where you went to school, and then just a little bit about your family.

KP: Sure. My name is Kenneth Ponce. I was born on Kauaʻi in Līhuʻe at Wilcox Hospital. And I been living all my life and grew up in Kapaʻa, down in Waipouli. And then my family moved up to the Kapaʻa homestead next to Kapaʻa School. So I went to grade school in Kapaʻa Elementary. Then I switched over at third grade to St. Catherine's School here, up in Kapaʻa Homestead. And then I went to high school, after 8th grade, from 3rd grade to 8th grade, I was attending St. Catherine's Catholic school. Then after the 8th grade, I went to Kapaʻa High School, where I graduated in 1967.

DD: Okay, well mahalo for sharing your background there. And would you like to share any more about how you're connected to the area there, and maybe about a little bit of how you learned about the area there?

KP: Well, I've been here for almost 76 years. I'll be 76, December of this year, of 2025. So, this is where I grew up all my life. I'm familiar with all the plantation camps that the people were living in, up in the Olohena Bypass, and further down towards the Kapaʻa Bypass, there was another camp on that bypass road up mauka of the road. [pause] And also, people used to tell me that makai of the bypass road there were rice paddies in that area, between that road and Kapaʻa town, but way back when, back in the early 1900s up to the mid-1900s, I guess, I don't really know, but it was gone when I was born, but people used to talk about rice paddies being up there.

DD: Oh, okay, okay. So earlier I shared with you the map of that intersection there and where they're gonna have the lay down area and that kinda general area where they wanna put the roundabout. So you're saying, kinda like around that area, makai of the area there, used to be rice paddies, and then from that area, where would you say the plantation was, in relation to that area?

KP: The plantation homes? Where the roundabout is going to be developed, it's about maybe more than a quarter of a mile, maybe half a mile from that area, up mauka, right up the haul cane road. There used to be, underneath, an old haul cane road before it was the Kapaʻa Bypass. They used it to alleviate the traffic through Kapaʻa town.

DD: Okay, that's pretty nearby then. I see. And then, was anything else in that area, that intersection area?

KP: Not to my knowledge. It was just, people couldn't go on the road because, like I said, it was usually for the haul cane trucks that used to transport the sugar on that road.

DD: Okay, mahalo for sharing that. And then I'm familiar with the plantation camp blueprint on Oʻahu, where the camps were spread out, Chinese camp here, Portuguese camp, Spanish camp, Filipino camp. Was it similar for the Kapaʻa area, where it was spread out across like that?

KP: Yes, it was. Yeah, there were camps all over in that area, up mauka. Yeah, there's like at least four camps that I can think of all in the area. There were camps above that specific area next to the haul cane road, "35 Camp." And there was also another camp nearby the Kapaʻa Middle School, there was a camp above the Kapaʻa Middle School, so I can remember at least about four plantation camps in that area.

DD: Oh, wow. And was it also separated by ethnic background, those camps?

KP: You know what, I guess so. I just remember, some of them were Filipinos, and some of them were Japanese, but I guess it was all pretty mixed.

DD: Okay. And then to be clear, this is sugarcane, not pineapple, yeah?

KP: No, this is this is all sugarcane.

DD: Okay. And are there any other things you can share about the area regarding old moʻolelo, stories, legends place names?

KP: Not to my knowledge.

DD: Okay, maybe you could share a little more about the changes in the area. You talked about how it used to be, and obviously there's a lot of changes. Could you elaborate on that, when you think about how it used to be and how it looks now?

KP: You mean the roadway?

DD: Yeah, the area where the roundabout will be and the nearby vicinity, could you talk a little bit about the changes of how it used to be and how it is now?

KP: Yeah, well just the development around the bypass road across the street from Kūhiō Highway, we have the Plantation Marketplace, and then we get other buildings makai of that, but it never really changed that much, except for, they just upgraded the haul cane road. But everything is pretty mauka of the highway, there's no development up there.

DD: Hmm, okay, alright, do you think that this proposed roundabout would affect any cultural sites, or access to any cultural sites?

KP: No, I don't believe it would impact any, not that I know of.

DD: Okay, what about any traditional practices?

KP: I don't think it would impact any traditional practices, not that I know of.

DD: Okay, and then one more question, do you think that this roundabout would have any adverse impacts, any kind of bad impacts to the area?

KP: I don't think it would have a adverse impact on that area.

DD: Okay, alright, are there any other concerns that you or the community might have regarding this proposed roundabout, that we haven't talked about, that you think maybe we should talk about?

KP: Yes, so many years ago, very recently, they had two lanes going from north to south to the Wailua Bridge, and that really helped alleviate the traffic, people coming from the Kapaʻa Bypass Road and people coming through Kūhiō Highway from Kapaʻa town, going towards the south, towards Līhuʻe. And our concern is if the traffic is going to flow into the two lanes going south, you know, they don't have that on [the map], it's not detailed. I don't see a detailed drawing of the roundabout, so I don't know how it's going to impact the two roads going towards the Wailua Bridge. And I hope they don't change that because it would really change the flow of traffic. Right now it flows really good. And people that I talk to, this guy that I talked to said that if it's a roundabout, it might impact, you know, it might back up traffic again. But I told him that if they keep the flow constant where we can just flow the Kapaʻa traffic and just merge with the Kapaʻa Bypass, and flow into the two lanes, to me, it would be good.

So that's one of our concerns, 'cause before it was just one lane going towards the bridge. Now it's two lanes. So we just have to see how they're gonna configure this roundabout, converging into the two lanes going south. And I guess that's the main concern.

DD: Oh, okay, okay. I see. So in other words, it went from one lane going each way into two lanes going each way. And that was a big help.

KP: Well, it was just one lane going south.

DD: Oh, it was only…

KP: Then they widened the road and made it two lanes, which really alleviated the traffic, 'cause we could flow from the Kapaʻa Bypass, right onto the two-lane highway. And the people from Kapaʻa town could just, 'cause now they made two lanes, so they would take the other lane, and so the traffic flow would be constant instead of backing up, 'cause so many years ago, I don't know, 3, 4, 5 years ago before these changes, it was horrendous. It was backing up quite a ways back. Towards Kapaʻa town, we just merged into the two lanes, and it was just, it was a constant flow to the Wailua Bridge and onward to Līhuʻe.

DD: Right, right. Okay, so it was two lanes going south into Līhuʻe, and that that was a big help.

KP: Yeah.

DD: And so the recommendation is to hopefully keep it two lanes, that even with this roundabout, to be cognizant that this two-lanes [design] was a big help, keep it two lanes to keep the flow going, even with the roundabout, so that it keeps flowing smoothly. Am I getting it correctly?

KP: Yeah. When I see this, I don't think they're gonna change the two. I think they're going to utilize the two lanes. It's already existing. But it's the flow from the Kapaʻa Bypass and it's the flow from Kapaʻa town merging with the two lanes, you know?

DD: Yeah, that makes sense.

KP: I dunno how they're gonna do that. I'm pretty sure these planners are gonna figure this out, but yeah, we'll see. I guess that's a main concern, not backing up the traffic.

DD: Mmhmm.

KP: 'Cause right now it's working real well.

DD: Yeah. If it works, you don't need to fix it. What about going north? Would you recommend changing that to two lanes or leave it as one lane?

KP: Well, right now it's working okay. The traffic is is going in the morning, it's going south towards Līhuʻe.

DD: Ah, I see. Yeah, that's where everybody's going.

KP: So the northbound traffic is not that much of a concern.

DD: Yeah, that makes sense.

KP: It's the traffic that's going from Kapaʻa, from the north, coming south, everything coming through Kapaʻa town.

DD: Right, because everybody needs to go to Līhuʻe or towards the south.

KP: Yes.

DD: Okay, anything else, any other recommendations or concerns?

KP: [pause] Not at the moment. I think we covered everything that concerns the proposed roundabout.

DD: Okay, well if anything else comes up, don't hesitate to give me a call.

KP: Okay, thank you, glad to be of help.

DD: No, Mahalo nui to you. Before we close, I just wanna say again, mahalo to Uncle Kenneth for taking the time out of his busy Friday to talk story and share his comments, concerns, and recommendations. So mahalo, have a good weekend, and aloha.

KP: Okay, aloha, thank you.

Appendix E Flora and Fauna Survey Report

Flora and Fauna Survey Report for the Kapa‘a Roundabout Project, Kaua‘i

SEPTEMBER 2025

PREPARED FOR

WSP USA

PREPARED BY

SWCA Environmental Consultants

FLORA AND FAUNA SURVEY REPORT FOR THE KAPAʻA ROUNDABOUT PROJECT, KAUAʻI

Prepared for

WSP USA
1001 Bishop Street
Honolulu, Hawaii 96813
Attn: Dennis Silva, Jr.

Prepared by

SWCA Environmental Consultants
1200 Ala Moana Boulevard, Suite 380
Honolulu, Hawaiʻi 96814
(808) 548-7922
www.swca.com

SWCA Project No. 90495

September 2025

EXECUTIVE SUMMARY

The Hawaiʻi Department of Transportation is undertaking a project to construct a roundabout where the Kuhio Highway intersects the Kapaʻa Bypass, near the intersection of Kuhio Highway and Papaloa Street, in Kapaʻa, Kauaʻi. WSP USA commissioned SWCA Environmental Consultants to conduct a terrestrial flora and fauna survey for the proposed project, which was conducted on May 11, 2025.

