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MAR 23 2013

William P. Kenoi
Mayor

William T. Takaba
Managing Director

Warren H. W. Lee
Director

Brandon A. K. Gonzalez
Deputy Director

County of Hawai'i
DEPARTMENT OF PUBLIC WORKS
Aupuni Center
101 Pauahi Street, Suite 7 · Hilo, Hawai'i 96720-4224
(808) 961-8321 · Fax (808) 961-8630
www.co.hawaii.hi.us

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HONOLULU, HAWAII

March 7, 2013

The Honorable Gary Gill, Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawai'i 96813

SUBJECT: Draft Environmental Assessment and Anticipated Finding of No Significant Impact
Kuakini Highway Improvements, Phase II
Hualālai Road to the Proposed Ali'i Highway
Kailua-Kona, Hawai'i County, Hawai'i
Federal Aid Project No. STP 01102

With this letter, the County of Hawai'i transmits the Draft Environmental Assessment and Anticipated Finding of No Significant Impact (DEA-AFNSI) for the proposed Kuakini Highway Improvements, Phase II situated in Kailua-Kona, on the island of Hawai'i for publication in the next available edition of the Environmental Notice.

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

If there are any questions, please contact Mr. Kiran Emler at (808) 323-4851.

Sincerely,

Ben Ishii, Division Chief
Department of Public Works

c: DPW-ADM
DPW-ENG-HILO/KONA
Parsons Brinckerhoff

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AGENCY ACTIONS
SECTION 343-5(B), HRS
PUBLICATION FORM (JULY 2012 REVISION)

Project Name:	Kuakini Highway Improvements, Phase II, Hualālai Road to the Proposed Ali‘i Highway
Island:	Hawaii
District:	North Kona
TMK:	Highway right-of-way, 7-5-08:014 (pors.), 7-5-08:016 (pors.), 7-5-08:003 (pors.), 7-5-09:025 (pors.), 7-5-09:021 (pors.), 7-5-09:010 (pors.), 7-5-09:040 (pors.), 7-5-06:003 (pors.), 7-5-18:012 (pors.), 7-5-18:028 (pors.), 7-5-10:085 (pors.), 7-5-30:024 (pors.), and 7-5-17:038 (pors.)
Permits:	CZM, NPDES, and Noise Permit; SMA for design alternative 2 only
Proposing/ Determination Agency:	County of Hawai‘i Department of Public Works, Engineering Division Building D First Floor 74-5044 Ane Keohokalole Highway Kailua-Kona, HI 96740 Contact: Kiran Emler Phone: (808) 323-4851
Consultant:	Parsons Brinckerhoff 1001 Bishop St., American Savings Bank Tower, Suite 2400 Honolulu, Hawaii 96813 Contact: Mr. James Hayes Phone: (808) 566-2239

Status (check one only):

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

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

The County of Hawai‘i Department of Public Works (DPW) and the Federal Highway Administration (FHWA) are proposing improvements to Kuakini Highway between Hualālai Road and the future intersection with the proposed Ali‘i Highway in Kailua Village, North Kona on the island of Hawai‘i. Improvements to Kuakini Highway within the project limits would include increasing vehicle capacity, enhancing safety, facilitating emergency response, enhancing pedestrian facilities, improving roadway drainage, maintaining a common design standard, and other features. The project is included in the current Statewide Transportation Improvement Program (STIP) and the Hawai‘i Long Range Land Transportation Plan.

DPW has completed the widening and improvement of an adjacent stretch of Kuakini Highway between Palani Road and Hualālai Road. That project, ("Phase 1" of the Kuakini Highway widening), is separate from the action currently proposed. Widening from Hualālai Road to Ali‘i Highway, the work now proposed, has been designated Phase 2.

Three alternatives are considered: widen the highway without acquiring any new right-of-way, widen the highway with minimal acquisition of right-of-way, and No-Build. The two build alternatives would not substantially alter the environment and adverse impacts would be minimal.

A public meeting to collect comments on this DEA-FNSI will be held at _County of Hawai‘i Civic Center Building A – County Council Chamber, 74-5044 Ane Keohokalole Highway, Kailua-Kona, HI 96740 on April 19, 2013, at 1:30 p.m.

William P. Kenoi
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Ben Ishii, Division Chief
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c: DPW-ADM
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Parsons Brinckerhoff

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SECTION 343-5(B), HRS
PUBLICATION FORM (JULY 2012 REVISION)

Project Name: Kuakini Highway Improvements, Phase II, Hualālai Road to the Proposed Ali‘i Highway

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Department of Public Works, Engineering Division
Building D First Floor
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Kailua-Kona, HI 96740
Contact: Kiran Emler
Phone: (808) 323-4851

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DRAFT ENVIRONMENTAL ASSESSMENT
Kuakini Highway Improvements, Phase II
Hualālai Road to the Proposed Aliʻi Highway
Kailua-Kona, Hawaiʻi County, Hawaiʻi

Submitted Pursuant to the

Hawaiʻi Environmental Policy Act,
Chapter 343, Hawaiʻi Revised Statutes, and
Title 11, Chapter 200, Hawaiʻi Department of Health Administrative Rules

by the

Department of Public Works
Hawaiʻi County

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

Kiran Emler, Engineer
County of Hawaiʻi
Department of Public Works, Engineering Division
Building D First Floor
74-5044 Ane Keohokalole Highway
Kailua-Kona, HI 96740
(808) 323-4851

This Draft Environmental Assessment documents a provisional finding that there would be no significant environmental impacts if Kuakini Highway were widened to four lanes between Hualālai Road and Aliʻi Highway. The project would increase highway capacity and decrease congestion. Facilities for pedestrians and cyclists would also be improved.

Comments on this draft Environmental Assessment (EA) are due by April 22, 2013, and should be sent to the Department of Public Works at the address above with copies to the Office of Environmental Quality Control, 235 South Beretania Street, Suite 702, Honolulu, Hawaiʻi 96813 and Jim Hayes, Parsons Brinckerhoff, Inc., 1001 Bishop Street, Suite 2400, Honolulu, Hawaiʻi 96813.

March 2013

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CHAPTER 1
DESCRIPTION OF THE PROPOSED ACTION

1.1 INTRODUCTION

The County of Hawai‘i Department of Public Works (DPW) and the Federal Highway Administration (FHWA) are proposing improvements to Kuakini Highway between Hualālai Road and the future intersection with the proposed Ali‘i Highway in Kailua Village, North Kona on the island of Hawai‘i (see Figure 1-1). Improvements to Kuakini Highway within the project limits would include increasing vehicle capacity, enhancing pedestrian facilities, improving roadway drainage and other features. The project is included in the current Statewide Transportation Improvement Program (STIP) and the Hawai‘i Long Range Land Transportation Plan.

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1.1.1 Purpose of this Document

The Proposed Action requires environmental review in accordance with Chapter 343 of Hawai‘i Revised Statutes (HRS) because of the use of County funds and lands for its construction. Therefore, the environmental review must comply with Hawai‘i Administrative Rules [Title 11, Chapter 200 (August 1996)].

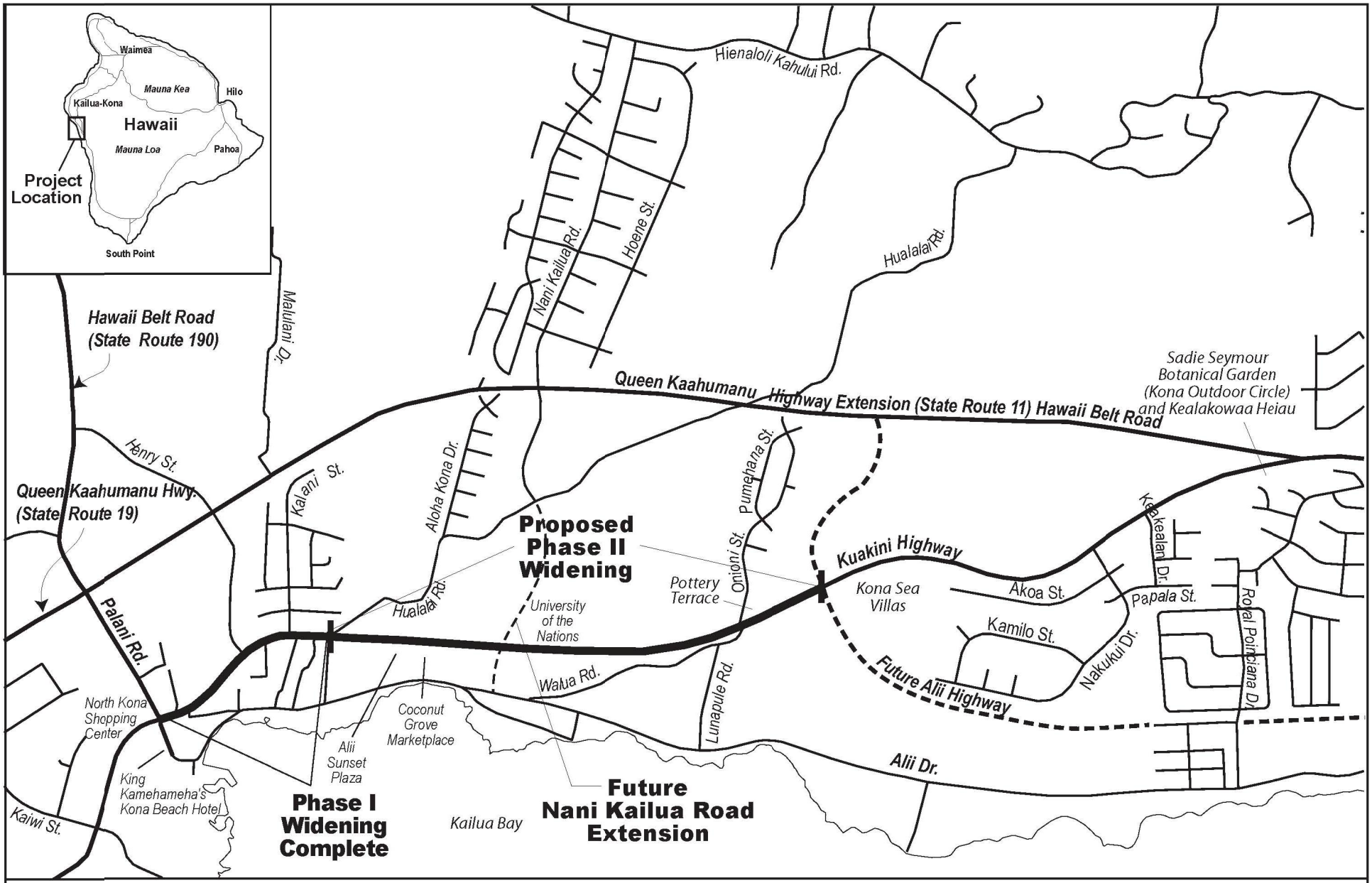
This Draft Environmental Assessment (EA) discloses the environmental and social impacts that could result from the project's implementation, and commits to the employment of specific measures to prevent, minimize, or mitigate adverse impacts to the environment. Additionally, this Draft EA contains a record of all comments and consultation activities that have been conducted to date as part of project planning.

Because federal funds administered by the FHWA would be used for design and construction, the project must also comply with the National Environmental Policy Act (NEPA), a Federally-mandated environmental review process. NEPA does not require both a draft and final version of an EA. Because of this difference between State and Federal environmental review processes (HRS Chapter 343 and NEPA), this Draft EA has been prepared to address State requirements only. The NEPA document for this project will be the HRS Chapter 343 Final EA.

Other federal laws apply to the proposed project such as Section 7 of the Endangered Species Act, Section 106 of the National Historic Preservation Act, and Section 4(f) of the 1966 Department of Transportation Act. Compliance with these federal environmental regulations is ongoing or has been completed, and is documented in this Draft EA.

DPW has determined that the Proposed Action is not likely to have a "significant" impact in accordance with HRS Chapter 343. Therefore, DPW proposes to issue a "Finding of No Significant Impact" (FONSI) on the project. After receipt of comments on this Draft EA, DPW will reassess its preliminary determination that a FONSI is appropriate.

FHWA will not determine whether a FONSI is appropriate under NEPA until they review the Final EA, which will be the NEPA document for the project.



Project Location

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

Figure 1-1

1.1.2 Organization of This Document

Chapter 1 discusses the purpose and need for the proposed project. It introduces the alternatives that were considered and the project's anticipated schedule and cost. It also lists permits and approvals that may be required. Chapter 2 describes existing environmental conditions, potential environmental impacts, and the mitigation measures that are proposed to reduce the level of adverse impact. Chapter 3 documents agency and public coordination conducted to date with respect to the project. Chapter 4 provides the Anticipated Finding of No Significant Impact (FONSI) statement, pursuant to HRS Chapter 343. Chapter 5 consists of a list of references used in the preparation of this EA. Appendix A contains records of comments and coordination conducted for the proposed project. Appendix A through Appendix H are various technical reports prepared for this project.

1.1.3 Naming Conventions in This Document

This document generally uses the directional terms north, south, east, and west. However, the terms "mauka" and "makai" (towards the mountains and towards the ocean, respectively) are also used, especially where these terms may be the most convenient to describe a direction or location. For this project area, mauka generally corresponds to an easterly direction, and makai is a westerly direction.

1.2 PROJECT PURPOSE AND NEED

Based on an analysis of current and proposed conditions, the following project purposes and needs have been established for the proposed project:

- Improve Kailua-Kona's roadway network by increasing vehicular roadway capacity;
- Improve roadway drainage;
- Implement common design standards that were incorporated into Phase 1 of Kuakini Highway widening, such as enhancements to pedestrian and bicycle facilities, and improvements to the visual character of the corridor; and
- Enhance emergency access / evacuation capacity.

1.2.1 Improve Kailua-Kona's Roadway Network

A key purpose of the proposed project is to help relieve existing and forecasted traffic congestion. Growth in Kailua-Kona has generated traffic and the County is proposing improvements to address future transportation constraints proactively. During the traffic study to support this EA (Section 2.3.1), traffic was somewhat constricted during peak times in the morning, noon, and afternoon. Congestion was concentrated at the northern limit of the proposed project; the intersection of Hualālai Road and Kuakini Highway. This intersection was found to be operating at a level-of-service (LOS) of C, which corresponds to "average traffic delays." By 2020, traffic is expected to increase significantly as future development along Kuakini Highway and in the surrounding area occurs. Additional roadway capacity is needed to handle the projected increase in traffic volume that will accompany development. If Kuakini Highway is not improved, by 2020 vehicles at all intersections within the project limits are projected to experience the long delays and severe congestion associated with LOS ratings of D, E and F.

Widening Kuakini Highway would help address existing and future traffic congestion. Widening is proposed only as far as the future intersection with proposed Ali‘i Highway because with Ali‘i Highway in place, it is projected that the volume of traffic on Kuakini Highway south of Ali‘i Highway would only be half the volume as on Kuakini Highway north of Ali‘i Highway.

1.2.2 Improve Roadway Drainage

Roadway drainage improvements are needed to address existing drainage conditions. Much of Kuakini Highway within the project limits does not have drainage facilities. Storm water runoff from the road sheet flows to the side of the road into unimproved areas, or along gutters to drain inlets in those areas where gutters do exist.

Flow diversion and control at stream crossings is also needed to protect the roadway during large storms. Such storms occur regularly in the Kona area and occasional flooding of Kuakini Highway occurs. However, improvements to stream crossings are not part of this project because other agencies are currently addressing the concerns associated with stream crossings. The Keōpū Stream drainage way at the northern terminus of the proposed project is being studied by the U.S. Army Corps of Engineers (USACE). It is anticipated that USACE will construct improvements upstream so that the box culvert at Kuakini Highway would not require resizing (personal communication, Derrick Elfalan, Oceanit, Inc., May 5, 2006). Nevertheless, all culverts will be assessed during final design to verify that culvert sizes are sufficient to convey predicted runoff at each location. Improvements needed at the Waiaha Stream drainage way, including its “Splitflow #3” crossing near the southern project terminus, have been included in the design of the Ali‘i Highway project.

1.2.3 Implement Common Design Standards – Enhance Pedestrian and Bicycle Facilities and Visual Character

Another purpose of this project is to apply common design standards along Kuakini Highway. These design standards are described in Section 1.4. While some stretches of Kuakini Highway have been previously upgraded by private developers in association with their projects, varying design standards across the development projects has led to an inconsistent appearance. Moreover, those segments of roadway without recent development have not been improved. Therefore, the County proposes to create a more visually cohesive roadway design.

Beyond widening and adding vehicular lanes to the roadway, the County also proposes to extend the enhancement of pedestrian and bicycle facilities that was begun in Phase 1 between Palani and Hualālai Roads. Early public input regarding the project (see Chapter 3) confirmed that pedestrian and bicycle facility improvements are needed in this roadway segment. Employees and students at the University of Nations represent a significant portion of the need since many people walk or bike regularly between the campus and the center of Kailua-Kona. Therefore, connecting the University to Hualālai Road, with its pedestrian and bicycle facilities, would benefit the University community and residents in the adjacent areas.