Of the flora and fauna documented within the proposed project area, only one species is classified as a federally or state-listed threatened, endangered, proposed, or candidate species (collectively referred to as special-status species). This species—the nēnē, or Hawaiian goose (*Branta sandvicensis*)—was observed flying over the project area. The project area does not overlap with the federally designated critical habitat of any special-status species. However, foraging and nesting habitat for four endangered Hawaiian waterbirds—Hawaiian common gallinule or ʻalae ʻula (*Gallinula galeata sandvicensis*), Hawaiian coot or ʻalae keʻokeʻo (*Fulica alai*), Hawaiian duck or koloa maoli (*Anas wyvilliana*), and Hawaiian stilt or aʻeo (*Himantopus mexicanus knudseni*)—exists in the project area. Additionally, potential roosting trees for the Hawaiian hoary bat (*Lasiurus cinereus semotus*), a federally and state-listed endangered mammal, are present within the project area. Lastly, the special-status Hawaiian seabirds, band-rumped storm-petrel or ʻakeʻake (*Hydrobates castro*), Hawaiian petrel or ʻuaʻu (*Pterodroma sandwichensis*), Newell's shearwater or ʻaʻo (*Puffinus newelli*), and short-tailed albatross (*Phoebastria* [=*Diomedea*] *albatrus*), may transit over the project area.

This report outlines detailed avoidance and minimization measures to protect these endangered species. By adhering to these measures, the project is not expected to have a significant adverse effect on these special-status species, their habitats, or other terrestrial biological resources.

CONTENTS

1 Introduction 1
2 Regulatory Environment 1
2.1 Endangered Species Act 1
2.2 Migratory Bird Treaty Act 2
2.3 Hawai‘i Revised Statutes 195D 2
3 Site Information 2
4 Methods 4
5 Literature Review 4
6 Results 5
6.1 Flora 5
6.2 Vegetation and Land Cover Types 5
6.2.1 Ruderal 5
6.2.2 Nonnative Grassland 6
6.2.3 Riparian 6
6.2.4 Nonnative Secondary Forest 7
6.3 Fauna 8
6.3.1 Avifauna 8
6.3.2 Mammals 9
6.3.3 Terrestrial Reptiles and Amphibians 9
6.3.4 Insects and Other Invertebrates 9
6.4 Flora 9
6.5 Fauna 9
7 Discussion and Recommendations 12
7.1 Flora and Biosecurity Considerations 12
7.2 Fauna 13
7.2.1 Hawaiian Hoary Bat 13
7.2.2 Seabirds 13
7.2.3 Hawaiian Waterbirds 14
7.2.4 Hawaiian Goose or Nēnē 14
8 Conclusions 15
9 Literature Cited 16

Appendices

Appendix A. Vascular Plant Species Recorded During the May 11, 2025, Survey
Appendix B. Endangered and Threatened Flora and Fauna Species with the Potential to Occur in the Project Area
Appendix C. Biosecurity Guidelines
Appendix D. Best Management Practices for Work in Aquatic Environments

Figures

Figure 1. Location of the project area. 3
Figure 2. Typical ruderal vegetation in the project area. 5
Figure 3. Typical nonnative grassland in the project area. 6
Figure 4. Typical riparian vegetation in the project area. 7
Figure 5. Typical secondary forest in the project area. 8

Tables

Table 1. Kapa‘a Roundabout Project Flora and Fauna Literature Review 4
Table 2. Birds Observed in and near the Project Area on May 11, 2025 8
Table 3. Special-Status Species Listed in the USFWS IPaC Search Results and their Potential to Occur in the Project Area 10

1 INTRODUCTION

The Hawai‘i Department of Transportation is undertaking a project to construct a roundabout within a 8.9-acre area at the intersection of Kuhio Highway and the Kapa‘a Bypass Road, near the intersection of Kuhio Highway and Papaloa Road in Kapa‘a, on Kaua‘i Island.

WSP USA commissioned SWCA Environmental Consultants (SWCA) to conduct a terrestrial flora and fauna survey for the proposed project, which was conducted on May 11, 2025. The specific purpose of this survey was to locate populations of special-status species and identify any critical habitat for these species in the project area.

The methods and results of this survey, and measures to avoid and minimize impacts on special-status species as part of project implementation, are presented herein.

2 REGULATORY ENVIRONMENT

This section describes laws and regulations applicable to aquatic and terrestrial flora and fauna in the context of the project.

2.1 Endangered Species Act

The Endangered Species Act of 1973, as amended (ESA), is regulated by the U.S. Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration National Marine Fisheries Service. It protects wildlife and plant species that have been listed as threatened or endangered and is designed to conserve the ecosystems on which species depend. Candidate species, which may be listed in the near future, are not afforded protection under the ESA until they are formally listed as endangered or threatened.

Section 9 of the ESA and the rules promulgated under Section 4(d) of the ESA prohibit the unauthorized take of any endangered or threatened species of wildlife listed under the ESA. Under the ESA, the term *take* means “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect species listed as endangered or threatened, or to attempt to engage in any such conduct.” As defined in regulations, the term *harm* means “an act that actually kills or injures wildlife; it may include significant habitat modification or degradation, which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering” (50 Code of Federal Regulations [CFR] 17.3). The rules define *harass* to mean “an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent, as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering” (50 CFR 17.3).

The ESA affords maximum legal protections to species listed as threatened or endangered under the law and provides authorization for incidental take permits for take that occurs incidental to otherwise legal operations. To comply with federal laws, additional measures must be taken to ensure that take of federally listed species does not occur. Any fatality of a listed species should be reported to the USFWS and the Hawai‘i Department of Land and Natural Resources, Division of Forestry and Wildlife as soon as possible, and an incident report should be filed within 24 hours of detection.

The ESA also provides for the designation of critical habitat for listed species if there are areas of habitat believed to be essential to conservation of the species. Critical habitat can be designated for a single species or a group of species. A critical habitat designation does not necessarily restrict further development but prevents federal actions from destroying or adversely modifying that habitat.

2.2 Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918, as amended (MBTA), is regulated by the USFWS and prohibits the take of migratory birds. A list of birds protected under MBTA is published under 50 CFR 10.13. Unless permitted by regulations, under the MBTA, “it is unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess, offer to sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product” (16 United States Code 703–712). The MBTA provides no process for authorizing incidental take of MBTA-protected birds. As a result, birds that are not covered under the ESA that may be adversely affected by the project cannot be covered by take authorizations. Regardless, incidental take of individual MBTA-protected species is unlikely to adversely affect MBTA-protected species as a whole; however, any take of MBTA-protected species should be documented and reported in a similar manner as any endangered or threatened species of wildlife listed under the ESA.

2.3 Hawai‘i Revised Statutes 195D

The purpose of Hawai‘i Revised Statutes (HRS) 195D is “to ensure the continued perpetuation of indigenous aquatic life, wildlife, and land plants, and their habitats for human enjoyment, for scientific purposes, and as members of ecosystems” and is regulated by the Hawai‘i Department of Land and Natural Resources, Division of Forestry and Wildlife. HRS 195D-4 states that any endangered or threatened species of fish or wildlife recognized by the ESA shall be so deemed by the state statute. Like the ESA, the unauthorized take of such endangered or threatened species is prohibited (HRS 195-D-4(e)), but incidental take licenses can be obtained (HRS 195D-21). In addition to species protected under the ESA, rules adopted under HRS 195D-4 allow for the listing of indigenous species as threatened or endangered for the following reasons:

- Habitat destruction or alteration (current or predicted)
- Overexploitation
- Disease or predation
- Lack of regulatory mechanisms
- Other factors threatening the species’ continued existence

Determinations are made based on all available sources of data (scientific, commercial, and other) and consultation with appropriate agencies (federal, state, and county) and interested organizations and parties.

3 SITE INFORMATION

The project area is within the *ahupua‘a* (land division) of Olohena, in the *moku* (district) of Kawaihau on the *mokupuni* (island) of Kaua‘i (Figure 1). The project area is where Kuhio Highway intersects the Kapa‘a Bypass Road. Mean annual rainfall for the project area is approximately 42 inches (106 centimeters). Rainfall is typically highest between October and March and lowest between April and September (Frazier et al. 2016).



Figure 1. Location of the project area.

4 METHODS

On May 11, 2025, two SWCA biologists conducted a comprehensive survey of the proposed project area (see Figure 1). The survey was conducted on foot and documented all vascular plant, vertebrate (birds, mammals, and amphibians), and macroinvertebrate (gastropods and arthropods) species within the project area. The survey specifically focused on locating populations of special-status species; however, acoustic or in-person surveys for the endangered Hawaiian hoary bat or ‘ope‘ape‘a (*Lasiurus cinereus semotus*), or nighttime surveys for listed seabird species or insects were not conducted. Identification of birds was aided by 10 × 42–millimeter binoculars, as well as auditory vocalization identifications. Any signs of animals, such as scat or tracks, were also noted.

5 LITERATURE REVIEW

During the preparation for the field survey, SWCA conducted a literature review to evaluate the historic land use of the project site, background on the project, and the presence of special-status species, their habitats, and sensitive natural communities within the project area. This literature review encompassed a thorough search of referenced scientific journals; technical journals and reports; environmental assessments; environmental impact statements; newspaper articles; relevant government documents; USFWS online data, including the Information for Planning and Consultation (IPaC) website (USFWS 2025); and unpublished data that provide insight into the project area’s natural history and ecology. SWCA also reviewed available geospatial data, aerial imagery, and topographic maps of the project area. Literature and other resources reviewed for this project are described in Table 1.