Visual improvements such as landscaping and the relocation of overhead utility poles were also part of the Phase 1 design. Under Phase 2, DPW proposes to extend such improvements to achieve a consistent look, enhancing the corridor. Where possible, the proposed typical section for Phase 2 was made similar to Phase 1, including the placement of utility poles only on the mauka side of the road. See Section 1.4 below for more details on the typical section.

1.2.4 Enhance Emergency Access / Evacuation Capacity

The town of Kailua-Kona on the Kona coast is vulnerable to coastal hazards such as tsunamis and tropical storms. In the event of an evacuation, the routes presently available are Ali‘i Drive, Kuakini Highway, Queen Kaahumanu Highway and capacity-limited mauka-makai roads. Ali‘i Drive is near sea level, making it vulnerable to flooding. Ali‘i Drive also has a narrow, two-lane configuration with only limited expansion potential due to its proximity to the shoreline. The section of Kuakini Highway proposed for widening also has a narrow, two-lane configuration. The limitations of these two main roads out of Kailua-Kona, and the limited number of mauka-makai access points, constrain emergency evacuation.

Widening Kuakini Highway to four lanes and increasing mauka-makai roadway capacity under separate projects would enhance the emergency access and evacuation capacity of the roadways in Kailua-Kona.

1.3 BASIC TRANSPORTATION ASSUMPTIONS

This analysis is based on certain transportation network assumptions. It is assumed that all projects in the STIP and other County roadway projects are implemented with the exception of the proposed project. In particular, it is assumed that the following key roadway projects proceed:

- Phase I of Ali‘i Highway, which would connect it to Kuakini Highway, is assumed to be completed before or simultaneous to the completion of the southern portion of this proposed project.
- Queen Ka‘ahumanu Highway Extension, between Malulani Drive and Kuakini Highway, is assumed to be widened by HDOT.
- Kuakini Highway, south of its intersection with Queen Ka‘ahumanu Highway Extension to Kamehameha III Road, is assumed to be widened by HDOT.

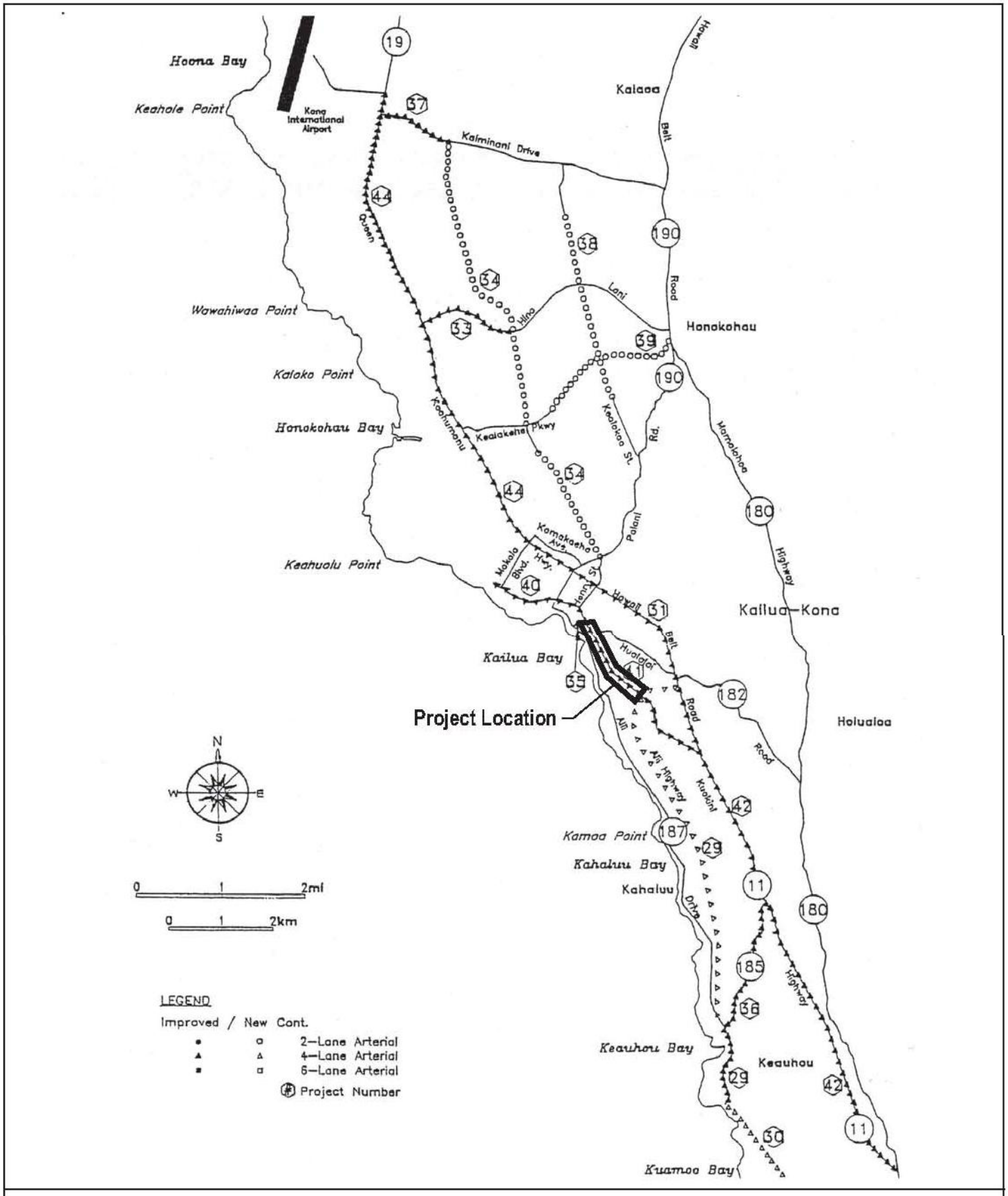
The roadway network presumed for 2020 is illustrated in Figure 1-2.

1.4 ALTERNATIVES ADDRESSED IN THIS EA

Two main alternatives are analyzed in this EA, the No-Build and Build. The proposed project is the Build Alternative. There are two versions of the Build Alternative described below. The preferred version of the Build Alternative has not been selected and would be identified in the Final EA. Other alternatives that were considered but rejected are addressed in Section 1.5.

1.4.1 No-Build Alternative

The No-Build Alternative assumes that the widening of Kuakini Highway between Hualālai Road and Ali‘i Highway would not be accomplished by 2020. The existing two-lane cross-section would remain in the bulk of the project area. However, it is assumed that between now and the year 2020 some intersection improvements, such as additional turn lanes and signalization, would be made to try and respond to demand without widening the entire length of the highway. This alternative assumes implementation of the other roadway construction projects described in Section 1.3.



Year 2020 Network and Proposed Project

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

N

Figure 1-2

The No-Build Alternative would not address the purpose and needs of this project because it would not relieve existing or future traffic congestion, improve local traffic circulation, improve roadway drainage, nor achieve common design standards along Kuakini Highway. No cycling and pedestrian facilities would be provided, and the visual character of the roadway would remain similar to the existing conditions.

This alternative is included because it was suggested at a public meeting on November 16, 2005 that other projects should receive higher priority than this one.

1.4.2 Build Alternative

The Build Alternative involves widening Kuakini Highway to four lanes from Hualālai Road to the proposed Ali‘i Highway. Additional improvements include auxiliary lanes; bike lanes and sidewalks on both sides; curbs, gutters, and drainage system; utility relocations; highway lighting; and intersection improvements. Figure 1-3 shows the proposed 80-foot-wide typical section, and Figure 1-4, Figure 1-5, and Figure 1-6 show the anticipated project footprint.

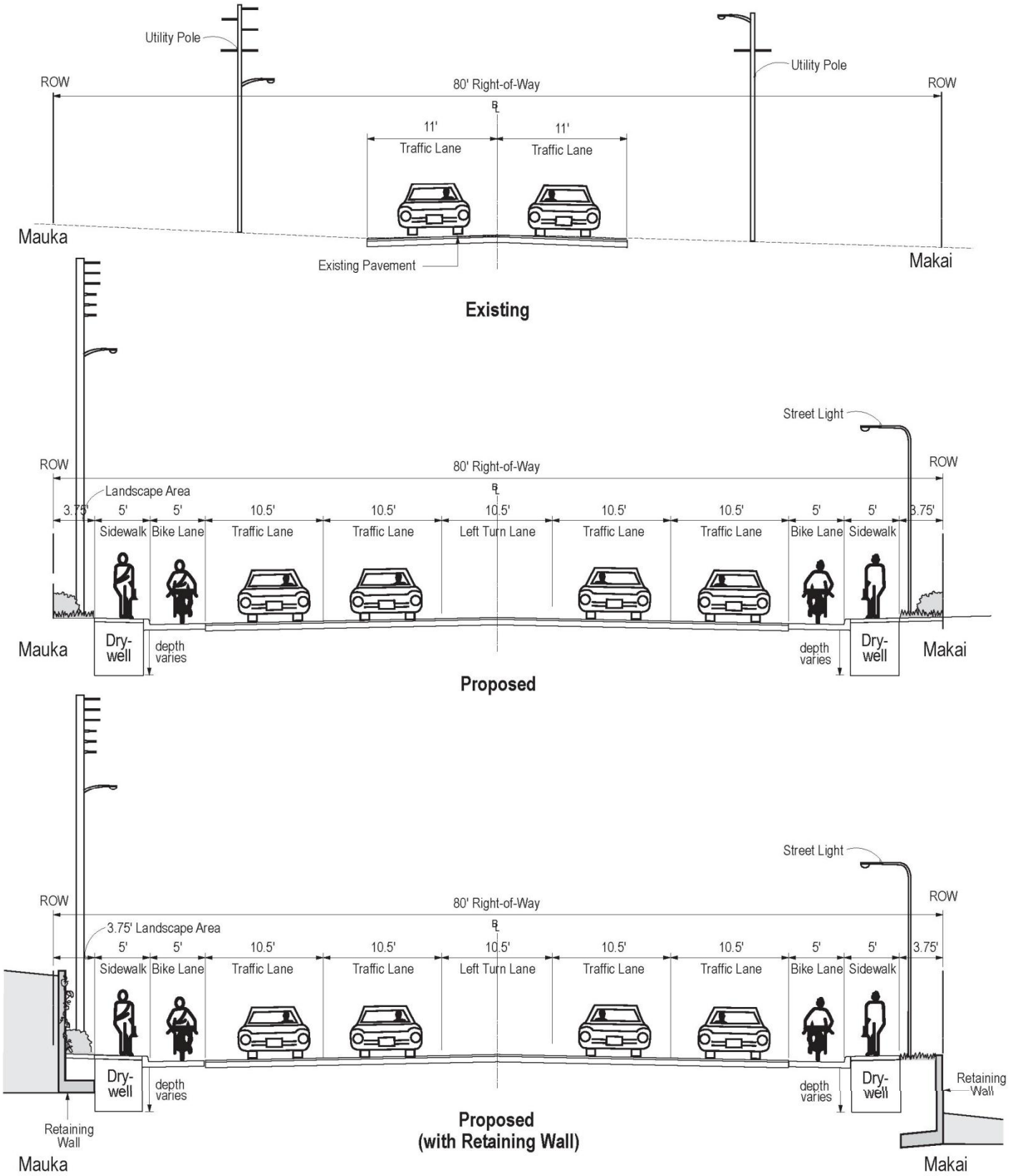
Two slightly different versions of the Build Alternative are under consideration, Design Alternatives 1 and 2. Both use the same general/existing alignment and would provide similar roadway cross-sections. They differ in that the footprint of Design Alternative 1 is designed to remain within the existing 80-foot right–of-way (ROW) owned by the County while the centerline of Design Alternative 2 diverts slightly from the current centerline in places, resulting in the footprint of Design Alternative 2 extending beyond the current ROW in areas. Design Alternative 1 would not require any ROW acquisition but Design Alternative 2 would require some ROW acquisition. Design Alternative 2 is designed to reduce the height of retaining walls; a balance between ROW acquisition and retaining wall height was struck for Design Alternative 2 such that no displacements would occur as a result of the ROW acquisition. Both versions of the Build Alternative would generate construction impacts beyond the existing or new ROW.

Due to similarities between the two versions of Build Alternative, they are treated as the same alternative in much of this EA. Where differences exist in their descriptions and/or their impacts, those differences are specifically noted. The following three sections address elements common to both Design Alternatives, and elements specific to each.

1.4.2.1 Common Elements of Both Design Alternatives

The following is a list of major work items proposed under the Build Alternative, followed by a discussion of additional details for selected items:

- Widen Kuakini Highway from a two-lane undivided roadway to a four-lane roadway with center turn lane, curb, and gutter;
- Construct retaining walls, including cuts and fills where necessary;
- Construct drywells and permanent post-construction Best Management Practices (BMPs);
- Install bike lanes on both sides of the road, in accordance with Bike Plan Hawai‘i, with clear markings at intersections;
- Install sidewalks on both sides of the road, in accordance with the Americans with Disabilities Act (ADA);
- Improve driveways with direct access to Kuakini Highway;



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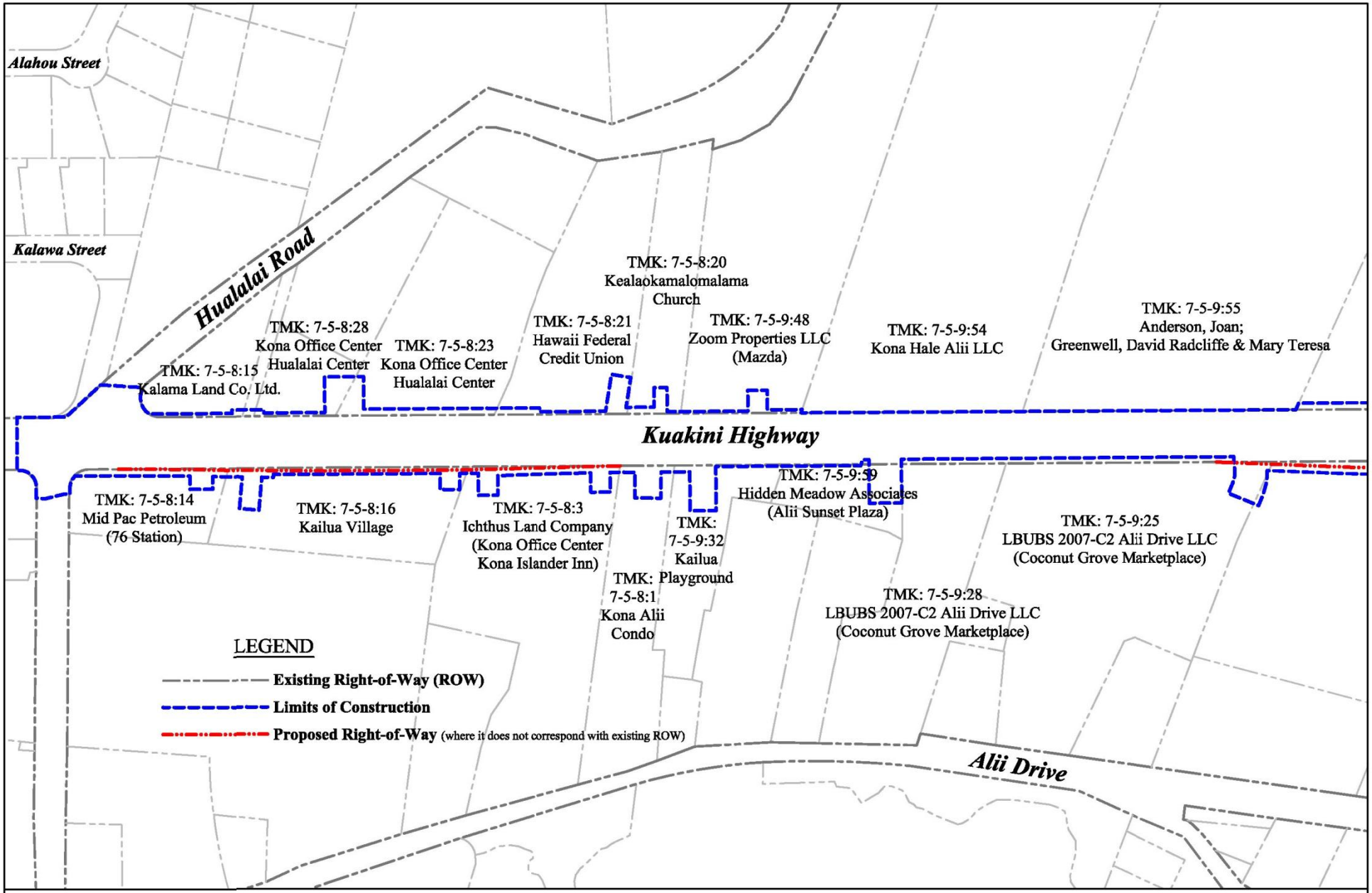
Typical Roadway Sections