Table 1. Kapa‘a Roundabout Project Flora and Fauna Literature Review

Document (Author)	Relevance
Recovery Plan for the Hawaiian Hoary Bat (Lasiurus cinereus semotus) (USFWS 1998)	Describes the current understanding, threat status, recovery strategy, and criteria for delisting Hawaiian hoary bat.
Hawaiian Goose (Nēnē) (*Branta sandvicensis*) (Banko et al. 1999)	Describes the current understanding regarding habitat and diet preferences, and breeding biology of nēnē.
Recovery Plan for Hawaiian Waterbirds, Second Revision (USFWS 2011)	Describes the current understanding, threat status, recovery strategy, and criteria for delisting endangered Hawaiian waterbirds. Also describes federally listed waterbird locations on Maui.
*Band-Rumped Storm-Petrel (*Oceanodroma castro*) Hawai‘i Distinct Population Segment 5-Year Review Summary and Evaluation* (USFWS 2021)	Describes the current understanding, threat status, and criteria for delisting band-rumped storm-petrel.
*Hawaiian Petrel (*Pterodroma sandwichensis*) 5-Year Review Summary and Evaluation* (USFWS 2022)	Describes the current understanding, threat status, and criteria for delisting Hawaiian petrel.
‘A‘o (Newell’s shearwater, Puffinus newelli*) 5-Year Review* (USFWS 2024)	Describes the current understanding, threat status, and criteria for delisting Newell’s shearwater.
*Short-tailed Albatross (*Phoebastria albatrus*) 5-Year Review* (USFWS 2020)	Describes the current understanding, threat status, and criteria for delisting short-tailed albatross.
USFWS Information for Planning and Consultation (IPaC) (USFWS 2025)	Produces a list of special-status species with potential to occur in the specified project area.

6 RESULTS

6.1 Flora

In all, 31 vascular plant species were recorded in the project area, one of which, glossy nightshade (*Solanum americanum*) is native to the Hawaiian Islands. No special-status plant species were observed in the project area. Appendix A provides a list of the vascular plant species observed during the survey.

6.2 Vegetation and Land Cover Types

The vegetation in the project area consists of four vegetation types—ruderal, nonnative grassland, riparian, and nonnative secondary forest—described in detail below.

6.2.1 Ruderal

Ruderal vegetation was prevalent throughout much of the project area, particularly in locations frequently disturbed by roadsides, domestic livestock, or other activities. Weedy plant species were most common in this vegetation type. Guineagrass (*Urochloa maxima*) was the most prevalent, along with a mix of nonnative weeds such as false ragweed (*Parthenium hysterophorus*), sensitive plant (*Mimosa pudica*), and swollen fingergrass (*Chloris barbata*) (Figure 2).



Figure 2. Typical ruderal vegetation in the project area.

6.2.2 Nonnative Grassland

Areas that have undergone less frequent disturbance along the roadside or in adjacent pastures contained nonnative grasslands dominated by guineagrass. Woody species within this vegetation type were uncommon (Figure 3).



Figure 3. Typical nonnative grassland in the project area.

6.2.3 Riparian

Riparian vegetation was found in the project area where streams and ditches are present. The upper banks of these areas were dominated by koa haole (*Leucaena leucocephala*) and Java plum (*Syzygium cumini*). In the shallow channels, mixed weedy species were present on the channel floor. Some of the species found in these areas include sourbush (*Pluchea carolinensis*), cayenne porterweed (*Stachytarpheta cayennensis*), and umbrella sedge (*Cyperus involucratus*) (Figure 4).



Figure 4. Typical riparian vegetation in the project area.

6.2.4 Nonnative Secondary Forest

Secondary forest occurs in the project area along road edges and other areas where disturbance is less frequent. It occurs as a mix of various nonnative tree species such as koa haole, Java plum, Christmas berry (*Schinus terebinthifolius*), and bingabing (*Macaranga tanarius*). The understory in this vegetation type is frequently sparse or is occupied by guineagrass (Figure 5).



Figure 5. Typical secondary forest in the project area.

6.3 Fauna

6.3.1 Avifauna

One special-status species, nēnē or Hawaiian goose (*Branta sandvicensis*), was observed flying over the project area. Additionally, five nonnative bird species were noted during the survey (Table 2). These nonnative species are common in disturbed, low-elevation areas on Kaua‘i.

Table 2. Birds Observed in and near the Project Area on May 11, 2025

Common Name	Scientific Name	Status*	MBTA Species (Yes or No)
Cattle egret	*Bubulcus ibis*	NN	Yes
Common myna	*Acridotheres tristis*	NN	No
Feral chicken	*Gallus gallus*	NN	No
Nēnē	*Branta sandvicensis*	E	No
Spotted dove	*Spilopelia chinensis*	NN	No
Zebra dove	*Geopelia striata*	NN	No

* E = endemic, NN = nonnative permanent resident

Endangered Hawaiian waterbirds were not detected in the field survey, although one waterbird, Hawaiian common gallinule or ‘alae ‘ula (*Gallinula galeata sandvicensis*), was seen along waterways with hydrologic connectivity to the survey. Overall, the streams intersecting the project area provide potential nesting and foraging habitat for all special-status Hawaiian waterbirds: Hawaiian common gallinule or

‘alae ‘ula, Hawaiian coot or ‘alae ke‘oke‘o (*Fulica alai*), Hawaiian duck or koloa maoli (*Anas wyvilliana*), and Hawaiian stilt or a‘eo (*Himantopus mexicanus knudseni*). Similarly, special-status Hawaiian seabirds were not observed in the project area but may potentially fly over the project area to and from higher elevation nesting areas during the seabird breeding and fledging season. These seabirds are band-rumped storm-petrel or ‘ake‘ake (*Hydrobates castro*), Hawaiian petrel or ‘ua‘u (*Pterodroma sandwichensis*), Newell’s shearwater or ‘a‘o (*Puffinus newelli*), and short-tailed albatross (*Phoebastria* [=*Diomedea*] *albatrus*).

Additionally, potential roosting trees for the Hawaiian hoary bat, a federally and state-listed endangered mammal, are present within the project area.

6.3.2 Mammals

Feral pigs (*Sus scrofa*) were observed within the project area. Although house mice (*Mus musculus*) and rats (*Rattus* spp.) were not detected, they are likely to be present within the site. Additionally, habitat for foraging and roosting by the federally and state-endangered Hawaiian hoary bat exists in the project area, primarily within the riparian and nonnative secondary forest vegetation types, making it likely that this species is present at least periodically within the site.

6.3.3 Terrestrial Reptiles and Amphibians

No reptiles or amphibians were detected. No terrestrial reptiles and amphibians are native to Hawai‘i.

6.3.4 Insects and Other Invertebrates

During the survey, no native insects or other invertebrates were observed. However, one nonnative invertebrate species, the apple snail (*Pomacea canaliculata*), was recorded.

Special-Status Species and Critical Habitat

During the May 11, 2025, survey, one special-status species—the Hawaiian goose (nēnē)—was observed flying over the project area. Suitable foraging and nesting habitat for this species is present within the project area, indicating it may occur there periodically. One species protected under the MBTA—the cattle egret (*Bubulcus ibis*)—was also observed during the survey. According to the USFWS IPaC database (USFWS 2025), 10 vascular plant and 11 federally threatened and endangered animal species have ranges that overlap with the project area (Appendix B). An assessment of the likelihood of these species occurring within the project area is provided below and summarized in Table 3.

6.4 Flora

No USFWS-designated critical habitat for special-status plant species overlaps with the project area. Of the 10 vascular plant species identified through the USFWS IPaC database search (see Table 3, Appendix B), none are considered likely to occur in the project area due to past clearance of native vegetation and the land’s subsequent use for intensive agriculture and grazing.

6.5 Fauna

No USFWS-designated critical habitat for special-status wildlife overlaps with the project area. Of the 11 fauna species identified through the USFWS IPaC database search as potentially occurring in or passing through the area (see Table 3, Appendix B), five federally endangered species—the Hawaiian hoary bat,

Hawaiian common gallinule, Hawaiian coot, Hawaiian duck, Hawaiian goose, and Hawaiian stilt—have a high likelihood of occurring in or near the project area, including in grasslands, roost trees, ephemeral ponds or puddles, and riparian areas (Figures 3 and 4). All other special-status species listed by the USFWS have a low to very low likelihood of occurrence, or are otherwise not present within the project area (see Table 3).

Table 3. Special-Status Species Listed in the USFWS IPaC Search Results and their Potential to Occur in the Project Area

Species Common Name (*Scientific Name*)	Status	Habitat Within the Project Area	Likelihood of Occurring within the Project Area
Plants (vascular species only)			
‘Awikiwiki (*Canavalia napaliensis*) Awiwi (*Schenkia sebaeoides*) Carter's panicgrass (*Panicum fauriei* var. *carteri*) *Cyperus pennatiformis*; Ihi (*Portulaca villosa*) *Kadua st.-johnii*; *Microlepia strigosa* var. *mauiensis* Ohai (*Sesbania tomentosa*) Pu`uka`a (*Cyperus trachysanthos*)	Endangered	These species occupy a broad range of Hawaiian habitats, from dry coastal dunes, rocky cliffs, and talus slopes to sandy wetlands, mud flats, and mesic to wet forests. They are found from sea level to over 1,800 meters, often in exposed, rocky, or salt-spray environments, as well as periodically wet lowlands and upland forests. Although some of these habitats are present within the project area, the habitats have undergone significant disturbance due to historical habitat modification and land disturbance.	**Not present**. These species are not considered to occur within the project area due to factors such as the species not occurring on the island of Kaua‘i and/or within the area of Kaua‘i where the project site is located, and unsuitability of the disturbed habitat present in the parcel.
Makou (*Peucedanum sandwicense*)	Threatened		
Mammals			
Hawaiian hoary bat (*Lasiurus cinereus semotus*)	Endangered	Most of the available documentation suggests that this elusive bat roosts in both native and nonnative trees equal to or greater than 15 feet (4.6 meters) among trees in areas near forests. Areas of suitable habitat for foraging were noted during the survey, and bats could roost in the tree species within and near the project area.	**High**. Likely to fly over, forage, and possibly roost in trees within the project area (see Figures 4 and 5).

Species Common Name (*Scientific Name*)	**Status**	**Habitat Within the Project Area**	**Likelihood of Occurring within the Project Area**
Avifauna			
Seabirds			
Band-rumped storm-petrel (*Oceanodroma castro*) Hawaiian petrel; (*Pterodroma sandwichensis*) Short-tailed albatross (*Phoebastria* [=*Diomedea*] *albatrus*) Newell’s shearwater (*Puffinus auricularis newelli*)	Endangered Threatened	According to a 2002 report, an estimated 171–221 nesting pairs of band-rumped storm petrel exist on Kaua`i, primarily along the Nā Pali Coast and Waimea Canyon cliffs (e.g., Pōhakuao, Nu‘ulolo, and Kalalau) (Wood et al. 2002; Raine et al. 2017; USFWS 2021). No nesting habitat for this species exists in the project area, but the species could transit over the project site. Hawaiian petrel breeds in high-elevation, forested, or rocky sites, including Nā Pali Reserve and upper Limahuli on Kaua‘i. (Troy et al. 2017). No nesting habitat for this species exists in the project area, but the species could transit over the project site. Short-tailed albatross breeds mainly on small island groups south of Japan, with about 80% nesting on Torishima Island (USFWS 2020), and is occasionally seen on Midway Atoll. Outside the breeding season, the species ranges across the temperate and subarctic North Pacific, from Japan to California, typically staying near islands and coastlines. As it nests elsewhere in the world, the species will not nest within the project site and has a low likelihood of flying over the project area. Newell’s shearwater nests in burrows beneath dense forest ferns and roots on steep mid- to high-altitude slopes (e.g., Alaka‘i–Nā Pali) (USFWS 2019; Ainley et al 2020). No nesting habitat for this species exists in the project area, but the species could transit over the project site.	**Low**. These species could potentially fly over the project area, but they are highly unlikely to land or nest at the project site.

Species Common Name (*Scientific Name*)	Status	Habitat Within the Project Area	Likelihood of Occurring within the Project Area
Waterbirds			
Hawaiian coot (*Fulica americana alai*) Hawaiian duck (*Anas wyvilliana*) Hawaiian common gallinule (*Gallinula galeata sandvicensis*) Hawaiian stilt (*Puffinus auricularis newelli*) Hawaiian goose (nēnē; *Branta sandvicensis*)	Endangered	Hawaiian coot, Hawaiian duck, Hawaiian common gallinule, and Hawaiian stilt can be found nesting, foraging, and flying over agricultural lands on Kaua‘i, especially in or near managed wetlands, streams and rivers, taro fields, irrigation networks, and fallow wet fields (Engilis and Pratt 1993; Reed and Oring 1993; USFWS 2011). Areas of open pasture, including seasonally wet areas, and riparian wetlands are present within the project area and could provide habitat for all five species. Nēnē will forage and transit across agricultural zones, particularly where open grasslands or food sources exist. Pasturelands can support both foraging and occasional nesting, especially in less disturbed areas. (Banko et al. 1999).	**Moderate to High**. The project area contains both pasture and riparian wetlands that could provide habitat for all five endangered wetland bird species.
Reptiles			
Hawksbill sea turtle (*Eretmochelys imbricata*)	Endangered	Hawksbill sea turtles are marine species that haul out on beaches to rest. No suitable habitat for this species is present in the project area.	**Very low.** This species is highly unlikely to occur within the project area, as the project site is not directly connected to marine waters.

7 DISCUSSION AND RECOMMENDATIONS

The following relevant avoidance and mitigation measures are provided to reduce or eliminate project-related impacts and to avoid adverse effects on any special-status species that may periodically occur within the project area. These measures should be implemented as part of the project.

7.1 Flora and Biosecurity Considerations

The vegetation type and species identified during the survey are not considered unique, and the one native plant species recorded at the site is not a special-status species. More than 90% of the vegetation cover observed in the project area consists of nonnative plant species. The proposed project is not expected to have a significant, adverse impact on botanical resources.

Several factors may have contributed to the limited number of native vascular plant species observed at the site during the survey, including previous land use for ranching and cropping, as well as the dominant presence of invasive, nonnative plants such as Guinea grass and koa haole, and others. Nonetheless, based on the survey results and historical land use of this area, the proposed project is not expected to have a significant adverse impact on botanical resources.

Weedy nonnative plant species are common in the project area. Most of these weedy species are widespread in Hawai‘i, and their control is not expected to result in a significant decrease in their number or distribution. However, construction activities are known to spread invasive species to new areas through the movement of vehicles and materials. For this reason, Appendix C provides guidelines on

minimizing the risk of unintentionally introducing invasive species to the project site and the island of Kaua‘i.

7.2 Fauna

7.2.1 Hawaiian Hoary Bat

The Hawaiian hoary bat is found on Kaua‘i in native, nonnative, agricultural, and developed landscapes (U.S. Department of Agriculture 2009; USFWS 1998). This species forages in open, wooded, and linear habitats across a wide range of vegetation types. As insectivores, this bat is frequently observed foraging over streams, reservoirs, and wetlands, extending up to 300 feet (about 91 meters [m]) offshore (U.S. Department of Agriculture 2009). Hawaiian hoary bats typically roost in trees taller than 15 feet (4.6 m) within either dense canopy foliage or in the subcanopy when the canopy is sparse, allowing open access for launching into flight (Gorresen et al. 2013; U.S. Department of Agriculture 2009).

Direct impacts to bats could occur during vegetation removal if a juvenile bat that is too small to fly but too large to be carried by a parent is present in a tree or branch that is cut down. To prevent direct impacts to Hawaiian hoary bat, the following measures are recommended:

- No trees taller than 15 feet (4.6 m) in the project area should be trimmed or removed between June 1 and September 15 when flightless juvenile bats may be roosting in the trees.
- To minimize the risk of entanglement for the Hawaiian hoary bat, any fences installed as part of the project should include a barbless top-strand wire in place of barbed wire.

7.2.2 Seabirds

Major threats to the endangered band-rumped storm-petrel or ‘ake‘ake, Hawaiian petrel or ‘ua‘u, threatened Newell’s shearwater or ‘a‘o, and short-tailed albatross due to project activities include the attraction of adults (all four seabird species) and newly fledged juveniles (band-rumped storm-petrel, Hawaiian petrel, and Newell’s shearwater) of these species to bright lights while transiting between their nest sites and the ocean. Juvenile birds are particularly susceptible to light attraction and can become disoriented, sometimes resulting in grounding (Mitchell et al. 2005). Many grounded birds are vulnerable to mammalian predators or being struck by vehicles. The following recommendations are provided to avoid and minimize the light attraction of these seabird species to the project area:

- Construction activity should be restricted to daylight hours as much as practicable during both the seabird breeding (April–November) and fledging (September 15–December 15) seasons to avoid the use of nighttime lighting that could attract seabirds.
- All outdoor lights should be shielded to prevent upward radiation. This has been shown to reduce the potential for seabird attraction (Telfer et al. 1987).
- Outside lights that are not needed for security and safety should be turned off from dusk through dawn during the fledgling fallout period (September 15–December 15).
- Automatic motion sensor switches and controls should be installed on all outdoor lights or lights should be turned off when human activity is not occurring in the lighted area.

To avoid and minimize the likelihood of seabirds colliding with fences, powerlines, and other structures near nesting colonies, the following measures should be implemented as part of the project:

- Where fences extend above vegetation, three strands of polytape should be integrated into the fence to increase visibility.
- For powerlines, guywires, and other cables, exposure should be minimized above vegetation height and vertical profile.

7.2.3 Hawaiian Waterbirds

Habitat for endangered Hawaiian common gallinule or ‘alae‘ula, Hawaiian stilt or a‘eo, Hawaiian coot or ‘alae ke‘oke‘o, and Hawaiian duck or koloa maoli, including areas of wet turf, areas of standing water, and surrounding low-growing vegetation, exists in the project area. The following best management practices are recommended during construction activities to avoid effects on listed waterbirds:

- In areas where vegetated streambanks would be disturbed, waterbird nest searches should be conducted by a qualified biologist before any work is conducted and after any subsequent delay in work of 3 or more days (during which birds may attempt nesting).
- If a nest with eggs or chicks is discovered, work should cease within 100 feet (30 m) of the nest and the following actions should be taken:
    - Contact the USFWS within 48 hours for further guidance.
    - Do not conduct potentially disruptive activities or habitat alteration within this 100-foot (30-m) buffer.
    - Have a biological monitor that is familiar with the species’ biology present on the project site during all construction or earth-moving activities until the chicks/ducklings fledge to ensure that Hawaiian waterbirds and nests are not adversely impacted.
- If an endangered Hawaiian waterbird is present or flies into the area during ongoing activities, all activities within 100 feet (30 m) of the bird should cease; the bird should also not be approached. Work may continue after the bird leaves the area of its own accord.
- In areas where waterbirds are known to be present, reduced speed limits should be posted and enforced, and project personnel and contractors should be informed about the presence of endangered species on-site.
- Applicable *Best Management Practices for Work in Aquatic Environments* (Appendix D) should be integrated into the project design.