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

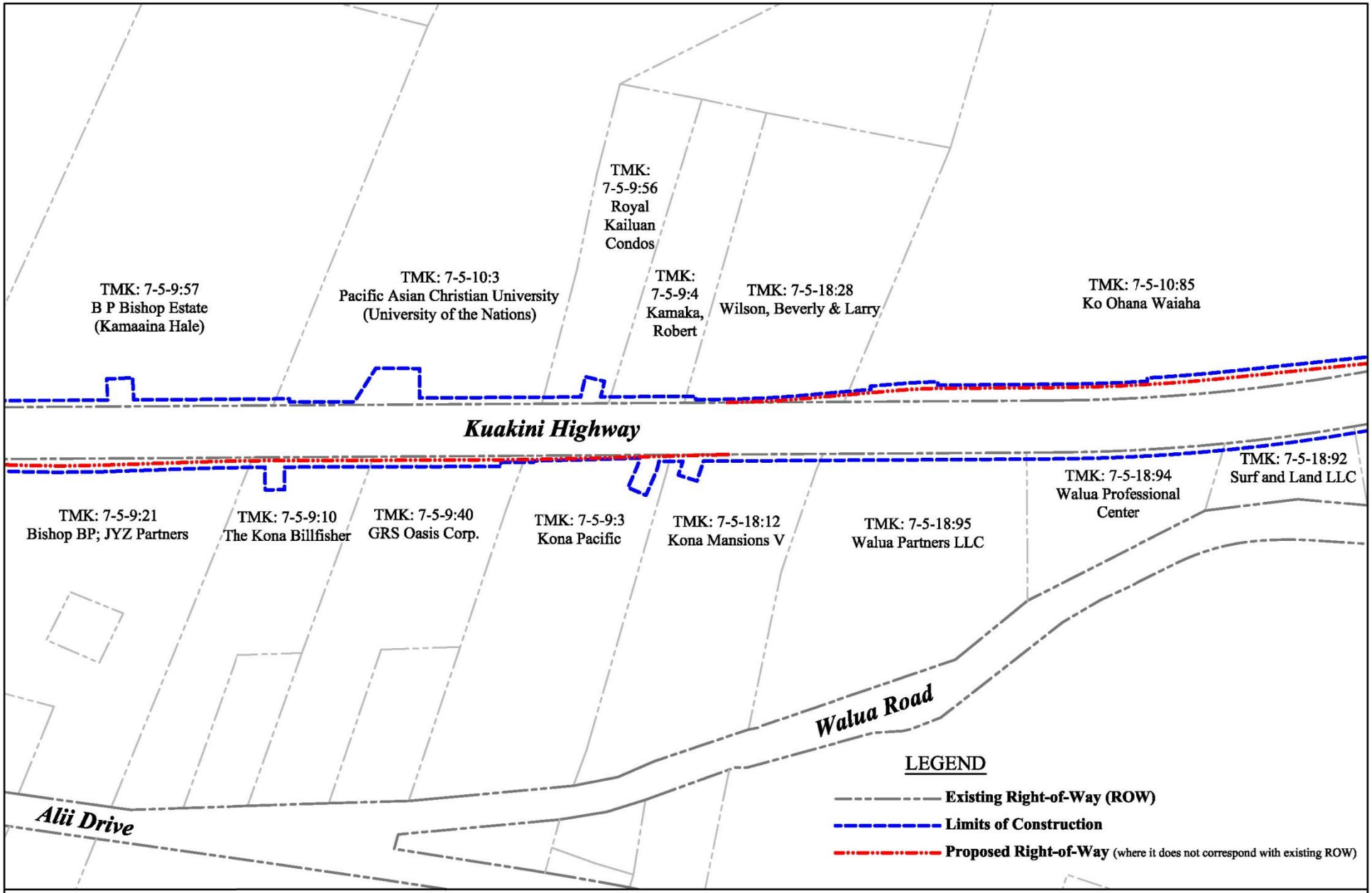
Figure 1-3



Limits of Construction - Section 1

Kuakini Highway Improvements Project, Phase 2; Kailua-Kona, Hawaii

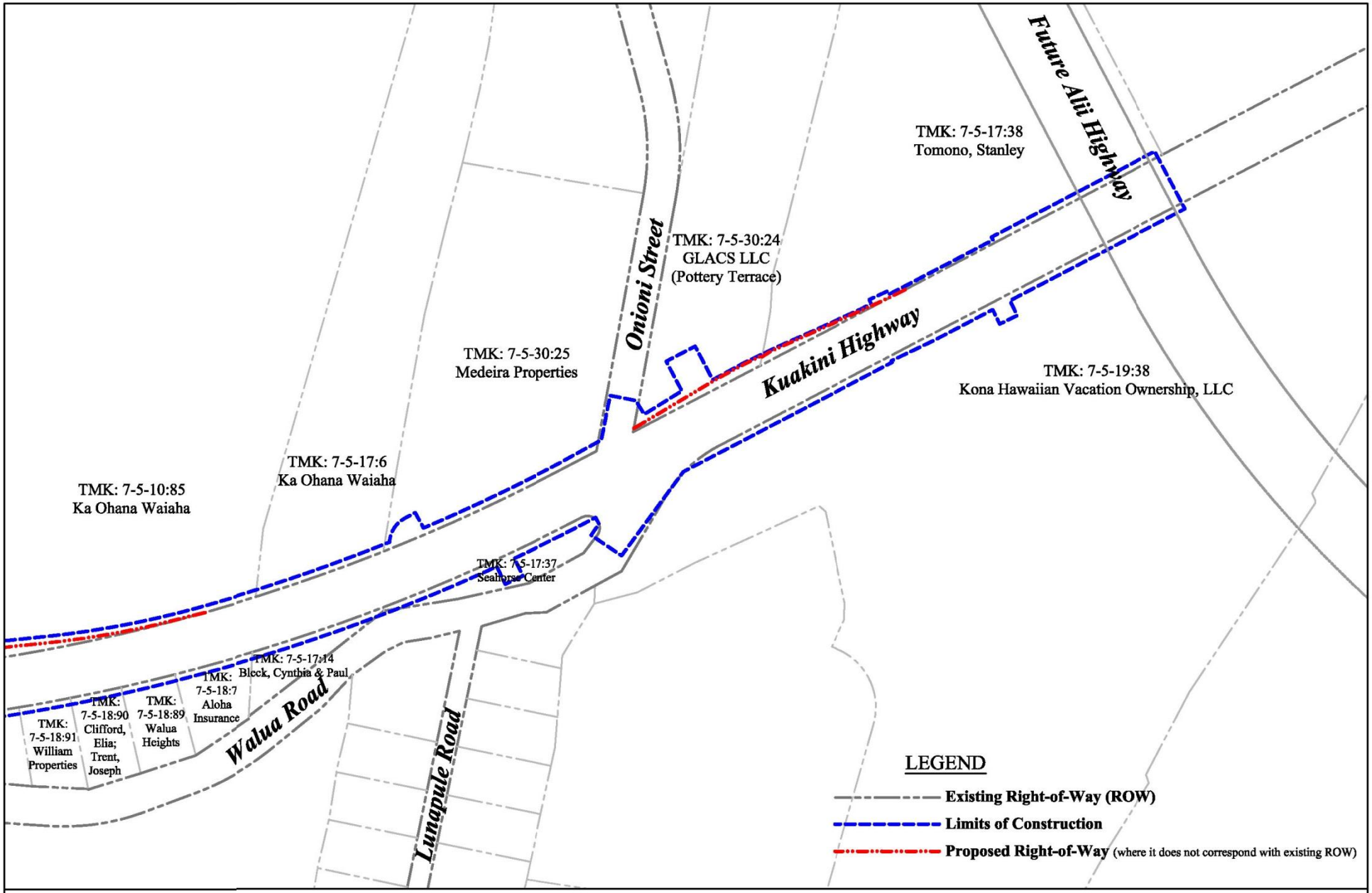
Figure 1-4



Limits of Construction - Section 2

Kuakini Highway Improvements Project, Phase 2; Kailua-Kona, Hawaii

Figure 1-5



Limits of Construction - Section 3

Kuakini Highway Improvements Project, Phase 2; Kailua-Kona, Hawaii

Figure 1-6

- Improve existing intersections at Walua Road/Onioni Street, and coordinate design of the intersections with the proposed Nani Kailua Road extension and Ali‘i Highway;
- Relocate and consolidate existing overhead utilities to the mauka side of highway on 80 foot poles, and place service lines to makai-side customers underground;
- Protect existing buried utilities, such as sewer lines;
- Install landscaping in accordance with a landscaping plan to be developed during final design;
- Install signage and pavement markings;
- Bridge historic Laniākea Cave, if it is found to be within the project alignment and close to the surface of the roadway;
- Construct noise wall(s) to mitigate substantial noise impacts that would otherwise occur at homes abutting the roadway (Kama’aina Hale Condos);
- Install crosswalks along Kuakini Highway as needed; and
- Along entire length of project, upgrade/install street lights and other safety fixtures that comply with the Roadside Design Guide of the National Cooperative Highway Research Program.

Both versions of the Build Alternative would have construction impacts beyond the existing ROW. The worst-case limits of construction are shown in Figure 1-4, Figure 1-5, and Figure 1-6. Should the selected contractor require a construction staging area beyond the areas already cleared through this and other environmental review processes (i.e. Ali‘i Highway’s environmental review process), it would be an obligation of the contractor to conduct the necessary environmental reviews prior to use. Areas surveyed during this EA were limited to a 200-foot-wide corridor along the existing street centerline.

Most existing pavement would be replaced concurrently with the roadway widening. In the few areas where disturbance to existing pavement should be minimized, such as adjacent to the human burial monument in the sidewalk above Coconut Grove Marketplace, the pavement would be removed only to about a two-inch depth to prepare the roadway for new pavement. The roadway’s base course would not be disturbed in these few sensitive areas.

Due to steep slopes along much of the project area, retaining walls would be needed to permit the construction of flat areas to accommodate the wider road. The sizes and locations of retaining walls, and corresponding cuts and fills, differ between the two Design Alternatives and are described in the following sections (Sections 1.4.2.2 and 1.4.2.3). A geotechnical report prepared to address the design of retaining walls was also prepared during the project planning process, and is included as Appendix B.

A 24-inch culvert located about 1,000 feet north of the Walua Road intersection would be relocated by about 10 feet so that the flow would be better aligned with existing drywells on private property makai of Kuakini Highway. Two other culverts and drainpipes within the project limits, servicing the Keōpū and Waiaha Streams, are currently being addressed by the U.S. Army Corps of Engineers and the Ali‘i Highway Project respectively, and therefore are not included in the scope of this project.

The drainage improvements that are part of this project would consist of constructing drywells under the sidewalk to handle roadway runoff as shown in Figure 1-3. Details of drywell locations and sizes would be developed during project design, but construction depth is

estimated to be roughly 30 feet. Permanent post-construction Best Management Practices (BMPs) would be incorporated into the design to handle and treat storm water runoff from the roadway, in accordance with the City and County of Honolulu's "Rules Relating to Storm Drainage Standards" (January 2000). The County of Hawai'i is currently developing its own storm drain standards, but until those standards are completed, Honolulu's standards would be used.

Although access from Kuakini Highway to abutting properties would be maintained, it may be restricted to one location and/or turning movements may be prohibited as necessary to provide the proposed improvements. All driveways with access to Kuakini Highway would be temporarily affected by construction. Bringing the edge of the road closer to abutting property lines would further increase the slope of driveways. Re-grading and adjustment of steep driveways would be necessary. Three such steep driveways serve the Kailua Playground on the makai side, and Hualālai Center and Kama'aina Hale on the mauka side.

DPW would work with affected residents to minimize any construction inconveniences. All driveway modifications would meet federal driveway grade criteria. Most of the driveway grades would not change much because they are already steep, but the ramps would extend further into the parcels.

The improved intersection at Walua Road and Onioni Street would be a signalized intersection. The County is also planning to extend Nani Kailua Road, which would result in a new intersection within the Project limits; intersection improvements, including signalization would be part of the road extension project, not the proposed action. The Ali'i Highway intersection would be signalized upon its construction.

Utility poles would be placed only on the mauka side of Kuakini Highway, and utility line crossings to the makai side would be placed underground. Complete undergrounding of utility lines was considered but rejected due to cost considerations (See Section 1.5). Pole design details, including options for adjusting pole heights, would be considered during the design phase. All improvements to utilities would be coordinated with the appropriate utility company and addressed during project design. Design details for the overhead utilities would be similar to the design details implemented in the Phase 1 widening of Kuakini Highway.

Laniākea Cave is a historic lava tube whose path has not been clearly defined. According to anecdotal information, it appears that Laniākea Cave passes below Kuakini Highway between the Hualālai Road intersection and the Keōpū Stream culvert, about 225 feet south of the intersection. Research indicates that parts of this cave may lie below the proposed project area, and the roof of the cave may be close to the ground surface. The County would make reasonable efforts to investigate the course and depth of this cave in more detail during the design phase. If it is determined that the cave is shallower than previously believed, roadway improvements may involve bridging over the cave so the roof of the cave would not be breached. If piles were required, they would be placed beyond the limits of the cave.

Noise walls would be built between the widened highway and Kama'aina Hale Condos. The wall would extend from one end of the Kama'aina Hale Condos property to the other, with a break for the access driveway in the middle. The wall would be 5 to 10 feet high and located within the right-of-way just mauka of the sidewalk.

The depth of excavation required for roadway construction would be about three feet in most areas. On the mauka side, in specific locations where utility poles are to be placed, 12-foot deep holes would be drilled. Where utility relocations are necessary, including those areas where overhead utilities would be placed underground to cross to the makai side, excavation

would be four to five feet deep. Construction of drywells would entail excavation to a depth of about 30 feet. Footings for retaining walls would also be excavated. Depths would depend on the size of walls, but would be generally four feet deep.

The designed speed of the facility would be 50 miles per hour (mph). The posted speed limit would be 35 mph.

1.4.2.2 Design Alternative 1 – Minimize Land Acquisition

Under Build Alternative 1, Kuakini Highway as widened would lie within the existing ROW already owned by the County. No ROW acquisition would be needed. Because the widening would extend the edges of the road essentially to match the 80-foot ROW, the construction zone would extend beyond the edge of the ROW by around ten feet on each side to accommodate construction activities.

Because of space constraints associated with keeping the roadway within the existing ROW, this alternative would require retaining walls longer and/or higher than in Design Alternative 2, increasing the construction cost. The height of retaining walls on the makai side would range from two to 16 feet; those on the mauka side would range from two to 12 feet. Under this Design Alternative, there would be a total of 18 wall structures with a total length of 4,820 feet. Twelve walls would be in fill condition (makai side), and six walls would be in cut condition (mauka side).

1.4.2.3 Design Alternative 2 – Minimize Retaining Walls

This design alternative is intended to create a Build Alternative requiring fewer and shorter retaining walls, reducing construction cost. Property beyond the existing roadway ROW would be needed. As a result, the project footprint under Design Alternative 2 would be slightly larger than under Design Alternative 1. The areas shown as proposed ROW on Figure 1-4, Figure 1-5, and Figure 1-6 indicate where Design Alternative 2 would have a larger footprint than Design Alternative 1.

Under this alternative, the height of retaining walls on both the makai and mauka sides would range from two to 16 feet. There would be a total of 22 wall structures with a total length of 4,170 feet. Fifteen walls would be in fill condition (makai side), and seven walls would be in cut condition (mauka side).

See Section 2.2.3 for details of proposed ROW acquisitions.

1.5 ALTERNATIVES CONSIDERED BUT REJECTED

This section consists of brief descriptions of alternatives (or components of alternatives) that were considered, and the reason(s) for rejection of that alternative. Suggestions received during the pre-assessment consultation period are also included. For a description of comments received, see Chapter 3 and Appendix A of this EA.

The following types of alternatives were considered for this project:

- Transportation System Management (TSM) alternative;
- Alignment alternatives (different project limits);
- Design alternatives (different conceptual designs); and
- Parking mitigation alternatives.

1.5.1 Transportation System Management Alternative

The TSM Alternative is defined as the application of construction, operational, and institutional actions to increase the effectiveness of the present transportation system without large capital expenditures. Relatively minor modification of existing roadway facilities fall into this category. An example of these actions would be intersection channelization and signalization. This includes the addition of turn lanes and extra through lanes near intersections provided they fit within the ROW of the highway.

The TSM Alternative is essentially the same as the No-Build Alternative because a true no build was considered unreasonable given projected future traffic conditions. Projected 2020 traffic conditions indicate that the TSM Alternative would result in extreme delays throughout the Kuakini Highway corridor considered in this analysis. The study found that a four-lane Kuakini Highway cross-section would be needed to accommodate through traffic between the future intersection with Ali‘i Highway and Hualālai Road. Therefore, the TSM Alternative was rejected because it does not address the need for future transportation capacity in the project corridor.