7.2.4 Hawaiian Goose or Nēnē

The Hawaiian goose occupies a variety of habitats, including beach strand, shrubland, grassland, and lava rock, at elevations ranging from coastal lowlands to alpine areas. They are found on the islands of Hawai‘i, Maui, Moloka‘i, and Kaua‘i (Banko 1988; Banko et al. 1999). The geese feed on plant material, with their diet largely dependent on the vegetative composition of their surrounding habitats. Their food primarily consists of leaves and seeds of grasses and sedges, leaves and flowers of various herbaceous composites, and fruits from several shrub species (Banko et al. 1999; Black et al. 1997). Hawaiian geese appear to be opportunistic in their choice of food plants, provided the plants meet their nutritional needs (Banko et al. 1999; Woog and Black 2001). They have an extended breeding season, with eggs reported in all months except May, June, and July, although most nest during the rainy (winter) season between October and March (Banko et al. 1999; Kear and Berger 1980).

Suitable habitat for foraging and nesting was noted during the surveys. To prevent impacts to the Hawaiian goose, the following measures are recommended:

- If a Hawaiian goose is observed in the area during construction activities, all activities within 100 feet (30 meters [m]) of the species should cease, and work should not continue until the species leaves the area on its own accord.
- In areas where the Hawaiian goose is known to occur, post and implement reduced speed limits, and inform project personnel about the presence of the Hawaiian goose.
- Do not approach, feed, or disturb nēnē.
- If nēnē are observed loafing or foraging within the project area during the breeding season (September–April), have a biologist familiar with nēnē nesting behavior survey for nests in and around the project area prior to the resumption of any work. Repeat surveys after any subsequent delay of work of 3 or more days during which the birds may attempt to nest.
- Cease all work immediately and contact the Service for further guidance if a nest is discovered within a radius of 150 feet (45 m) of the proposed project, or a previously undiscovered nest is found within the 150-foot (45-m) radius after work begins.

8 CONCLUSIONS

A survey of the 8.9-acre roundabout project area documented one special-status species—the Hawaiian goose (nēnē). The project site does not overlap with federally designated critical habitat, but several additional species may occur, at least periodically, within the project area, including the Hawaiian common gallinule (‘alae ‘ula), Hawaiian coot (‘alae ke‘oke‘o), Hawaiian duck (koloa maoli), Hawaiian stilt (a‘eo), and Hawaiian hoary bat. Special-status seabirds such as the band-rumped storm-petrel (‘ake‘ake), Hawaiian petrel (‘ua‘u), Newell’s shearwater (‘a‘o), and short-tailed albatross may also fly over the area. No special-status plants were observed, and none are likely to occur due to the project site’s highly modified condition. By implementing the avoidance and minimization measures outlined in this report, the project is not expected to have significant adverse effects on terrestrial biological resources.

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APPENDIX A

Vascular Plant Species Recorded During the May 11, 2025, Survey

Table A-1 provides a checklist of plant species observed by SWCA on May 11, 2025, during surveys of the Kapa‘a Roundabout project area. The plant names are arranged alphabetically by family and then by species into two groups: monocots and dicots. The taxonomy and nomenclature of the flowering plants are in accordance with Wagner et al. (1999) and Staples and Herbst (2005). Recent name changes are those recorded in Wagner et al. (2012).

Table A-1. Vascular Plants Observed within the Project Area on May 11, 2025

Family	Scientific Name and Authorship	Hawaiian and/or Common Name	Status*
Monocots			
Arecaceae	*Cocos nucifera* L.	niu, ololani, coconut	P
Cyperaceae	*Cyperus involucratus* Rottb.	umbrella sedge, ‘ahu‘awa haole, pu‘uka‘a haole	X
Poaceae	*Chloris barbata* Sw.	swollen fingergrass, mau‘u lei	X
Poaceae	*Dactyloctenium aegyptium* (L.) Willd.	beach wiregrass	X
Poaceae	*Urochloa maxima* (Jacq.) R.D.Webster	guineagrass	X
Poaceae	*Urochloa mutica* (Forssk.) T.Q.Nguyen	California grass, Para grass	X
Dicots			
Amaranthaceae	*Alternanthera pungens* Kunth	khaki weed	X
Anacardiaceae	*Schinus terebinthifolius* Raddi	Christmas berry, wilelaiki, nani o Hilo (Moloka‘i)	X
Asteraceae	*Parthenium hysterophorus* L.	false ragweed, Santa Maria	X
Asteraceae	*Pluchea carolinensis* (Jacq.) G.Don	sourbush, marsh fleabane	X
Boraginaceae	*Heliotropium procumbens* var. *depressum* (Cham.) Fosberg		X
Brassicaceae	*Lepidium virginicum* L.	pepperwort, peppergrass	X
Capparaceae	*Cleome gynandra* L.	wild spider flower, spider wisp, honohina, ‘ili‘ohu	X
Convolvulaceae	*Ipomoea obscura* (L.) Ker Gawl.	morning glory	X
Convolvulaceae	*Merremia tuberosa* (L.) Rendle	wood rose, pilikai	X
Euphorbiaceae	*Euphorbia hirta* L.	hairy spurge, garden spurge, koko kahiki	X
Euphorbiaceae	*Macaranga tanarius* (L.) Mūll.Arg.	bingabing	X
Fabaceae	*Canavalia cathartica* Thouars	maunaloa	X
Fabaceae	*Desmanthus pernambucanus* (L.) Thell.	slender mimosa, virgate mimosa	X
Fabaceae	*Indigofera spicata* Forssk.	creeping indigo	X
Fabaceae	*Leucaena leucocephala* (Lam.) de Wit	koa haole	X
Fabaceae	*Macroptilium atropurpureum* (DC.) Urb.		X
Fabaceae	*Mimosa pudica* var. *unijuga* (Duchass. & Walp.) Griseb.	sensitive plant, sleeping grass, pua hilahila	X
Malvaceae	*Malvastrum coromandelianum* subsp. *coromandelianum*	false mallow	X
Malvaceae	*Sida rhombifolia* L.		X
Moraceae	*Ficus microcarpa* L.f.	Chinese banyan, Malayan banyan	X
Myrtaceae	*Syzygium cumini* (L.) Skeels	Java plum	X
Onagraceae	*Ludwigia octovalvis* (Jacq.) P.H.Raven	primrose willow, kāmole, alohalua, kāmole lau li‘i, kāmole lau nui	P?

Family	Scientific Name and Authorship	Hawaiian and/or Common Name	Status*
Solanaceae	*Solanum americanum* Mill.	glossy nightshade, pōpolo, ‘olohua, polopolo, pōpolohua (Ni‘ihau)	I?
Verbenaceae	*Stachytarpheta cayennensis* (Rich.) Vahl	ōwī, oï	X
Verbenaceae	*Stachytarpheta jamaicensis* (L.) Vahl	Jamaica vervain, ōwī, oï	X

Notes: I? = probably indigenous but possibly naturalized, P = Polynesian introduced, P? = probably Polynesian introduced but possibly introduced in historic times, X = nonnative.

APPENDIX B

Endangered and Threatened Flora and Fauna Species with the Potential to Occur in the Project Area

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish And Wildlife Office
300 Ala Moana Boulevard, Box 50088
Honolulu, HI 96850-5000
Phone: (808) 792-9400 Fax: (808) 792-9580

In Reply Refer To: 07/03/2025 19:19:12 UTC
Project Code: 2025-0003528
Project Name: Kuhio Highway Intersection Improvements

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened and endangered species, as well as designated critical habitat that may occur within the boundary of your proposed project and that may be affected by project related actions. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Please contact the Service's Pacific Islands Fish and Wildlife Office (PIFWO) at 808-792-9400 if you have any questions regarding your IPaC species list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may adversely affect threatened and endangered species and/or designated critical habitat.

Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a Biological

Evaluation, similar to a Biological Assessment, be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment or Biological Evaluation are described at 50 CFR 402.12.

Due to the significant number of listed species found on each island within PIFWO's regulatory jurisdiction, and the difficulty in accurately mapping ranges for species that we have limited information about, your species list may include more species than if you obtained the list directly from a Service biologist. We recommend you use the species links in IPaC to view the life history, habitat descriptions, and recommended avoidance and minimization measures to assist with your initial determination of whether the species or its habitat may occur within your project area. If appropriate habitat is present for a listed species, we recommend surveys be conducted to determine whether the species is also present. If no surveys are conducted, we err on the side of the species, by regulation, and assume the habitat is occupied. Updated avoidance and minimization measures for plants and animals, best management practices for work in or near aquatic environments, and invasive species biosecurity protocols can be found on the PIFWO website at: https://www.fws.gov/office/pacific-islands-fish-and-wildlife/library.

If a Federal agency determines, based on the Biological Assessment or Biological Evaluation, that a listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at: http://www.fws.gov/endangered/esa-library/index.

Non-federal entities can also use the IPaC generated species list to develop Habitat Conservation Plans (HCP) in accordance with section 10(a)(1)(B) of the Act. We recommend HCP applicants coordinate with the Service early during the HCP development process. For additional information on HCPs, the Habitat Conservation Planning handbook can be found at https://www.fws.gov/sites/default/files/documents/habitat-conservation-planning-handbook-entire.pdf.

Please be aware that wind energy projects should follow the Service’s wind energy guidelines (http://www.fws.gov/windenergy) for minimizing impacts to migratory birds. Listed birds and the Hawaiian hoary bat may also be affected by wind energy development and we recommend development of a Habitat Conservation Plan for those species, as described above. Guidance for minimizing impacts to migratory birds for projects including communications towers can be found at:

- http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers
- http://www.towerkill.com
- http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow

Fish and Wildlife Coordination Act: Any modification to freshwater or marine waters of the U.S. including impounding, diverting, deepening, controlling, or modification for any other purpose requires a Fish and Wildlife Coordination Act (FWCA) consultation with the U.S Fish and Wildlife Service, State/ Territorial wildlife agency (State of Hawaii Division of Aquatic

Resources, American Samoa’s Department of Marine and Wildlife Resources, Guam’s Division of Aquatic and Wildlife Resources, or the Northern Mariana Island’s Division of Fish and Wildlife) and the National Marine Fisheries Service. The Pacific Islands Fish and Wildlife Office in Honolulu should be notified of a FWCA consultation request with a project description and any relevant biological information in order to expedite the appropriate level of coordination and consultation needs.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation actions that benefit threatened and endangered species into their project planning to further the purposes of the Act in accordance with section 7(a)(1). Please include the Consultation Tracking Number associated with your IPaC species list in any request for consultation or correspondence about your project that you submit to our office. Please feel free to contact us at PIFWO_admin@fws.gov or 808-792-9400 if you need more current information or assistance regarding the potential impacts to federally listed species and federally designated critical habitat.

Attachment(s):

- Official Species List

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Pacific Islands Fish And Wildlife Office
300 Ala Moana Boulevard, Box 50088
Honolulu, HI 96850-5000
(808) 792-9400

PROJECT SUMMARY

Project Code: 2025-0003528

Project Name: Kuhio Highway Intersection Improvements

Project Type: Road/Hwy - Maintenance/Modification

Project Description: The Project Action Area exists at the intersection of Kuhio Highway, Papaloa Road (North) and Kapaa Bypass Road in Kapaa on Kauai Island. The Project Action Area is approximately 8.96 acres and encompasses the Hawaii Belt Road Right of way as well as some private TMK parcels mauka of the ROW. Staging will occur mauka of the Hawaii Belt Road ROW. The surrounding land uses are agricultural lands and urban lands. There are 3 wetlands within the project area.

The purpose of the project is to improve intersection functionality by combing the two unsignalized T intersections into one signalized intersection. This will be done by relocating Kapaa Bypass Road to where Papaloa Road intersects with Kuhio Highway. The project will also include installing new highway lights which will be shielded down and on a narrow spectrum.

The project area off of the road and staging area is densely vegetated and will require clearing. Staging areas will be restored to an improved condition after construction is completed.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@22.055385049999998,-159.32962726765373,14z



Counties: Kauai County, Hawaii

ENDANGERED SPECIES ACT SPECIES

There is a total of 21 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Hawaiian Hoary Bat *Lasiurus cinereus semotus*	Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/770
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/6477.pdf

BIRDS

NAME	STATUS
Band-rumped Storm-petrel *Hydrobates castro*	Endangered

Population: USA (HI)
No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/1226
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/6939.pdf

Hawaiian Common Gallinule *Gallinula galeata sandvicensis* — Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/6612
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/6934.pdf

Hawaiian Coot (alae Ke`oke`o) *Fulica alai* — Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/7233
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/6934.pdf

Hawaiian Duck *Anas wyvilliana* — Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/7712
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/6934.pdf

Hawaiian Goose *Branta (=Nesochen) sandvicensis* — Threatened

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/1627
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/6925.pdf

Hawaiian Petrel *Pterodroma sandwichensis* — Endangered

No critical habitat has been designated for this species.

NAME STATUS

Species profile: https://ecos.fws.gov/ecp/species/6746
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/6939.pdf

Hawaiian Stilt *Himantopus mexicanus knudseni* Endangered
No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/2082
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/6934.pdf

Newell"s Shearwater *Puffinus newelli* Threatened
No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/2048
General project design guidelines:
https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/6939.pdf

Short-tailed Albatross *Phoebastria (=Diomedea) albatrus* Endangered
No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/433

REPTILES

NAME STATUS

Hawksbill Sea Turtle *Eretmochelys imbricata* Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/3656

FLOWERING PLANTS

NAME STATUS

`awikiwiki *Canavalia napaliensis* Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/1325

Awiwi *Schenkia sebaeoides* Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/7103

Carter's Panicgrass *Panicum fauriei var. carteri* Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/5578

Cyperus pennatiformis Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/6868

Ihi *Portulaca villosa* Endangered
No critical habitat has been designated for this species.

NAME	STATUS
Species profile: https://ecos.fws.gov/ecp/species/4886	
Kadua st.-johnii	Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.	
Species profile: https://ecos.fws.gov/ecp/species/4337	
Makou *Peucedanum sandwicense*	Threatened
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.	
Species profile: https://ecos.fws.gov/ecp/species/5579	
Ohai *Sesbania tomentosa*	Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.	
Species profile: https://ecos.fws.gov/ecp/species/8453	
General project design guidelines: https://ipac.ecosphere.fws.gov/project/KJMLEM64ZBFMXHAO6YEY46X7HQ/documents/generated/7050.pdf	
Pu`uka`a *Cyperus trachysanthos*	Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.	
Species profile: https://ecos.fws.gov/ecp/species/7749	

FERNS AND ALLIES

NAME	STATUS
Microlepia strigosa var. mauiensis	Endangered
No critical habitat has been designated for this species.	
Species profile: https://ecos.fws.gov/ecp/species/4737	

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

IPAC USER CONTACT INFORMATION

Agency: Private Entity
Name: Isabella McRae
Address: 1001 Bishop Street
Address Line 2: Suite 2400
City: Honolulu
State: HI
Zip: 96813
Email isabella.mcrae@wsp.com
Phone: 8084458535

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Hawaii Department of Transportation
Name: Eric Fujikawa
Email: eric.i.fujikawa@gawaii.gov
Phone: 8082413015

APPENDIX C

Biosecurity Guidelines

SWCA recommends the following invasive species minimization measures to avoid the unintentional introduction or transport of invasive species to Kaua‘i:

- All construction equipment and vehicles arriving from outside of Kaua‘i should be washed and inspected before entering the project area.
- Construction materials arriving from outside of Kaua‘i should also be washed and/or visually inspected (as appropriate) for excessive debris, plant materials, and invasive or harmful nonnative species (plants, amphibians, reptiles, and insects).
- Inspection and cleaning activities should be conducted at a designated location before entering the project area. The inspectors should be qualified botanists and/or entomologists able to identify invasive species that are of concern relevant to the point of origin of the equipment, vehicle, or material.
- When possible, raw materials (e.g., gravel, rock, soil) should be purchased from a local supplier on Kaua‘i to avoid introducing nonnative species not yet present on the island.
- If landscaping occurs as part of the project, native Hawaiian plants or noninvasive, nonnative plants should be used to the maximum extent possible. Additional information on selecting appropriate (noninvasive) plants for landscaping can be obtained from the following online sources:
    - Plant Pono: https://plantpono.org/
    - Hawaiian Ecosystems at Risk project (HEAR) Alternatives to Invasives: http://www.hear.org/alternativestoinvasives/pdfs/mcaac_hpwra_a2i_list.pdf
    - HEAR What Not to Plant: http://www.hear.org/oisc/oahuearlydetectionproject/pdfs/oedposterwhatnottoplant.pdf

APPENDIX D

Best Management Practices for Work in Aquatic Environments

U.S. Fish and Wildlife Service
Recommended Standard Best Management Practices

The U.S. Fish and Wildlife Service (USFWS) recommends the following measures to be incorporated into project planning to avoid or minimize impacts to fish and wildlife resources. Best Management Practices (BMPs) include the incorporation of procedures or materials that may be used to reduce either direct or indirect negative impacts to aquatic habitats that result from project construction-related activities. These BMPs are recommended in addition to, and do not over-ride any terms, conditions, or other recommendations prepared by the USFWS, other federal, state or local agencies. If you have questions concerning these BMPs, please contact the USFWS Aquatic Ecosystems Conservation Program at 808-792-9400.

1. Authorized dredging and filling-related activities that may result in the temporary or permanent loss of aquatic habitats should be designed to avoid indirect, negative impacts to aquatic habitats beyond the planned project area.

2. Dredging/filling in the marine environment should be scheduled to avoid coral spawning and recruitment periods, and sea turtle nesting and hatching periods. Because these periods are variable throughout the Pacific islands, we recommend contacting the relevant local, state, or federal fish and wildlife resource agency for site specific guidance.

3. Turbidity and siltation from project-related work should be minimized and contained within the project area by silt containment devices and curtailing work during flooding or adverse tidal and weather conditions. BMPs should be maintained for the life of the construction period until turbidity and siltation within the project area is stabilized. All project construction-related debris and sediment containment devices should be removed and disposed of at an approved site.

4. All project construction-related materials and equipment (dredges, vessels, backhoes, silt curtains, etc.) to be placed in an aquatic environment should be inspected for pollutants including, but not limited to; marine fouling organisms, grease, oil, etc., and cleaned to remove pollutants prior to use. Project related activities should not result in any debris disposal, non-native species introductions, or attraction of non-native pests to the affected or adjacent aquatic or terrestrial habitats. Implementing both a litter-control plan and a Hazard Analysis and Critical Control Point plan (HACCP – see https://www.fws.gov/policy/A1750fw1.html) can help to prevent attraction and introduction of non-native species.

5. Project construction-related materials (fill, revetment rock, pipe, etc.) should not be stockpiled in, or in close proximity to aquatic habitats and should be protected from erosion (*e.g.*, with filter fabric, etc.), to prevent materials from being carried into waters by wind, rain, or high surf.

6. Fueling of project-related vehicles and equipment should take place away from the aquatic environment and a contingency plan to control petroleum products accidentally spilled during the project should be developed. The plan should be retained on site with the person responsible for compliance with the plan. Absorbent pads and containment booms should be stored on-site to facilitate the clean-up of accidental petroleum releases.

7. All deliberately exposed soil or under-layer materials used in the project near water should be protected from erosion and stabilized as soon as possible with geotextile, filter fabric or native or non-invasive vegetation matting, hydro-seeding, etc.