1.5.2 Alignment Alternatives

1.5.2.1 Construct New Arterial Road

Attempting to construct an additional north-south arterial appears infeasible. Government planning documents and master plans have not identified any other arterial roadway for Kailua-Kona, and environmental impacts of a new roadway facility would greatly exceed those of widening an existing roadway.

Moreover, the proposed project would function in conjunction with the new Ali‘i Highway, which is a north-south arterial in the segment south of its intersection with Kuakini Highway, but also turns east (mauka-bound) to serve as a mauka-makai connector between Kuakini Highway and Queen Ka‘ahumanu Highway Extension (See Figure 1-1).

1.5.2.2 Widen Other Existing Roadways

Another option considered was widening other existing and future north-south arterial roadways to reduce travel demand on Kuakini Highway.

Other arterials in Kailua-Kona are already being widened or are planned for future widening. The State Department of Transportation (HDOT) plans to widen Queen Ka‘ahumanu Highway Extension between Malulani Drive and Kuakini Highway and Kuakini Highway between Queen Ka‘ahumanu Highway Extension and Kamehameha III Road. These roads would be widened from two to four lanes, and possibly six lanes in places. The northern portion of Ali‘i Highway, which includes its intersection with Kuakini Highway, it is initially proposed to be built as a two-lane facility, but a four-lane configuration is also possible. Space constraints would make it difficult to widen Ali‘i Drive, which is adjacent to the coastline.

However, even with these other facilities being widened, and regardless of whether Ali‘i Highway is built as two or four lanes, the widening of Kuakini Highway would still be needed by 2020 because travel forecasts show that there would otherwise not be enough north-south capacity serving Kailua-Kona near the village center. Further widening the existing facilities would have minimal effectiveness due to difficulty handling additional lanes at intersections and due to ROW constraints.

1.5.2.3 Alternative Treatments of Southern Terminus

Public comments during the pre-assessment consultation phase (See Section 3.1) included suggestions to extend the roadway widening further south than the proposed terminus at the future Ali‘i Highway intersection. However, this alternative was rejected because the current proposed project would feed Ali‘i Highway as the through route for north-south mobility. Therefore, widening Kuakini south of the intersection with Ali‘i Highway is not needed to address the purposes and needs of the project.

Other suggestions included connecting Kuakini Highway directly into Ali‘i Highway as the through route. However, given the existing Kuakini Highway alignment and the need for a mauka-makai connector between Ali‘i Highway and Queen Ka‘ahumanu Highway Extension, this option was considered less reasonable than the proposed Build Alternative. Regardless of the intersection geometry, a signal would be required. That signal would be programmed to make the intersection as efficient as possible.

1.5.3 Roadway Design Alternatives

1.5.3.1 Three-Lane Widening Alternative

A three-lane widening alternative was developed that would consist of widening both existing lanes, and adding a center turn lane. Members of the public suggested this alternative during early project coordination.

Another variation of this alternative would involve widening Kuakini Highway to four lanes only in the northern segment to allow better flow through Hualālai Road, and use the three-lane configuration in the remaining southern segment.

This alternative was rejected from further consideration, because traffic delays and congestion are forecast to be significant if only two through lanes (one in each direction) are provided in the southern segment.

1.5.3.2 Complete Undergrounding of Utility Lines

As with Phase 1, complete undergrounding of utility lines was considered but eliminated from further consideration due to cost. Preliminary estimates indicate that complete undergrounding of utilities would be $10.5 million (in 2006 dollars), or almost double the cost of the proposed partial undergrounding at $5.9 million. Roughly 5,700 feet of undergrounding would be required. Additional details regarding undergrounding utilities are provided in Section 2.3.3.3 and the electrical engineering report in Appendix C of this EA.

Early public comments included a suggestion to underground utilities regardless of cost. While recognizing the aesthetic benefit and potential avoidance of natural hazard damages that may be achieved by undergrounding utilities, DPW has determined that the additional expenditure of capital funds to achieve complete undergrounding would not be the best use of County funds. It is also anticipated that federal funding would not be available to help cover the additional costs of undergrounding utilities.

1.5.3.3 Alternative Intersection Improvements

Roundabouts have been suggested as an alternative to the traditional signalized intersection. Roundabouts require much more land than a standard intersection and would not fit within the existing ROW, or the additional ROW considered for acquisition for Design Alternative 2.

Greater ROW acquisition, increased impacts to private property, and higher cost than associated with the Build Alternative would result from a roundabout. For these reasons, roundabouts were eliminated from consideration at this time.

In the future, intersections could be evaluated on a case-by-case basis for the possibility of converting them to roundabouts as development along the corridor occurs.

1.5.4 Miscellaneous Design Alternatives

Public comments received during project planning included suggestions for the construction of a raised pedestrian walkway on the mauka side of the roadway and a pre-cast post-tensioned segment on the makai side. This would minimize grading and land acquisition costs, improve pedestrian and bicyclist safety, and provide scenic views.

These suggestions were considered but were rejected due to conflicts with driveways, difficulty in providing pedestrian and disabled access to these elevated walkways, and higher construction costs. Moreover, scenic views along most of the project alignment would be impeded due to existing structures and future developments unless the suggested walkway was constructed much higher than the existing roadway.

1.6 CONSISTENCY WITH GOVERNMENT PLANS, POLICIES, AND CONTROLS

This section discusses whether the No-Build and Build Alternatives are consistent with existing government plans, policies, and controls.

1.6.1 State of Hawai‘i Plans and Controls

1.6.1.1 Hawai‘i State Plan

The Hawai‘i State Plan (June 1991), as codified in Chapter 226 of the Hawai‘i Revised Statutes (HRS), serves as a guide for the future long-range development of the State. It consists of comprehensive goals, objectives, and policies for determining priorities and allocating resources. The State 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 Build Alternatives would support the goals and objectives of the Hawai‘i State Plan dealing with economic, physical, and natural environment, and transportation objectives and policies. The No-Build Alternative would do little to support the goals and objectives of the Hawai‘i State Plan, because it would not provide the transportation improvements needed to facilitate economic development for the region.

In accordance with the Plan’s economic objectives and policies, the Build Alternatives would facilitate commerce through improved transportation service. It would also contribute to the local and State economies by providing largely federally-funded construction jobs. In addition, the project would facilitate commerce without damaging the natural environment. As described in this EA, the proposed project would avoid or mitigate impacts to important historic, physical, and natural resources.

1.6.1.2 Hawai‘i State Land Use Controls

The State Land Use Commission (SLUC), under the authority granted in HRS Chapter 205, regulates land use through classification of State lands into four districts: Urban, Agriculture,

Conservation, and Rural. The intent of the land classification is to accommodate growth and development while retaining the natural and agricultural resources of the State. Each district has specific land use objectives and development constraints.

The area surrounding Kuakini Highway within the project limits is largely classified Urban, except for two disconnected areas on the mauka side of the highway. The proposed configuration of the highway improvements, which would include sidewalks, curbs, and gutters, would be typical of arterial roads within such environments, and, therefore, the Build Alternatives would be consistent with the mostly Urban classification of the study area.

1.6.1.3 Hawai‘i Long-Range Land Transportation Plan

The Hawai‘i Long-Range Land Transportation Plan (May 1998) identifies the major land transportation improvements needed by the year 2020. The long-range plan is currently being updated, but the update is not yet complete. The recommendations of the plan represent those projects needed to support anticipated growth and development on the Island of Hawai‘i. This plan identifies the widening of Kuakini Highway from Hualālai Road to Hawai‘i Belt Road as a needed and cost-feasible improvement. The proposed project from Hualālai Road to the future Ali‘i Highway intersection is a portion of the segment identified in the Plan.

Construction of Ali‘i Highway, including its intersection with Kuakini Highway and Queen Ka‘ahumanu Highway Extension, is also a component of the Hawai‘i Long-Range Land Transportation Plan.

1.6.1.4 Coastal Zone Management

The entire State of Hawai‘i is within the Coastal Zone Management (CZM) area, as federally-defined. The objectives and policies of the Hawai‘i CZM Program are to protect and manage Hawai‘i’s coastal resources. Federally-assisted activities within Hawai‘i’s coastal zone, including the project site, must be consistent with CZM objectives and policies.

The following is a discussion of the project’s Build Alternatives consistency with the objectives and policies of the State’s CZM Program. The Department of Business, Economic Development and Tourism (DBEDT), the agency administering the State’s CZM program, would review a more detailed assessment, to be submitted during final design (see Section 1.8).

<u>Recreation Resources</u>

The Build Alternatives would not adversely affect parks and recreational resources in the project area. Kailua Playground is the only park or recreational resource that has direct access to and from Kuakini Highway. The driveway access into the park would be modified to adjust it to the slope necessary to maintain the existing access. The slope would increase from 17 percent to approximately 18 percent, which is still within federal driveway standards (see Section 2.12). The driveway slope would penetrate further into the park than it currently does but none of the park facilities would be affected by the driveway modifications.

<u>Historic Resources</u>

An archaeological inventory survey (see Appendix E) was conducted to identify historic resources (archaeological, cultural, or historic sites on or eligible for the National Register of Historic Places) that could be affected by the project. In addition, the State Historic Preservation Division (SHPD) and others (see Section 2.11 and 3.2.1) were consulted to ensure that all potential historic properties were identified. NHPA Section 106 requires a good faith effort to identify historic properties that could potentially be affected by the project. The FHWA

determined that none of the historic sites identified would be adversely affected provided avoidance, protection, and/or mitigation measures outlined in this EA are followed. This assessment and the recommended mitigating measures was submitted to the Hawai‘i SHPO who is reviewing the determination. For more information see Section 2.11.

Scenic and Open Space Resources

The Build Alternatives would not block scenic resources (see Section 2.8). Existing mountain and ocean vistas would be unaffected by the project.

Coastal Ecosystems

The elements of the Build Alternatives would not be within the Shoreline Setback Area. Although the Special Management Area (SMA), areas designated to assure that development impacts do not negatively affect coastal environmentally sensitive resources, extends from the current makai edge of the ROW of Kuakini Highway to the shoreline, project elements would largely be constructed mauka of the SMA. Therefore, coastal habitats or ecosystems would not be affected by the project.

Economic Uses

The Build Alternatives would benefit residents, workers and visitors of Kailua-Kona by alleviating roadway congestion on Kuakini Highway, thereby improving the transportation network and improving access to community resources. Project construction would also contribute to the local economy. For further information see Section 2.9.

Coastal Hazards

Kuakini Highway is an infrastructure element for evacuation in the event of a coastal hazard, such as a hurricane or tsunami, as well as volcanic eruptions. The Build Alternatives would provide two additional lanes on Kuakini Highway, increasing evacuation capacity. Otherwise, there would be no change to conditions affected by natural hazards. For further information about natural hazards see Section 2.1.

Managing Development

The Build Alternatives would facilitate local development in areas planned for growth. The Build Alternative would also require State and County permits that include provisions for public participation. These permits are important for the protection of coastal resources.

Public Participation

To date, project planning has included one public information meeting, and a presentation to the Hawai‘i Island Burial Council. Consultations with federal, State and County agencies have also been conducted. For more information see Chapter 3. Additional opportunities for public participation would be afforded after the Draft EA is published.

Beach Protection

The Build Alternatives would not affect coastal erosion because the project site is not adjacent to or abutting the shoreline.

Marine Resources

The Build Alternatives would not have an impact on marine or coastal resources because the project site is not adjacent to or abutting the shoreline. Also see Coastal Ecosystems above.

1.6.2 County of Hawai‘i Plans and Controls

1.6.2.1 Hawai‘i County General Plan

The County of Hawai‘i’s General Plan (February 2005) is the policy document for the long range comprehensive development of the island of Hawai‘i. Its purpose is to guide the pattern of future development on the island; provide the framework for regulatory decisions, capital improvement priorities, acquisition strategies, and other pertinent government programs; and improve the physical environment of the county, among other purposes. In the area of transportation, the following goals were identified:

- Provide a system of roadways for the safe, efficient and comfortable movement of people and goods.
- Provide an integrated State and County transportation system so that new major routes will complement and encourage proposed land policies.

The General Plan’s Land Use Pattern Allocation Guide Map (LUPAG) shows most of the area surrounding Kuakini Highway within the project limits as medium density urban. In terms of transportation, the General Plan does not have specific recommendations for Kuakini Highway, but as described in Section 2.2, the proposed highway improvements under the Build Alternative would be consistent with the medium density land use designation.

1.6.2.2 Kona Community Development Plan

The Mapping Kona’s Future, Kona Community Development Plan (September 2008), adopted by the Hawai‘i County Council in 2008, encompasses the North and South Kona areas. The overall goal of the plan is to develop a mixed residential, commercial, industrial, resort, and recreational community to meet the Kona region’s growing needs. The Development Plan identifies some priority roadway improvements needed to accommodate traffic volumes and transportation goals, objectives, policies, and actions.

Although the proposed project is not specifically named in the transportation element of the plan, the plan does identify Kuakini Highway as a minor collector road. In addition, the plan identifies the construction of the Kahului-Keauhou Parkway (also known as Ali‘i Highway), as a priority arterial highway project. Without increasing the capacity of Kuakini Highway between Hualālai Road and the future Ali‘i Highway intersection, a bottleneck would result within this segment when Ali‘i Highway becomes operational.

1.6.2.3 Master Plan for Kailua-Kona

The Master Plan for Kailua-Kona (April 1994) is a comprehensive plan expressing the opportunities and constraints concerning land development controls, land use options, special design treatment areas, physical design treatment and design criteria guidelines, pedestrian and vehicular circulation patterns, other infrastructure assessments, public and private community facilities, historical and cultural sites, notable natural land forms and water features, views and vistas, and basic concepts of environmental character including architectural and design goals. During the plan development process, public and agency input on alternative engineering

approaches to use patterns and public infrastructure were incorporated. The plan also provides evaluation mechanisms and an implementation timetable.

The Master Plan recommends widening Kuakini Highway to a four-lane facility with improved walkways, bike lanes, and under-grounding of utilities. Phase 1 of this recommendation, the segment between Palani and Hualālai Roads, has been constructed, although the County in consultation with the public opted to underground utilities only partially, as described above. The proposed project would fulfill the next phase of this recommendation with a similar design.

1.7 PROJECT COST AND SCHEDULE

Based on conceptual engineering, the estimated construction cost of the project is $50.2 million (2007 dollars) for Design Alternative 1 and $45.2 million (2007 dollars) for Design Alternative 2. These estimates include landscaping, drainage, highway lighting, traffic control measures, roadway signs and striping, appurtenances, paving, and environmental mitigation costs. Based on customary cost sharing formulas, the County would be responsible for 20 percent of the costs, and FHWA would contribute 80 percent.

The estimated project schedule is as follows:

- Completion of Environmental Planning: late-2013
- Begin Preliminary/Final Engineering and Permitting: early-2014
- Complete Engineering and Permitting: late-2014
- Coordinate with utilities, particularly HELCO: 3-year duration (some overlap with engineering and permitting)
- Advertise/Award Construction Contract: mid-2015
- Start Construction/End Construction: mid-2015 to mid-2017

This project would be constructed in two phases – Phases 2A and 2B. Phase 2A would be the segment between Hualālai Road and just past Coconut Grove Marketplace, where the future Nani Kailua Road extension is proposed to intersect Kuakini Highway. Phase 2B would extend south of Phase 2A to the future Ali‘i Highway intersection. Phase 2B would not be required until Ali‘i Highway is connected to Kuakini Highway. At the time of this writing, the time frame for construction of Ali‘i Highway’s northern segment (Phase II--connecting with Kuakini Highway) is uncertain.

1.8 PERMITS AND APPROVALS

Table 1-1 lists approvals and permits that may be required for the Build Alternative. As noted below, activities to obtain some approvals are ongoing and need to be finalized prior to completion of the environmental review process. Other permits and approvals would be obtained during final design or prior to construction.

It is anticipated that a Section 404 permit from the U.S. Army Corps of Engineers (USACE) under the Clean Water Act (CWA), as amended, would not be needed. Although older topographic maps indicate that water bodies exist along the project alignment, none of these water bodies are in existence today because of extensive development and changes to topography that have occurred. Therefore, no dredging or fill of regulatory “Waters of the U.S.” would occur as a result of this project. Coordination with the USACE is documented in Section 3.2.3 and Appendix A of this EA.

Table 1-1: Permits and Approvals

AGENCY	PERMIT OR APPROVAL
Department of the Army	Section 404 of the Clean Water Act (on-going)
State Historic Preservation Officer	Section 106 of the National Historic Preservation Act (on-going)
U.S. Fish and Wildlife Service	Endangered Species Act Section 7 (informal consultation only; on-going)
Department of Business, Economic Development, and Tourism	Hawai'i Coastal Zone Management Program Consistency concurrence
Department of Health	National Pollutant Discharge Elimination System (NPDES) Permit for storm water discharges relating to construction activities
Department of Health	Water Quality Certification, Section 401 of the Clean Water Act (possible, if Section 404 is triggered)
Department of Health	Noise Permit
Department of Land and Natural Resources	Stream Channel Alteration Permit (possible, if Section 404 is triggered)
Department of Land and Natural Resources, Historic Preservation Division	HRS Chapter 6E-8 Review (on-going in coordination with Section 106)
Planning Department	Special Management Area (SMA) permit, only if Design Alternative 2 is selected
Department of Public Works	Grading, Grubbing, Stockpiling and Excavation permit

CHAPTER 2
AFFECTED ENVIRONMENT, POTENTIAL IMPACTS, AND PROPOSED MITIGATION

This chapter describes existing conditions in the area potentially affected by the project. It also describes immediate and long-term environmental impacts of the proposed action, including construction-phase impacts. Where an impact is considered adverse, measures proposed to avoid, minimize, or mitigate the impact are specified.