Appendix F Hawai‘i Coastal Zone Management Program, Chapter 205(A), HRS

Appendix H: Hawaiʻi Coastal Zone Management Program, Chapter 205(A), HRS

HAWAI‘I COASTAL ZONE MANAGEMENT PROGRAM
CHAPTER 205(A), HRS

Recreational Resources

Objective: Provide coastal recreational opportunities accessible to the public.

Policies:

A. *Improve coordination and funding of coastal recreational 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 restoration of coastal resources that have significant recreational and ecosystem value, including but not limited to coral reefs, surfing sites, fishponds, sand beaches, and coastal dunes, when these resources will be unavoidably damaged by development; or requiring monetary compensation to the State for recreation when restoration is not feasible or desirable;*

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 uses of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;*

vi. *Adopting water quality standards and regulating point and nonpoint 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; and*

viii. *Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting that dedication against the requirements of section 46-6.*

Discussion: The Proposed Action would not adversely impact coastal recreational resources. There are no coastal parks in the project area, and access to the parks and beaches will remain unaffected. The anticipated improvements to traffic flow along Kūhiō Highway may facilitate access to coastal recreational activities upon project completion. See Section 2.7 of this Environmental Assessment (EA) for additional information on parks and recreational resources.

HAWAIʻI COASTAL ZONE MANAGEMENT PROGRAM
CHAPTER 205(A), HRS

Historic Resources

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

Policies:

A. *Identify and analyze significant archaeological 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 resources.*

Discussion: Given the history of human burials in the area and the identified burial at the project boundary, the State of Hawaiʻi Department of Transportation (HDOT) anticipates a determination of "Effect, with Proposed Mitigation Measures". See Sections 2.3 of this EA for additional information on historic and archaeological resources.

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 those 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*

D. *Encourage those developments that are not coastal dependent to locate in inland areas.*

Discussion: The Proposed Action would not adversely impact scenic and open space resources. There would be no significant impacts to coastal parks because these areas are outside of the project area boundaries. New street lighting would be implemented within the project area, rural property mauka of Kūhiō Highway would be used to align Kapaʻa Bypass to a new two-lane roundabout. However, because the project area consists of Kūhiō Highway, a principal arterial highway, intersections, and adjoining residential and commercial developments, the existing visual setting is already defined by roadways and tourism hubs. Construction would temporarily affect

the appearance of the existing roadway corridor and the rural property mauka of Kūhiō Highway, but any significant visual or scenic changes would be restored as much as possible upon completion.

Coastal Ecosystems

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

Policies:

A. *Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;*

B. *Improve the technical basis for natural resource management;*

C. *Preserve valuable coastal ecosystems of significant biological or economic importance, including reefs, beaches, and dunes;*

D. *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*

E. *Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.*

Discussion: The Proposed Action is not anticipated to directly or significantly impact any coastal ecosystem, because the intersection improvements would be limited to existing roadways and undeveloped properties mauka of the highway.

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 and coastal related development are located, designed, and constructed to minimize exposure to coastal hazards and adverse social, visual, and environmental impacts in the coastal zone management area; and*

C. *Direct the location and expansion of coastal development to areas designated and used for that development and permit reasonable long-term growth at those areas, and permit coastal development outside of designated areas when:*

i. *Use of designated locations is not feasible;*

ii. *Adverse environmental effects and risks from coastal hazards and minimized; and*

iii. *The development is important to the State's economy.*

Discussion: The Proposed Action would improve traffic operations along Kūhiō Highway and at Kapaʻa Bypass, a necessary public facility for traveling through East Kauaʻi. The Proposed Action is not expected to adversely impact surrounding coastal ecosystems.

Coastal Hazards

Objective: Reduce hazard to life and property from coastal hazards.

Policies:

A. *Develop and communicate adequate information about the risks of coastal hazards;*

B. *Control development, including planning and zoning control, in areas subject to coastal hazards;*

C. *Ensure that developments comply with requirements of the National Flood Insurance Program; and*

D. *Prevent coastal flooding from inland projects.*

Discussion: The project area involves an existing highway and is roughly 1,000 feet from the nearest shoreline; therefore, the Proposed Action would not immediately impact shorelines, reefs or nearshore waters, and it would not adversely affect the risks of coastal hazards occurring. The project area is in Flood Zone X, meaning it is outside the 500-year floodplain and highly unlikely to flood. See Section 2.10 of this EA for more information. This Proposed Action would also be designed with appropriate permanent drainage features.

Managing Development

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

Policies:

A. *Use, implement, and enforce existing law 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 or 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 and review process.*

Discussion: As described in Section 2.2 of this EA, a portion of this project is within the Special Management Area, and part of the project area is also within the Agricultural Lands of Importance to the State of Hawai‘i. The Proposed Action does not take place in a Conservation District. The proposed project is undergoing public review as part of this HRS Chapter 343 EA Process. On September 17th, 2025, HDOT presented this project and its potential alternatives to the community at a public meeting on Kaua‘i. At the meeting, the public introduced concerns that have since been addressed, and the public decided amongst the Proposed Action alternatives to nominate a two-lane roundabout. See summary of the public meeting in Section 4.2 of this EA. Comments on the Draft EA will be taken into consideration as the Final EA is prepared.

Public Participation

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

Policies:

A. *Promote public involvement in coastal zone management processes;*

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 issues, developments, and government activities; and*

C. *Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.*

Discussion: See “Managing Development” discussion above.

Beach and Coastal Dune Protection

Objective: Protect beaches and coastal dunes for:

(i) Public use and recreation;

(ii) The benefit of coastal ecosystems; and

(iii) Use as natural buffers against coastal hazards;

Coordinate and fund beach management and protection.

Policies:

A. *Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion;*

B. *Prohibit construction of private shoreline hardening structures, including seawalls and revetments, at sites having sand beaches and at sites where shoreline hardening structures interfere with existing recreational and waterline activities;*

C. *Minimize the construction of public shoreline hardening structures, including seawalls and revetments, at sites having sand beaches and at sites where shoreline hardening structures interfere with existing recreational and waterline activities;*

D. *Minimize grading of and damage to coastal dunes;*

E. *Prohibit private property owners from creating a public nuisance by inducing or cultivating the private property owner's vegetation in a beach transit corridor; and*

F. *Prohibit private property owners from creating a public nuisance by allowing the private property owner's unmaintained vegetation to interfere or encroach upon a beach transit corridor.*

Discussion: The Proposed Action would not adversely impact beaches or coastal dunes. The project area is roughly 1,000 feet from the closest shoreline and beaches, and the project does not involve shoreline hardening. HDOT would install and maintain appropriate roadway landscaping, and replace vegetation as agreed with affected adjacent property owners.

Marine and Coastal Resources

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

Policies:

A. *Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;*

B. *Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;*

C. *Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;*

D. *Promote research, study, and understanding of ocean and coastal processes, impacts of climate change and sea level rise, marine life, and other ocean resources to acquire and inventory information necessary to understand how coastal development activities relate to and impact ocean and coastal resources; and*

E. *Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.*

Discussion: This project is a roadway improvement project not located on or adjacent to the coastline and thus has no nexus to the study or understanding of ocean resources and coastal processes. Therefore, the Proposed Action will have no significant effects on nearby marine and coastal resources.

HRS Chapter 205A-71 states that permits will not be granted for projects that have artificial lights from floodlights, uplights, or spotlights used for decorative or aesthetic purposes when the light directly illuminates the shorelines and ocean waters, or is directed toward the shoreline and ocean waters.

No light fixtures for decorative or aesthetic purposes will be installed during this project's construction. The project area contains existing highway lighting, and extra lighting implemented will comply with applicable standards and guidelines for motorists and pedestrians. In addition to permanent lighting, the Proposed Action would include temporary construction lighting for night work. See Section 2.5 for mitigation efforts to avoid temporary lighting impacts on seabirds. See Section 1.6 for more information the permanent lighting associated with the Proposed Action.

Appendix G Kaua‘i County General Plan, Kaua‘i County Planning Department

Appendix G: Kaua‘i County General Plan, Kaua‘i County Planning Department

1.2 Public Process – Foundational Community Values

Foundational Community Values:

- *Protection, management, and enjoyment of our open spaces, unique natural beauty, rural lifestyle, outdoor recreation, and parks.*
- *Conservation of fishing grounds and other natural resources, so that individuals and families can support themselves through traditional gathering and agricultural activities.*
- *Preservation of our cultural, historical, sacred, and archaeological sites.*
- *Safety for all citizens and visitors*
- *Broad participation in the public process.*

Discussion: The Proposed Action would not adversely impact scenic and open space resources. The roadway realignments and proposed new street lighting would not have a significant impact on the community, since the existing visual setting is already defined by roadways and tourism hubs. Any visual or scenic changes from the Proposed Action would be restored as much as possible upon completion.

The Proposed Action would consider any effects on natural resources in and around the project area, as well as any cultural, historical, sacred, or archaeological sites. See Chapter 2 of this Environmental Assessment (EA) for analysis on these effects. There are no fishing grounds in or around the project area.

The implementation of a two-lane roundabout is expected to improve traffic operations, decrease conflict points, and reduce intersection speed by relinquishing movement priority from Kūhiō Highway. These effects would help reduce the number of fatal and injury crashes at intersections.

The State of Hawai‘i Department of Transportation sent out pre-consultation letters to community stakeholders to request input on the Proposed Action. HDOT also held a public meeting in Kaua‘i to solicit community feedback.

1.4 Policies to Guide Growth

Policy #1: Manage Growth to Preserve Rural Character. Preserve Kaua‘i’s rural character by limiting the supply of developable land to an amount adequate for future needs. Prohibit development not adjacent to towns. Ensure new development occurs inside growth boundaries and is compact and walkable.