In most cases, the two Design Alternatives of the Build Alternative are similar, and are simply identified as the Build Alternative. Where impacts differ between the two Design Alternatives, such differences are specified.

2.1 GEOGRAPHIC SETTING AND HAZARDS

2.1.1 Existing Conditions

2.1.1.1 Geology and Soils

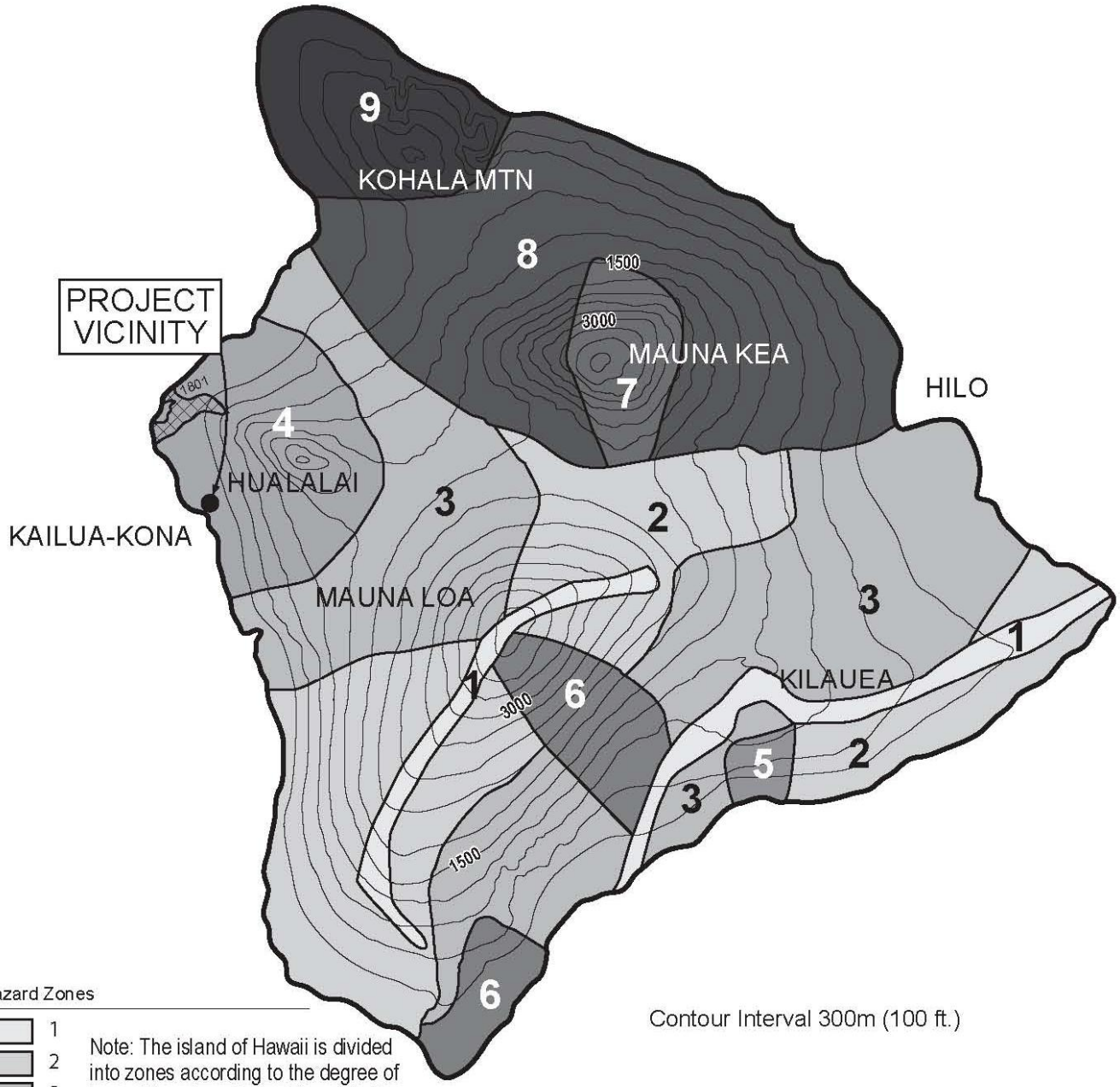
The Island of Hawai‘i, often referred to as the “Big Island,” was formed by the volcanic eruptions of Mauna Kea, Mauna Loa, Kohala, Kilauea, and Hualālai (see Figure 2-1). The project site is near the coastline on the western flank of Hualālai, which rises to an elevation of 8,271 feet above sea level (asl), and lies in between the larger Mauna Kea (13,796 feet asl) and Mauna Loa (13,677 feet asl). Although Hualālai is one of the older volcanoes on the Big Island, its superficial flows are geologically young, and therefore, well-developed drainage channels have not formed along the volcano’s flanks.

The project site is on the western slope of Hualālai, and is characterized by basalt rock formation of the Hualālai Volcanic Series. Most of the near surface geology in the project area appears to be comprised of pahoehoe type lava flow, with some localized coverage of a`a type lava flows.

2.1.1.2 Natural Hazards

Eruptions occurring at Hualālai are much less frequent than the more active Kilauea and Mauna Loa volcanoes. Hualālai last erupted in 1800-1801 from several vents to the north of Kailua-Kona. Since this last eruption was relatively recent on a geologic timescale, a Hualālai eruption is highly probable within the next two centuries. Four types of volcanic eruptions occur on the Big Island: lava flows, tephra, volcanic gases, and pyroclastic surges.

Lava flows are the most common type of eruption on the Big Island. The Hualālai area, which includes the project area, is designated Hazard Zone 4 for lava flows (Zone 9 has the lowest risk, and Zone 1 has the highest risk). However, hazard zone boundaries are imprecise, as evidenced by the fact that only about five percent of Zone 4 in North Kona is covered by fresh lava from Hualālai since 1800 and only about 15 percent of this Zone 4 is covered by lava from Hualālai since 1240 (Volcanic and Seismic Hazards on the Island of Hawai‘i, 1990).



Contour Interval 300m (100 ft.)

Hazard Zones

1
2
3
4
5
6
7
8
9

Note: The island of Hawaii is divided into zones according to the degree of hazard from lava flows: Zone 1 is the areas of the greatest hazard, Zone 9 of the least.

Hazard zone boundaries are approximate and gradational. These boundaries are not specific enough to determine the absolute degree of danger at any particular site. Lava flow hazard maps are designed to show relative hazard across the Island of Hawaii and are meant to be used for general planning purposes only.

Legend

Hualalai Lava Flow of 1801

Source: U.S. Department of the Interior/Geological Survey and the State of Hawaii Office of Planning, November 2001.

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Five Major Volcanoes of Hawaii

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

Figure 2-1

Tephra consists of volcanic ash and coarser fragments produced by fountaining lava and explosive eruptions. Tephra and volcanic gas are generally not considered a serious hazard to Kailua-Kona, although the project area is within Hazard Zone 2 for both types of eruptions (on a scale of 1 to 3, with 1 representing the greatest risk). Pyroclastic surges are not associated with Hualālai.

Volcanic activities, even if there were no eruption, often cause earthquakes from the movement of magma (subsurface molten rock). Such earthquakes occur relatively infrequently at Hualālai in comparison to the more active Kilauea and Mauna Loa. A series of earthquakes associated with Hualālai lasting more than a month occurred in 1929, in addition to a large 6.9 magnitude earthquake caused by a suboceanic tectonic displacement in 1951. Like the rest of the Big Island, Kailua-Kona is designated Zone 4 (the highest risk) for earthquake design in the Uniform Building Code.

Tsunamis are usually generated when the sea floor is deformed abruptly during an earthquake, and can travel hundreds of miles across an ocean. Based on historical records, the areas most vulnerable to tsunamis are Hilo and the North shores of all the islands. The greatest tsunami wave run-up heights along the Kona coast were between 5 to 16 feet, which occurred during the 1960 tsunami that caused extensive damage throughout the Hawaiian Islands. As shown on Figure 2-2, Kuakini Highway is on the eastern (mauka) edge of the tsunami evacuation area.

2.1.1.3 Hazardous Materials

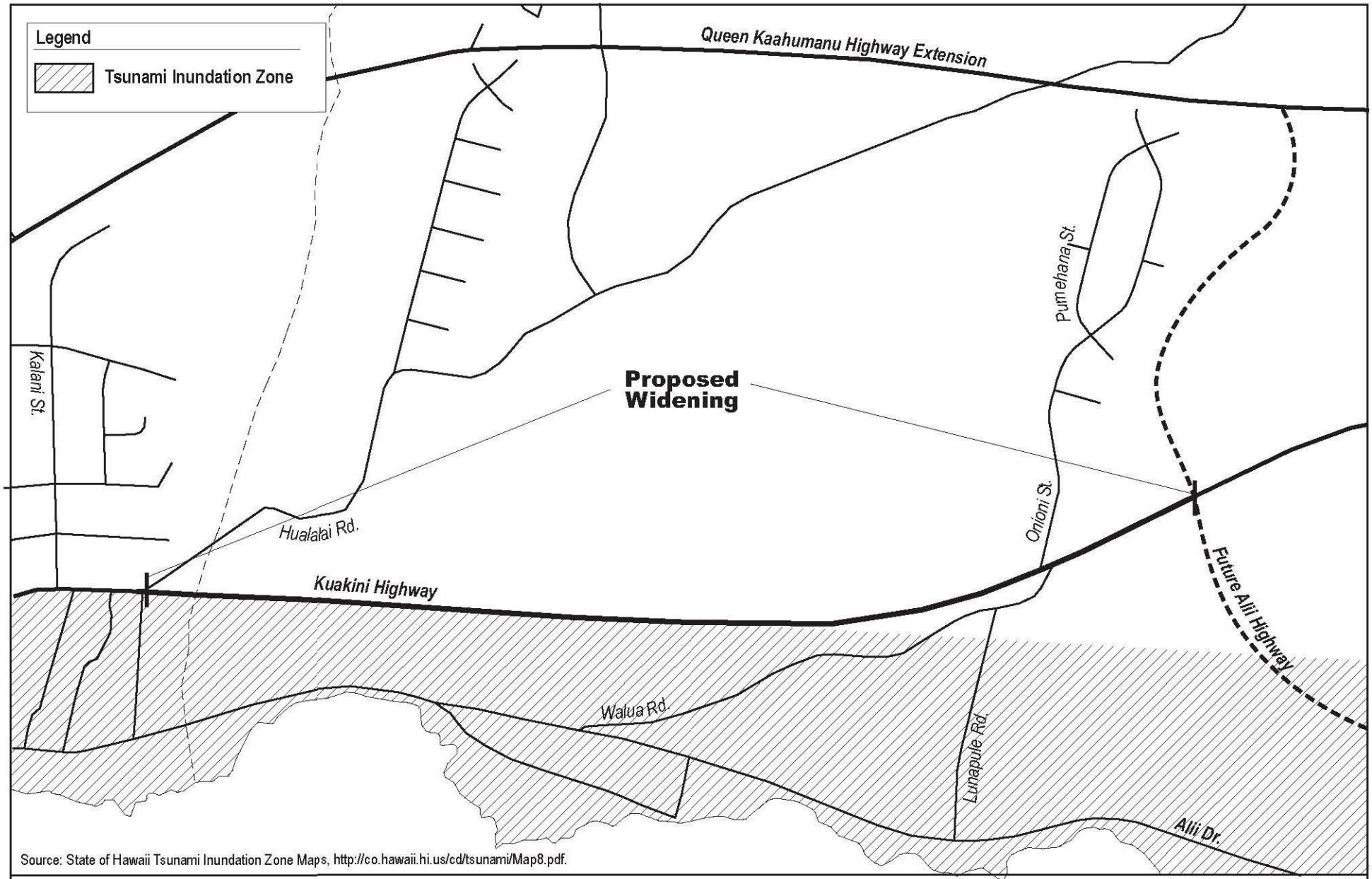
Hazardous materials encountered during highway construction could jeopardize worker safety, delay the project, cause cost overruns, and have other undesirable effects. A database search was conducted in October 2005 (Environmental Data Resources, Inc.), consisting of a review of existing federal and state environmental databases per the American Society for Testing and Materials (ASTM) standards for environmental site assessments (E1527-00) at that time.

The EDR database search identified nine potential hazardous waste sites in the general vicinity of the project site; however, none of these sites were located adjacent to the proposed project corridor. The project area was then surveyed to identify potential contaminant sites not listed in the databases. The intent of the assessment survey was to identify reported and obvious potential hazardous material conditions that would need to be addressed by the project. A definitive determination of the actual presence or absence of contamination has not been made.

Based on a visual assessment of the project corridor during the site reconnaissance, two potential hazardous waste sites which did not appear in the EDR database were identified adjacent to the proposed project alignment as follows:

- Unocal 76 Gas Station, 75-5756 Kuakini Highway – This site is a gas station and auto maintenance facility. Four pump islands and one power generator appeared to be housed on this well-kept site. No outward signs of hazardous materials were noted.
- Mazda/Subaru Dealership, 75-5793 Kuakini Highway – This well-kept site is a car dealership and auto maintenance facility. No outward signs of hazardous materials were noted.

No additional sites were identified during the project area survey.



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Tsunami Evacuation Area

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

Figure 2-2

2.1.2 Potential Impacts

Neither the Build nor No-Build alternatives would affect the geologic conditions of the study area. Because the Build Alternative requires cutting of slopes and building of retaining walls, some topographic changes would occur as part of the project definition. The No-Build Alternative would not result in any changes to the topography.

The Build Alternative could facilitate emergency egress from Kailua-Kona in the case of an evacuation due to a natural hazard, such as volcanic eruption or tsunami. The No-Build Alternative would not meet this project purpose and need.

Hazardous material impacts on the proposed project are not expected. Only edges of the Unocal 76 Gas Station and Mazda/Subaru Dealership properties would be directly affected by the proposed project. Construction would not approach the infrastructure on these properties which are set back from the road. However, during construction, the contractor should be aware that petroleum products are stored in underground tanks in the area and undocumented releases could have occurred. Personnel should be alert for signs of potential petroleum contamination when soil is excavated. If any contaminants are encountered during construction, they would be handled in accordance with applicable Hawai‘i Department of Health (HDOH) requirements. See Section 2.14.5.

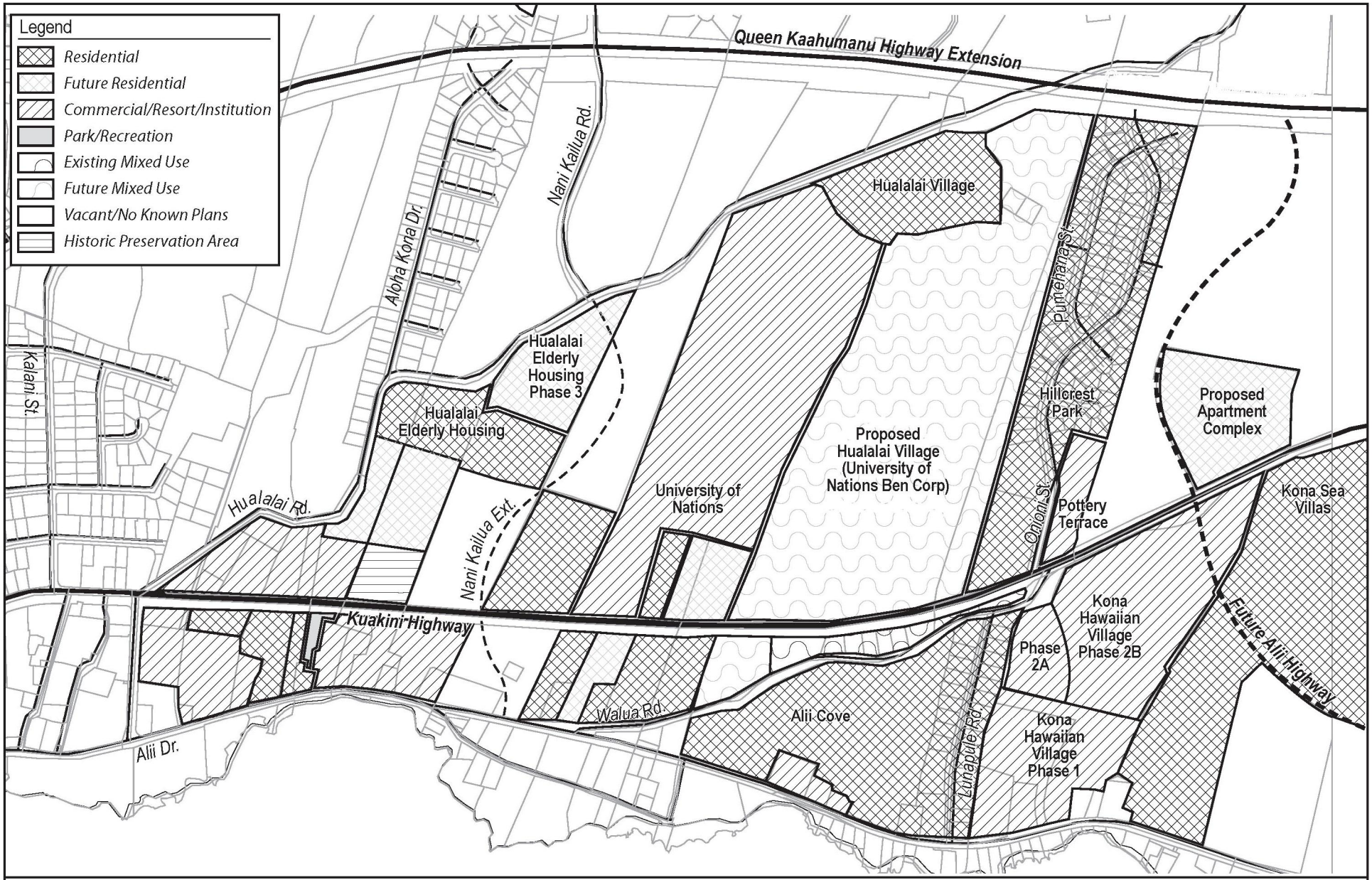
2.2 LAND USE

2.2.1 Existing Conditions

The proposed project is located in the town of Kailua-Kona, West Hawai‘i’s primary and largest urban area. It is also located near historic Kailua Village which is clustered around the northern section of Ali‘i Drive between Palani Road and Kahakai Road. This town center is Kailua-Kona’s primary visitor attraction supporting a few hotels, retail establishments, and restaurants. Cruise ships often dock offshore of the historic section of Kailua Village.

Figure 2-3 shows existing and future land uses along Kuakini Highway. Within the project limits, existing land use transitions from the commercial and urban Kailua Village core to sparsely developed parcels containing mostly of single-family residences and low-density timeshare units. Land uses surrounding the Kuakini Highway/Hualālai Road intersection consist of offices, retail shops, a gasoline service station, an automobile dealership, and an apartment building. Further south, land uses are substantially less dense as they transition to mostly low-density condominiums, single-family residences, and undeveloped parcels.

Major land uses within the project limits include the 45-acre University of the Nations’ Kona campus, the small Pottery Terrace shopping mall, and Kona Hawaiian Village. The University of the Nations is located about 2000 feet south of the Kuakini Highway/Hualālai Road Intersection and includes dormitories and ample open space. The Pottery Terrace shopping center is located close to the southern project terminus at the intersection of Kuakini Highway and Onioni Street/Walua Street. Kona Hawaiian Village is a timeshare resort located on a 33-acre parcel between Kuakini Highway and Ali‘i Drive consisting of 270 medium density bungalow-type apartments and recreational amenities.



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Existing and Future Land Uses Adjacent to Kuakini Highway

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

Figure 2-3

Current County of Hawai‘i zoning districts along the project alignment include Open, Residential, Agricultural, and Commercial. The County of Hawai‘i General Plan designates most of the area as medium density urban, with some area designated resort node at the northern makai end of the project area. The State Land Use District classification system shows the area as Urban and Agricultural. The project area is rapidly-developing, and rezoning actions are anticipated to bring zoning into conformance with the General Plan.

2.2.2 Land Use Development Trends

According to the County of Hawai‘i’s Land Use Pattern Allocation Guide Map (LUPAG) (General Plan, February 2005), most of the area surrounding Kuakini Highway within the project limits area is designated for medium density urban land uses, which would include village or neighborhood types of commercial establishments and single or multiple family residences up to 35 units per acre.

Some of the parcels on the makai side of Kuakini Highway are designated “resort node” by the LUPAG, which would allow ”a mix of visitor-related uses such as hotels, condominium-hotels, single family and multiple family residential units, golf courses and other typical resort recreational facilities, resort commercial complexes and other support services.” At the southern end of the project limits on the mauka side of Kuakini Highway, the LUPAG designates these parcels for urban expansion, which means that these parcels may allow “for a mix of high density, medium density, low density, industrial, industrial-commercial and/or open designations” if new settlements are “desirable, but where the specific settlement pattern and mix of uses have not yet been determined.”

Specific development projects in the corridor include Kona Sea Villas, Hualālai Village, and an apartment complex south of Pottery Terrace (see Figure 2-3). In addition, the Kailua Village Business Improvement District, formed in early 2006, has established a business improvement district to enhance and restore economic vitality in downtown Kailua-Kona. Clear boundaries of this business improvement district have been established as of October 2007.

2.2.3 Potential Impacts

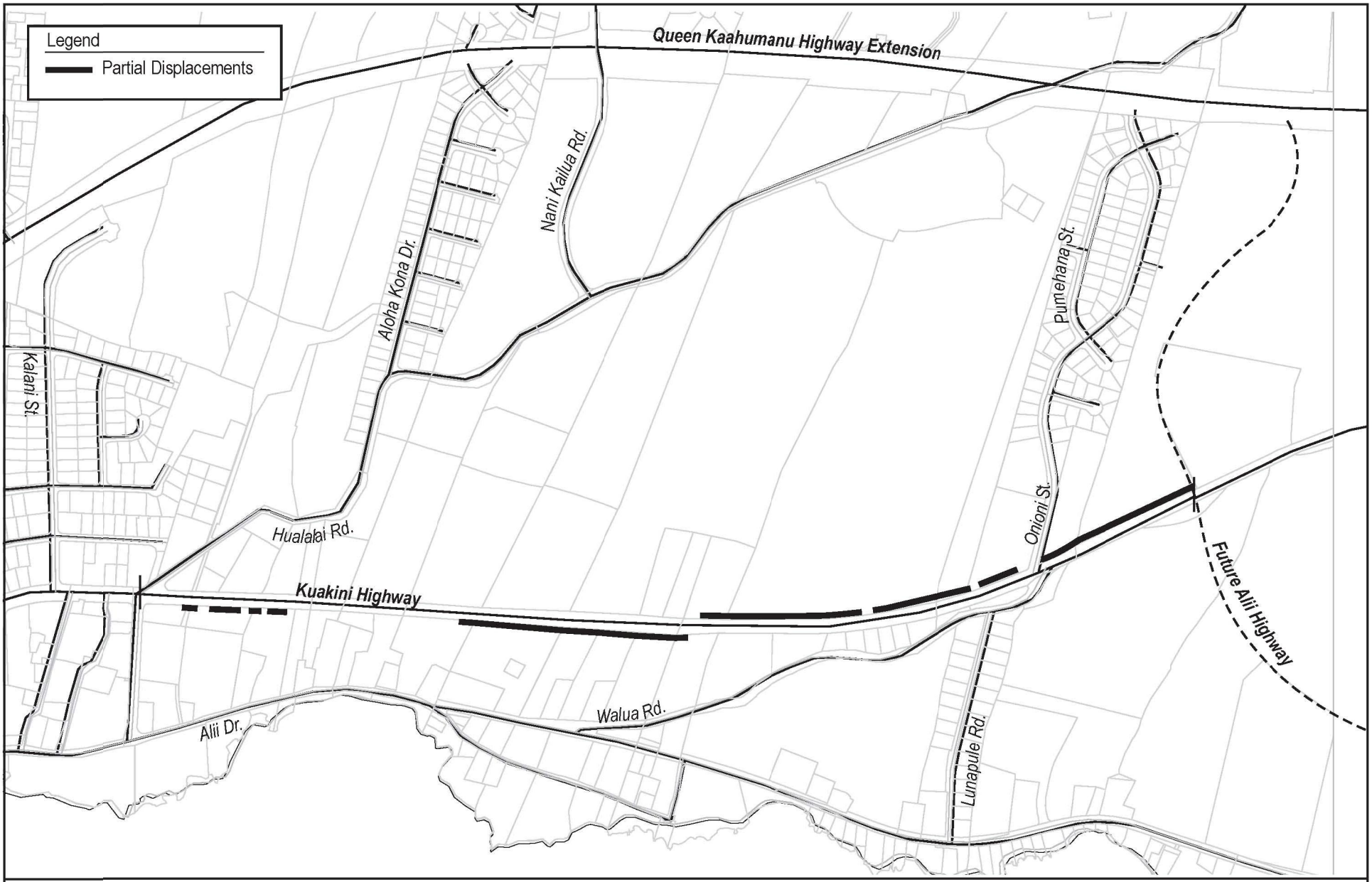
2.2.3.1 Displacements

No displacement impacts would occur under the No-Build Alternative.

Under the Build Alternative, no homes or other buildings would need to be relocated. However, the edge of Kuakini Highway would be closer to homes and businesses fronting the highway.

Under Design Alternative 1, no ROW acquisitions are anticipated. Design Alternative 2 would require ROW acquisition, as shown in Table 2-1 and Figure 2-4. Nine parcels on the makai side and four parcels on the mauka side would be affected. None of these land acquisitions are considered sufficiently large or disruptive to require relocation of the existing land uses on the affected parcels.

Although access from abutting properties to Kuakini Highway would be maintained, it may be restricted to one location as necessary to provide the proposed improvements and/or turning movements may be restricted. In addition, short-term disruptions during construction would occur. The contractor would coordinate all such work with property owners and occupants. See Section 2.14.1 for additional details.



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Partial Acquisitions Under Design Alternative 2

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

Figure 2-4

Regardless of the Design Alternative selected, almost all of the total 24 abutting properties on the makai side of the road and 19 properties on the mauka side could have up to about ten feet of the front of their property temporarily affected by construction as shown in Figure 1-4, Figure 1-5, and Figure 1-6. Temporary construction easements would be necessary.

Table 2-1: Partial Acquisitions under Design Alternative 2

TMK	Owner of Record	ROW Acquisition Sq. Ft.	Total TMK Area (sq. ft.)	% of TMK Acquired for ROW
Makai Properties				
7-5-08:014	Mid Pac Petroleum LLC	162	24401	1%
7-5-08:016	Kailua Village	1689	45994	4%
7-5-08:003	Icthus Land Company	553	102486	1%
7-5-09:025	LBUBS 2007-C2 Ali‘i Drive LLC	167	130419	0%
7-5-09:021	BP Bishop Trust Estate, JYZ Partners	3959	187831	2%
7-5-09:010	The Kona Billfisher	983	83163	1%
7-5-09:040	GRS Oasis Corp.	1367	97487	1%
7-5-06:003	County of Hawai‘i	937	124256	1%
7-5-18:012	Kona Mansions V	83	107666	0%
Mauka Properties				
7-5-18:028	Wilson, Beverly; Wilson, Larry	757	118884	1%
7-5-10:085	Ka Ohana Waiaha	1612	2465017	0%
7-5-30:024	GLACS LLC	2265	131072	2%
7-5-17:038	Stanley, Tomono	1598	295642	0%

Source: Ownership based on County tax records available on-line.

See Section 2.3.3 for a discussion of on-street parking displacements.

2.2.3.2 Land Use Trends

The project would support the recent and forecast land use changes in Kailua-Kona. Per the General Plan and other planning documents, properties in this part of Kailua-Kona are becoming more urbanized. As demonstrated in Section 1.6, the proposed project and surrounding development projects are consistent with government plans along Kuakini Highway. The proposed project would not change these land use trends, and in conjunction with other planned transportation projects, they would facilitate development and alleviate corresponding traffic congestion. See also Section 2.15 for a discussion of possible secondary and cumulative land use impacts.

2.2.4 Mitigation Measures

The County would contact the affected property owners and follow established federal guidelines regarding compensation for property acquisition. Owners of properties affected by ROW acquisition, identified in Table 2-1, would be compensated according to requirements of the federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended.

Private landscaping affected by the project would be replaced in like kind to the extent possible. Such landscaping mitigation would be addressed in detail in a landscaping plan that would be prepared during the design phase. Affected property owners and/or occupants would be consulted on the portions of the landscaping plan affecting their properties.

Prior to the start of construction, the contractor would coordinate with owners and occupants of properties affected by driveway re-construction to ensure that access is provided at almost all times.

2.3 PUBLIC FACILITIES

2.3.1 Roadways and Traffic

A Corridor Transportation Study was performed for this project and is presented in Appendix D. The following sections summarize study methods and findings.

2.3.1.1 Existing Conditions

Figure 2-5 shows the Kailua-Kona roadway network. The major north-south arterial roads in Kailua-Kona consist of the Queen Ka‘ahumanu Highway (including Queen Ka‘ahumanu Highway Extension), Kuakini Highway, and Ali‘i Drive. These existing north-south roadways are discussed in more detail in the subsections below. The planned Ali‘i Highway has not been completed but would be a mostly north-south facility between Queen Ka‘ahumanu Highway Extension and Ali‘i Drive. It would curve eastward to intersect with Kuakini Highway at the southern extent of the proposed project, and continue eastward (mauka) from there to intersect Queen Ka‘ahumanu Highway Extension.

Few east-west (mauka-makai) connections exist. They primarily consist of Palani Road and Henry Street to the north of the project corridor. Hualālai Road at the northern terminus of the proposed project connects Kuakini Highway and Queen Ka‘ahumanu Highway Extension. The County plans to extend Nani Kailua Road, which currently ends at Hualālai Road, so that it would cross Kuakini Highway and meet Ali‘i Drive. Smaller roads such as Walua Road and Lunapele Road connect Kuakini Highway with Ali‘i Drive.

The Island of Hawai‘i is served by the “Hele-On” Bus service, which includes daily routes to and from Kailua-Kona from as far away as Hilo.

Kuakini Highway

Kuakini Highway is an undivided two-lane arterial roadway that extends from Kailua-Kona to Honalo. The segment from Makala Boulevard in Kailua-Kona to Queen Ka‘ahumanu Highway Extension to the south is under County of Hawai‘i jurisdiction; south of that it is part of State Route 11. Within the project area Kuakini Highway has limited pedestrian or bicycle facilities, curbs, and gutters. Cross streets in the project area include Hualālai Road (signalized) and Walua Road/Onioni Street (two-way stop). In the northern segment of the project area the speed limit on Kuakini Highway is 25 miles per hour (MPH) but increases to 35 MPH south of the Kona Islander and further increases to 45 MPH south of the Walua Road/Onioni Street intersection.

The study performed for this project indicates that the signalized intersection of Kuakini Highway and Hualālai Road operates at a level of service (LOS) of C at peak times. This LOS indicates average traffic delays. The Walua Road/Onioni Street intersection operates at a LOS of A for all movements on Kuakini Highway and right turns off either Walua Road or Onioni Street; for vehicles crossing or turning left from Walua Road or Onioni Street there was an average delay corresponding to a LOS of C.

In the morning the peak direction of travel was northbound but in the afternoon it was southbound. This directional flow pattern corresponds to work and shopping trips between

primarily residential development to the south of the project area and industrial and commercial development to the north. Approximately 500 vehicles travel along the northern portion of the project area during peak hours; approximately 250 vehicles travel along the southern portion of the project area during peak hours. The difference is due to the dispersion of vehicles, particularly at Walua Road and developments like Coconut Grove Marketplace, in the northern portion of the project area.