Policy #4: Design Healthy and Complete Neighborhoods. Ensure new and existing neighborhoods have safe roads and functional parks, as well as access to jobs, commerce, transit, and public services.

Policy #5: Make Strategic Infrastructure Investments. New government investment should support growth areas and include priority projects as identified in Community Plans.

Policy #8: Protect Kaua‘i’s Scenic Beauty. Protect the island’s natural beauty by preserving the open space and views between towns.

Policy #12: Protect Our Watersheds. Act with the understanding that forests, biodiversity, and water resources are fragile and interconnected. Restore and protect our watershed from mauka to makai.

Policy #19: Communicate with Aloha. Kaua‘i’s residents care about planning and decision-making. Government must share information, encourage input, improve public processes, and be responsive.

Discussion: Kaua‘i’s rural character is detrimentally affected by traffic congestion. The project would help preserve the rural character by improving traffic operations on Kūhiō Highway in the vicinity of Kapa‘a Bypass Road. By enabling a more continuous flow of traffic, the Proposed Action would also reduce the likelihood of vehicle collisions along Kūhiō Highway.

This project would improve both the economic success of local business and the quality of life of Kaua‘i County residents, by improving vehicular access to growth areas in East Kaua‘i. As discussed above, the Proposed Action would not adversely impact scenic and open space resources.

The Proposed Action would be constructed in a way that would not significantly adversely affect the island’s biodiversity and overall quality of nearby wetland environments, as described in Section 2.5 and Section 2.6 of this EA.

The State of Hawai‘i Department of Transportation sent out pre-consultation letters to community stakeholders to request input on the Proposed Action. HDOT also held a public meeting in Kaua‘i to solicit community feedback.

2.4.5 Community Planning – East Kaua‘i

II. GOAL: Ensure that East Kaua‘i is resilient to Climate Change and coastal hazards.

VII. GOAL: Address traffic congestion.

Discussion: The Proposed Action addresses traffic congestion at the intersection of Kūhiō Highway with Kapa‘a Bypass and Papaloa Road. The project would not adversely affect the risks of Climate Change and coastal hazards occurring. The improved traffic operations from the Proposed Action would make it easier for emergency vehicles and service providers to travel quickly through the area. The removal of movement priority from Kūhiō Highway would allow for safer and easier left-turn movement onto Kapa‘a Bypass. No adverse air quality impacts are

anticipated to result from this project. For further discussion on air quality, see Section 2.13 of this EA.

3.0 Actions by Sector – Table 3-1 Summary of Goals and Sectors

Sector: III. Land Transportation

- *Sustainability (Growing Responsibility) – Promote multimodal shifts to reduce costs.*
- *Stewardship (Protecting Kaua‘i’s Unique Beauty) – Decrease vehicle miles traveled to reduce carbon emissions.*
- *Health & Resilience (Strengthening Communities) – Provide connectivity and safe routes to walk or bike to parks and schools.*
- *Opportunity (Promoting Diversity & Equity) – Promote equal access to transportation.*

Discussion: The Proposed Action would improve traffic conditions within the project area and remove movement priority from Kūhiō Highway, creating a safer intersection for all users with an overall reduced movement speed. See Section 2.9 of this EA for more information on the transportation infrastructure. The Proposed Action is also looking into the feasibility of adding bi-directional bus stops to the project area. Within the project area, Kūhiō Highway would become a signed shared roadway. No adverse air quality impacts are anticipated to result from this project. For further discussion on air quality, see Section 2.13 of this EA. For analysis of the effects of the Proposed Action on diversity and equity, see Section 2.14 of this EA.

4.2 Monitoring Progress – Table 4-1 General Plan Objectives and Draft Performance Measures

Objective #21: To safely and efficiently move people and goods with a choice of transportation options.

Objective #22: To provide a safe and accessible County road network that supports the Future Land Use Map.

Objective #23: To enhance the viability of transit as a transportation choice for residents and visitors.

Discussion: The Proposed Action stays true to the objectives of the General Plan and does not include any clearly conflicting action. It strives to implement these objectives by addressing traffic congestion. The Proposed Action would create a safer and more efficient intersection, and it would improve the accessibility of Kapa‘a Bypass when turning left from Kūhiō Highway.

Appendix H Hawai‘i State Plan

Appendix H: Hawaiʻi State Plan

HAWAIʻI STATE PLAN
CHAPTER 226, HRS PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES

HRS Chapter 226-4: State Goals.

Goals: In order to guarantee, for the present and future generations, those elements of choice and mobility that insure that individuals and groups may approach their desired levels of self-reliance and self-determination, it shall be the goal of the State to achieve:

1. *A strong, viable economy, characterized by stability, diversity and growth that enables fulfillment of the needs and expectations of Hawaii's present and future generations.*
2. *A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness, that enhances the mental and physical well-being of the people.*
3. *Physical, social and economic well-being, for individuals and families in Hawaii, that nourishes a sense of community responsibility, of caring and of participation in community life.*

Discussion: The Proposed Action would remove movement priority from Kūhiō Highway to create a slower yet continuous flow of vehicles where Kapaʻa Bypass and Papaloa Road intersect Kūhiō Highway. These improved traffic operations in the Wailua and Kapaʻa communities create a safer environment for all road-users, produce lower noise levels, and make it easier for emergency vehicles and service providers to travel quickly through the area. The Proposed Action is considering adding bi-directional bus stops, which would public transportation users direct access to Coconut Marketplace, which borders the project area.

HRS Chapter 226-9: Objectives and policies for the economy – federal expenditures.

Policy 3: Promote the development of federally supported activities in Hawaii that respect statewide economic concerns, are sensitive to community needs, and minimize adverse impacts on Hawaii's environment.

Policy 6: Strengthen federal-state-county communication and coordination in all federal activities that affect Hawaii.

Discussion: The Proposed Action is a State-led initiative in cooperation with the Federal Highway Administration. The State of Hawaiʻi Department of Transportation (HDOT) is seeking agency input and compliance through required consultations, including Section 106 of the National Historic Preservation Act, Section 7 of the Endangered Species Act, and the completion of a National Environmental Policy Act Categorical Exclusion.

HRS Chapter 226-11: Objectives and policies for the physical environment – Land-based, shoreline, and marine resources.

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

Policy 6: Encourage the protection of rare or endangered plant and animal species and habitats native to Hawaii.

Policy 8: Pursue compatible relationships among activities, facilities, and natural resources.

Discussion: The Proposed Action would consider any effects on the physical environment in and around the project area, as well as its impacts on rare or endangered species and critical habitats. These effects are analyzed and discussed in greater detail in Chapter 2 of this Environmental Assessment (EA).

HRS Chapter 226-13: Objectives and policies for the physical environment – Land, air, and water quality.

Policy 2: Promote the proper management of Hawaii's land and water resources.

Policy 3: Promote effective measures to achieve desired quality in Hawaii's surface, ground, and coastal waters

Policy 4: Encourage actions to maintain or improve aural and air quality levels to enhance the health and well-being of Hawaii's people.

Policy 6: Encourage design and construction practices that enhance the physical qualities of Hawaii's communities.

Discussion: The improved traffic operations along Kūhiō Highway would maintain the air quality levels and lower the noise levels in and around the project area. HDOT would ensure the proper implementation of mitigation efforts to reduce or avoid potential impacts to the surrounding physical area and nearby communities. These mitigation measures are discussed in greater detail in Chapter 2 of this EA.

HRS Chapter 226-14: Objective and policies for facility systems in general.

Policy 1: Accommodate the needs of Hawaii's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans.

Policy 2: Encourage flexibility in the design and development of facility systems to promote prudent use of resources and accommodate changing public demands and priorities.

Policy 3: Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user.

Discussion: The Proposed Action would adhere to the values and policies of the *Kauaʻi General Plan 2018*. HDOT sent out pre-consultation letters to community stakeholders to request input on the Proposed Action. HDOT also held a public meeting in Kauaʻi to solicit comments from the public on a preferred specific alternative.

HRS Chapter 226-17: Objectives and policies for facility systems – Transportation.

Policy 6: Encourage transportation systems that serve to accommodate present and future development needs of communities.

HAWAIʻI STATE PLAN
CHAPTER 226, HRS PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES

Policy 9: Encourage the development of transportation systems and programs which would assist statewide economic growth and diversification.

Policy 12: Coordinate intergovernmental land use and transportation planning activities to ensure the timely delivery of supporting transportation infrastructure in order to accommodate planned growth objectives.

Discussion: The incorporation of a two-lane roundabout at the intersection of Kapaʻa Bypass, Papaloa Road, and Kūhiō Highway would improve traffic operations and help maintain the efficient transport of goods and people through East Kauaʻi.

HRS Chapter 226-23: Objectives and policies for socio-cultural advancement – Leisure.

Policy 5: Ensure opportunities for everyone to use and enjoy Hawaii's recreational resources.

Discussion: The Proposed Action would improve access to Coconut Marketplace by creating a safer alternative to taking a left-hand turn from Kūhiō Highway onto Papaloa Road. Additionally, the Proposed Action would potentially add bi-directional bus stops, giving public transportation users direct access to Coconut Marketplace.

The proposed action would reduce traffic congestion in the Kapaa and Wailua communities, enhancing accessibility to recreational resources such as beach parks and neighborhood centers and events.

HRS Chapter 226-108: Sustainability.

Guideline 1: Encouraging balanced economic, social, community, and environmental priorities.

Discussion: HDOT is coordinating with Federal and State agencies, as well as relevant peoples and organizations, to ensure that the Proposed Action will have positive or at least minimal adverse effects on the economy, environment, and surrounding communities.