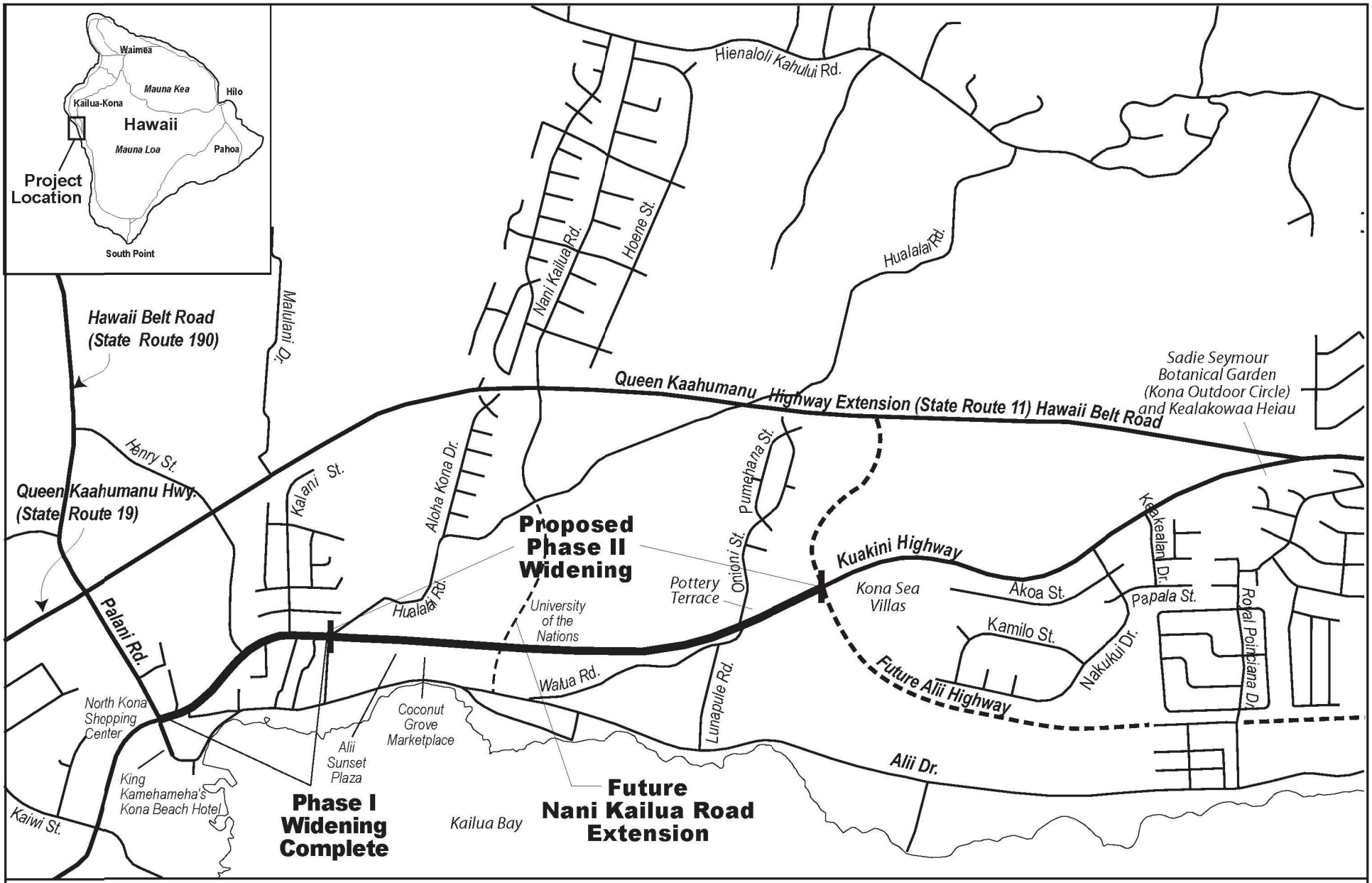
Figure 2-6 provides a schematic illustrating the current lane configurations at the intersections of Kuakini Highway with Hualālai Road and Onioni Street/Walua Road. Figure 2-7 illustrates existing peak hour traffic volumes in the study area in August 2005. Table 2-2 below summarizes the information collected in August 2005 at the intersections within the project area.

Table 2-2: Existing Intersection Information

Intersection	# Lanes	AM Peak			Midday Peak			PM Peak		
		LOS	Delay	V/Hr	LOS	Delay	V/Hr	LOS	Delay	V/Hr
Hualālai Road/Kuakini Highway (signalized)										
Overall	-	C	21.2		C	20.7		B	19.9	
Hualālai EB left	1	B	18.3	144	B	17.5	157	B	18.6	153
Hualālai EB through	1	B	16.1	38	B	15.9	71	B	16.7	66
Hualālai EB right		B	16.1	29	B	15.9	33	B	16.7	46
Hualālai WB left	1	C	26.7	60	C	27.8	61	C	33.3	83
Hualālai WB through		C	34.4	89	C	33.4	84	C	26.9	99
Hualālai WB right	1	C	34.4	112	C	33.4	92	C	26.9	117
Kuakini NB left	1	B	10.5	62	B	11.2	44	B	11.7	46
Kuakini NB through	1	C	20.2	323	B	19.4	314	B	16.7	379
Kuakini NB right		C	20.2	85	B	19.4	102	B	16.7	85
Kuakini SB left	1	B	10.4	97	B	11.0	98	B	10.3	75
Kuakini SB through	1	C	21.7	286	C	22.2	335	C	21.2	437
Kuakini SB right		B	19.7	149	B	19.4	179	B	16.5	187
Onioni Street/Walua Road/Kuakini Highway (two-way stop)										
Walua EB left	1	C	25.0	137	C	20.8	98	C	20.6	84
Walua EB through		C	25.0	7	C	20.8	13	C	20.6	15
Walua EB right	1	A	9.3	48	A	9.7	54	A	9.8	55
Onioni WB left	1	C	15.6	8	C	16.1	4	C	17.4	11
Onioni WB through		C	15.6	13	C	16.1	5	C	17.4	4
Onioni WB right		A	9.7	53	A	9.3	15	A	9.4	45
Kuakini NB left	1	A	7.7	74	A	7.9	98	A	7.9	84
Kuakini NB through		A	7.7	191	A	7.9	176	A	7.9	160
Kuakini NB right		A	7.7	12	A	7.9	5	A	7.9	17
Kuakini SB left	1	A	7.7	25	A	7.9	4	A	7.9	11
Kuakini SB through		A	7.7	145	A	7.9	191	A	7.9	206
Kuakini SB right	1	A	7.7	109	A	7.9	100	A	7.9	159

Source: PB, 2006

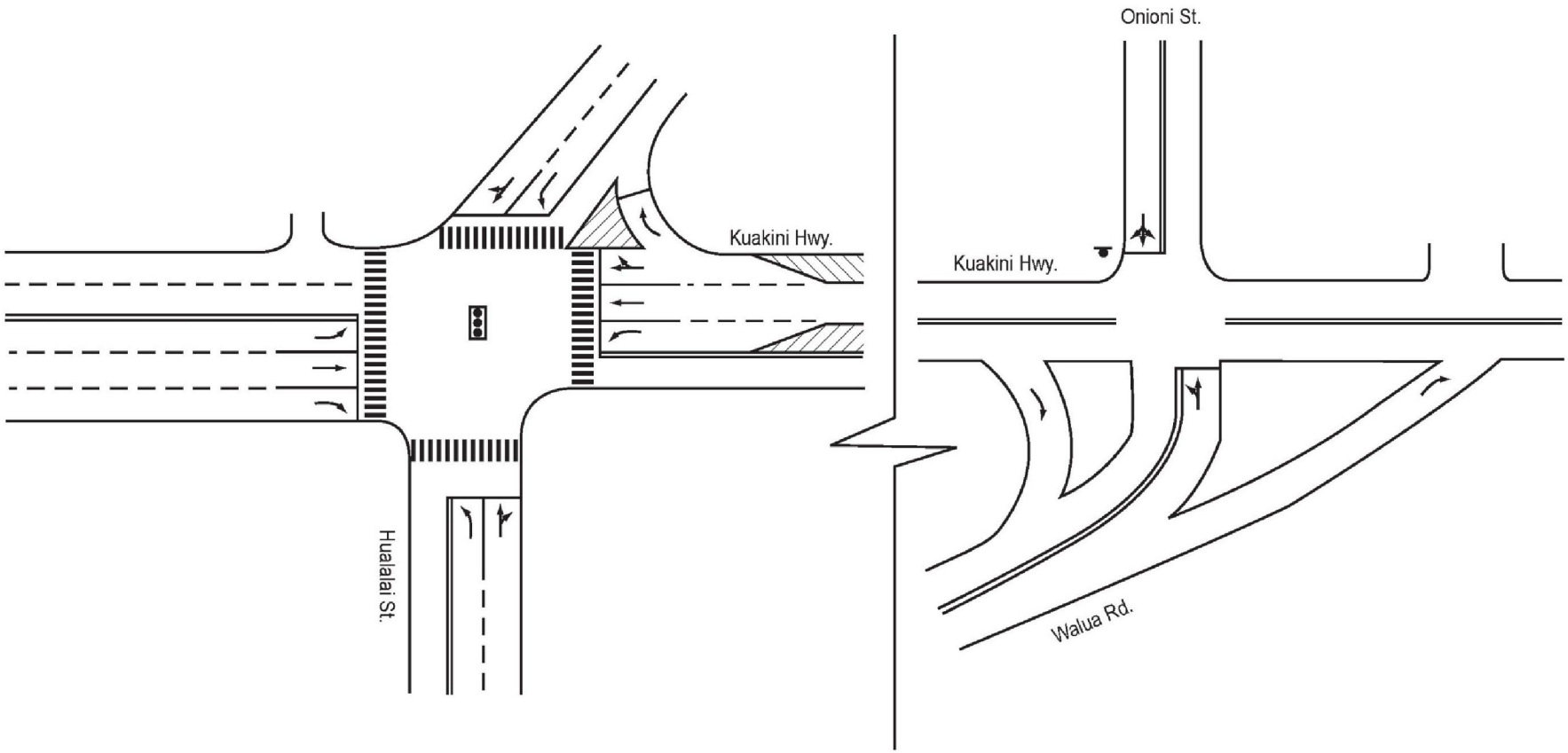
Notes: LOS = Level of service; Delay in vehicles per hour; V/Hr = vehicles per hour at peak (August 2005).
SB = south-bound; NB = north-bound; EB = east-bound; WB = west-bound.



Kailua-Kona Roadway System

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

Figure 2-5

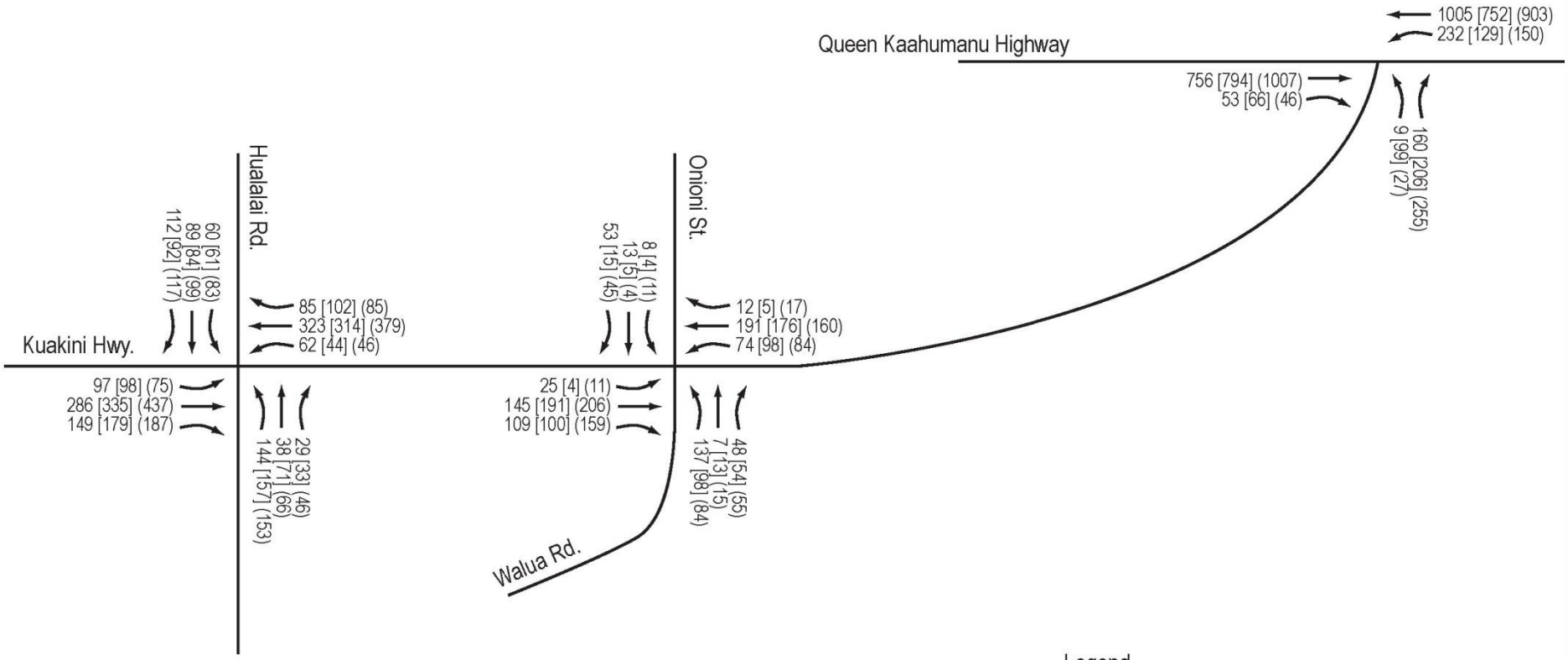


N NTS

Existing Lane Configurations - Hualalai Road and Onioni Street/Walua Road

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

Figure 2-6



Legend

XXX - AM Peak Hour Traffic Volumes
[XXX] - Midday Peak Hour Traffic Volumes
(XXX) - PM Peak Hour Traffic Volumes

Existing Peak Hour Traffic Volumes

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

Figure 2-7

Queen Ka‘ahumanu Highway

State Routes 19 (north of Kailua-Kona) and 11 (south of Kailua-Kona) form the principal north-south route on the west side of the Big Island, connecting Kailua-Kona to the rest of the island. The highway ranges from an undivided two-lane arterial roadway south of Malulani Drive to a 4-lane divided arterial roadway north of Palani Road. It is known as Queen Ka‘ahumanu Highway from Kawaihae (32 miles north of Kailua-Kona) to Palani Road in Kailua-Kona. From Palani Road southward it is known as Queen Ka‘ahumanu Highway Extension to a point approximately 2.5 miles south of Kailua-Kona, where it merges with County-owned Kuakini Highway and inherits the name Kuakini Highway. It merges with Kuakini Highway roughly 1.2 miles south of the project terminus. South of Palani Street in Kailua-Kona this highway is also known as the Hawai‘i Belt Road. South of Honalo, where Kuakini Highway ends, the highway is known as Māmalahoa Highway and the Hawai‘i Belt Road. It is under the jurisdiction of the State of Hawai‘i. The State is in the process of widening segments of the highway north of Kailua-Kona. Queen Ka‘ahumanu Highway Extension, adjacent to the project area, carries more than twice the volume of traffic as Kuakini Highway and has a posted speed limit of 45 MPH.

Ali‘i Drive

Ali‘i Drive is a two-lane collector roadway near the coast line that begins at Kuakini Highway in Kailua-Kona and continues south to Keauhou (roughly five miles to the south). Ali‘i Drive provides north-south circulation as well as access to many resort businesses and lodging. The speed limit on Ali‘i Drive is 30 MPH.

Overall Travel Patterns

Kailua-Kona town, just north of the project terminus, is the primary commercial area on the west side of the Big Island. The area north of downtown Kailua-Kona has also developed as big-box commercial and light industrial area. Further to the north is the airport and large resort developments. These commercial, industrial, and resort developments are the principal trip-generators in the area.

Of the north-south roads in the project area, Queen Ka‘ahumanu Highway is the principal route for vehicles to approach Kailua-Kona’s commercial area or pass by it on the way to and from points north or south, such as the airport and resorts. Kuakini Highway in the project area appears to be primarily used by nearby residents to get to or from the Kailua-Kona commercial area. However, nearly a third of the vehicles on Kuakini Highway enter/exit from Queen Ka‘ahumanu Highway Extension. This indicates it is used as an alternative to Queen Ka‘ahumanu Highway Extension to enter Kailua-Kona from the south, when traffic volumes are high. Ali‘i Drive is primarily used by local ocean-front residential and resort residents to access Kailua-Kona’s commercial area.

Of the mauka-makai routes in the project area Hualālai Road is the most heavily traveled. Hualālai Road is used to access businesses in the Kailua-Kona downtown area as well as travel between Ali‘i Drive and Queen Ka‘ahumanu Highway Extension. The volume of traffic on Walua Road between Kuakini Highway and Ali‘i Drive is similar to the volume on Hualālai Road. The bulk of those vehicles are going to or coming from the Kailua-Kona commercial center. It appears residents near the coast use Lunapele Road and Walua Road to access Kuakini Highway. They also use it as an entrance to Kailua-Kona rather than Ali‘i Drive, which tends to be more congested at peak hours.

2.3.1.2 Potential Impacts

The proposed project would improve traffic on Kuakini Highway and the immediate area. Other than the proposed project discussed in this document, the County and State have other planned transportation improvements for the area that would improve traffic in the Kailua-Kona area. Other projects already planned or in the planning stages include Ali‘i Highway at the southern terminus of the proposed project and extending further south, widening Queen Ka‘ahumanu Highway Extension and State-owned Kuakini Highway (route 11), and the extension of Nani Kailua Road from its current terminus at Hualālai Road to Ali‘i Drive. The proposed project is designed to work in concert with these other projects, particularly the Ali‘i Highway project, to improve traffic conditions in and around Kailua-Kona.

This project would provide a number of improvements to traffic conditions on Kuakini Highway. As development in the vicinity continues to occur, demand for transportation is expected to significantly increase. Travel demand on Kuakini Highway for the year 2020 was modeled to evaluate the impacts of the No-Build and Build alternatives. The modeling results are summarized in Table 2-3 and Figure 2-8; the results indicate that there would be a 100 to 200 percent increase in the volume of vehicles on Kuakini Highway between 2005 and 2020. For example, in 2005 there were approximately 280 northbound vehicles per hour on Kuakini Highway between Queen Ka‘ahumanu Highway Extension and Onioni Street during the AM peak. In 2020 it is estimated that there would be 888 northbound vehicles per hour on Kuakini Highway between Ali‘i Highway and Onioni Street during the same peak hour. The following sections describe the roadway and traffic impacts of the No-Build alternative and Build alternative. For the purposes of this discussion the two build alternatives are identical in their impacts.

<u>No-Build</u>

Under the No-Build alternative Kuakini Highway would not be widened to four lanes in the project area. However, it is assumed that between now and the year 2020 some intersection improvements, such as additional turn lanes and signalization, would be made to try and respond to demand without widening the entire length of the highway. Even with significant intersection improvements, there would be significant delays at all intersections along Kuakini Highway greater than current conditions. For example, intersection performance would range from LOS C and D at the Hualālai Road intersection with Kuakini Highway to LOS F at the Onioni Street/Walua Road and Ali‘i Highway intersections with Kuakini Highway. LOS F indicates demand exceeds capacity, resulting in extreme traffic delays with queuing that may cause severe congestion and impact nearby intersections.

The LOS and congestion on Kuakini Highway in 2020 at peak periods would result in vehicles seeking alternative routes into Kailua-Kona, even if they were out of the way. That would result in additional pressure on parallel routes. The related delays and congestion would also slow public transportation buses and lower their level of service. Therefore, the No-Build alternative would not address regional transportation needs.

<u>Build</u>

The demand for sub-regional and regional transportation mobility expected by 2020 would be met by widening Kuakini Highway to two lanes in each direction, with turn lanes at intersections, and building Ali‘i Highway at the southern project terminus. Even with the widening and improvements to Kuakini Highway and Ali‘i Highway, there would be long traffic delays for some by 2020. Overall LOS conditions along the widened Kuakini Highway would be C or D. No adverse impacts to the existing bus service are anticipated. The improvement in the roadway

network resulting from project implementation would improve bus travel times compared to the No Build alternative.

Overall, the proposed widening would improve north-south mobility within the Kailua-Kona-Keauhou roadway network by (a) providing better system redundancy to Queen Ka‘ahumanu Highway Extension, and (b) facilitating connectivity with the future Ali‘i Highway. The widening would also help to accommodate future modifications to the roadway network such as the proposed Nani Kailua Road extension. The widening would put some pressure on cross streets and adjoining streets that would need to be mitigated by intersection modifications. The modified intersections are illustrated in Figure 2-9 (Hualālai Road), Figure 2-10 (Onioni Street/Walua Road), and Figure 2-11 (Ali‘i Highway).

The widening should not promote the use of Kuakini Highway as a through street to destinations north of the commercial district of Kailua-Kona because the number of signalized intersections and corresponding delays would be greater than delays on Queen Ka‘ahumanu Highway Extension, particularly if Queen Ka‘ahumanu Highway Extension is widened as planned.

The portion of Kuakini Highway between future Ali‘i Highway and Queen Ka‘ahumanu Highway Extension would remain a two-lane facility. Based on modeling done during this study, traffic on this southern stretch of County-owned Kuakini Highway would remain similar to its condition today with LOS of A to C at intersections with Keakealani Drive and Queen Ka‘ahumanu Highway Extension.

2.3.1.3 Mitigation Measures

No-Build

If the entire length of Kuakini Highway was not widened, it is assumed that significant intersection improvements would be made to try and respond to the increasing transportation demand. Improvements would likely include adding turn lanes and signals at intersections.

Build

If Kuakini Highway is widened as proposed in the Build alternative, nearby facilities would experience some pressure. Modifications to those facilities would be appropriate to create the best environment for traffic flow. Proposed modifications include:

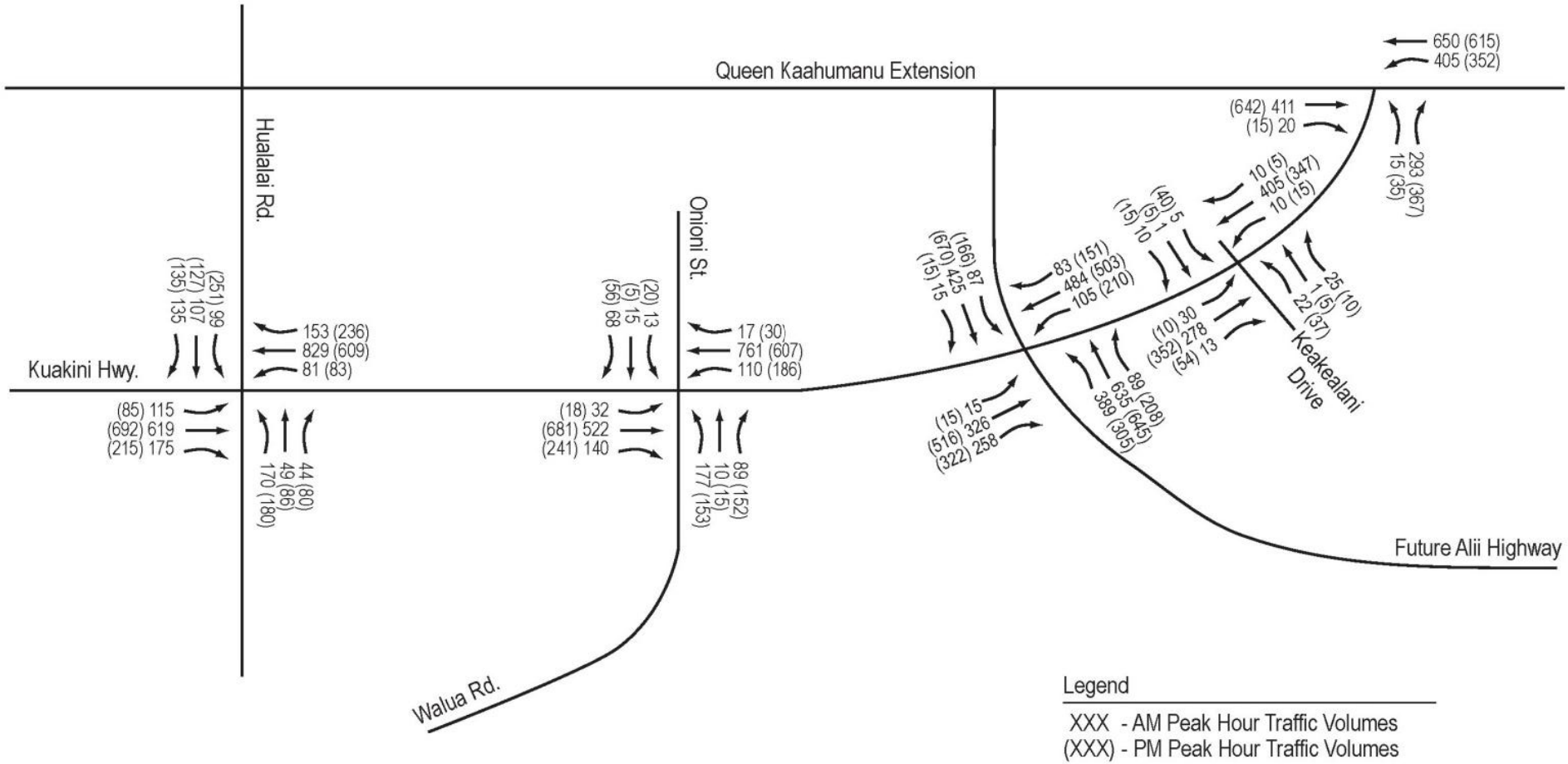
- At the intersection of Kuakini Highway and Hualālai Road, provide two southbound through lanes on Kuakini Highway just north of the project limits. The right lane would also provide for right turn movements. Currently there is a left turn lane, a through lane, and a right turn lane.
- Construct future Ali‘i Highway to four lanes between Queen Ka‘ahumanu Highway Extension and the mauka-makai road connecting Ali‘i Highway and Ali‘i Drive (Royal Poinciana Drive). This is consistent with the Hawai‘i Long Range Land Transportation Plan (May 1998) and would improve intersection performance from a LOS F condition to a LOS D condition (Table 2-3).

Table 2-3: Year 2020 Intersection Information

Intersection	# Lanes		AM Peak					PM Peak				
	No-Build	Build	No-Build		Build		2020 V/Hr	No-Build		Build		2020 V/Hr
			LOS	Delay	LOS	Delay		LOS	Delay	LOS	Delay	
Hualālai Road/Kuakini Highway (signalized)												
Overall	-		C	35.0	C	35.0		D	51.7	C	34.0	
Hualālai EB left	1	1	C	34.4	C	34.4	170	D	37.0	D	37.0	180
Hualālai EB through	1	1	C	34.4	C	34.4	49	C	33.0	C	33.0	86
Hualālai EB right			C	34.4	C	34.4	44	C	33.0	C	33.0	80
Hualālai WB left	1	1	C	24.4	C	24.4	99	D	38.6	D	38.6	251
Hualālai WB through			D	48.2	D	48.2	107	D	39.4	D	39.4	127
Hualālai WB right	1	1	D	48.2	D	48.2	135	D	39.4	D	39.4	135
Kuakini NB left	1	1	D	42.0	D	42.0	81	D	41.0	D	41.0	83
Kuakini NB through	*2*	2	C	28.8	C	28.8	829	C	30.7	C	30.7	609
Kuakini NB right	*1w/t*	1w/t	C	28.8	C	28.8	153	C	30.7	C	30.7	236
Kuakini SB left	1	1	D	45.9	D	45.9	115	D	41.0	D	41.0	85
Kuakini SB through	*1*	2	D	42.6	C	25.0	619	F	105.9	C	32.7	692
Kuakini SB right	*1*	1w/t	D	20.7	C	25.0	175	C	24.5	C	32.7	215
Onioni Street/Walua Road/Kuakini Highway (signalized)												
Overall			E	60.8	C	24.8		F	120.6	C	30.8	
Walua EB left	1	1	C	33.0	C	33.0	177	C	24.6	C	24.6	153
Walua EB through			C	33.0	C	33.0	10	C	24.6	C	24.6	15
Walua EB right	1	1	B	13.4	B	13.4	89	C	23.9	C	23.9	152
Onioni WB left	1	1	D	45.9	D	45.9	13	D	36.3	D	36.3	20
Onioni WB through			D	45.9	D	45.9	15	D	36.3	D	36.3	5
Onioni WB right			C	25.1	C	25.1	68	D	37.2	D	37.2	56
Kuakini NB left	*1*	1	D	35.8	D	35.8	110	D	38.4	D	38.4	186
Kuakini NB through	*1*	2	F	109.0	C	24.4	761	F	161.3	C	28.6	607
Kuakini NB right		1w/t	F	109.0	C	24.4	17	F	161.3	C	28.6	30
Kuakini SB left	*1*	1	C	33.6	C	33.6	32	C	32.4	C	32.4	18
Kuakini SB through	*1*	2	C	30.5	C	21.6	522	F	194.5	C	33.0	681
Kuakini SB right	1	1w/t	C	20.1	C	20.1	140	C	30.7	C	30.7	241
Ali‘i Highway/Kuakini Highway (signalized)												
Overall			F	176.1	D	40.2		F	119.7	D	49.6	
Ali‘i EB left	1	2	F	282.1	D	46.7	389	F	265.1	D	48.4	305
Ali‘i EB through	1	2	F	436.1	E	67.0	635	F	408.0	E	59.0	645
Ali‘i EB right	1	1	B	19.9	B	19.9	89	B	19.9	B	19.9	208
Ali‘i WB left	1	1	D	38.0	D	38.0	87	E	57.9	E	57.9	166
Ali‘i WB through	1	2	F	169.4	D	38.9	425	F	438.1	E	66.7	670
Ali‘i WB right	1	1	B	18.8	B	18.8	15	B	17.0	B	17.0	15
Kuakini NB left	*1*	1	D	40.9	D	40.9	105	E	55.9	E	55.9	210
Kuakini NB through	1	2	E	58.7	C	29.1	484	E	67.4	C	29.4	503
Kuakini NB right	*1*	1	B	12.8	B	12.8	83	B	15.2	B	15.2	151
Kuakini SB left	*1*	1	D	37.4	D	37.4	15	D	35.7	D	35.7	15
Kuakini SB through	1	1	C	32.6	C	32.5	326	E	74.0	E	74.0	516
Kuakini SB right	*1*	1	B	14.9	B	14.9	258	B	17.8	B	17.8	322

Source: PB, 2006

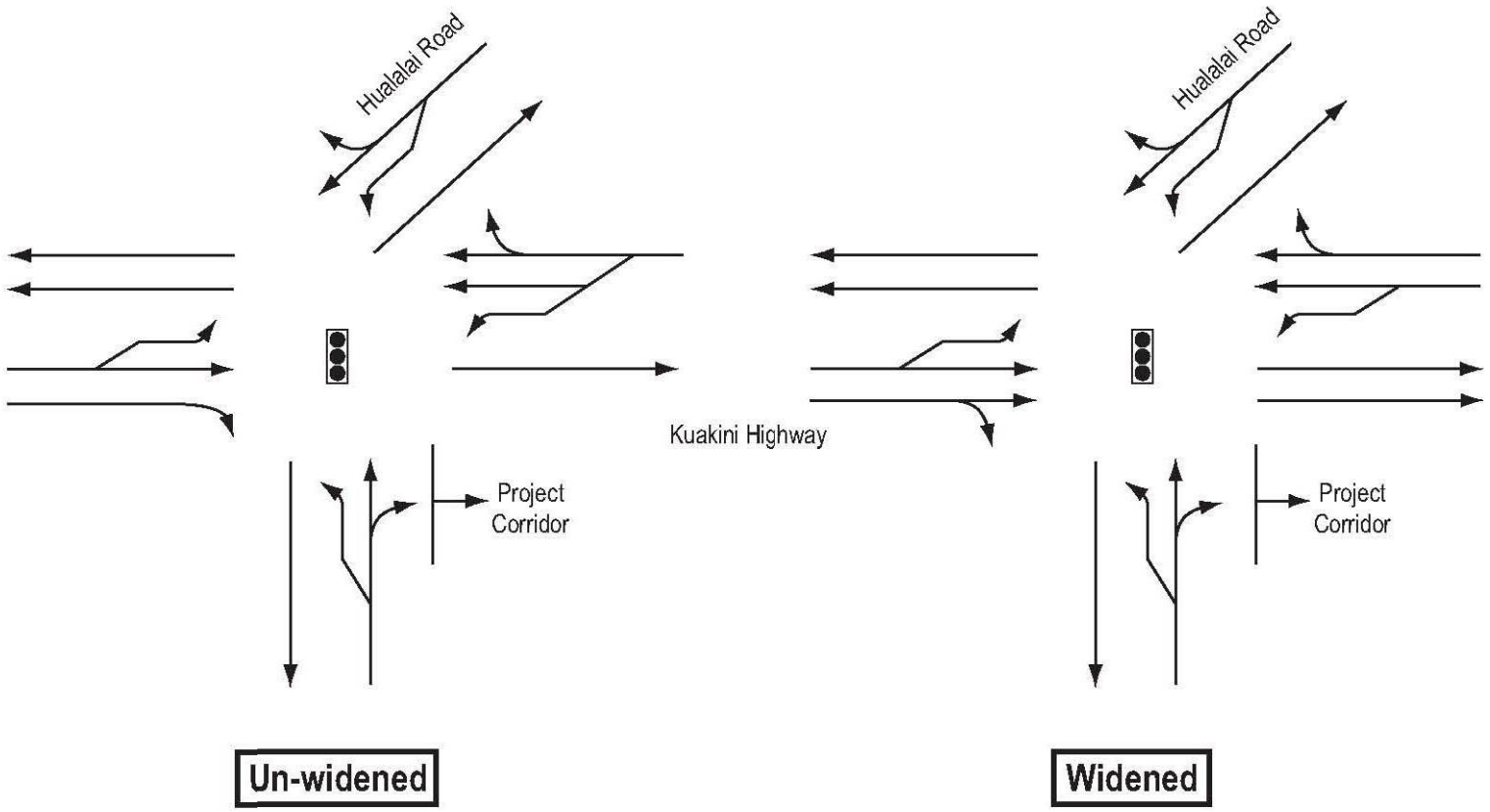
Notes: LOS = Level of service; Delay in vehicles per hour; V/Hr = vehicles per hour at peak.
SB = south-bound; NB = north-bound; EB = east-bound; WB = west-bound.
Shading = areas of improvement between No-Build and Build.
Italic = indicates No-Build assumes TSM intersection channelization improvements to increase the number of turning and through lanes over existing conditions (requires limited widening at intersections).



Year 2020 Peak Hour Traffic Volumes

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

Figure 2-8



Legend

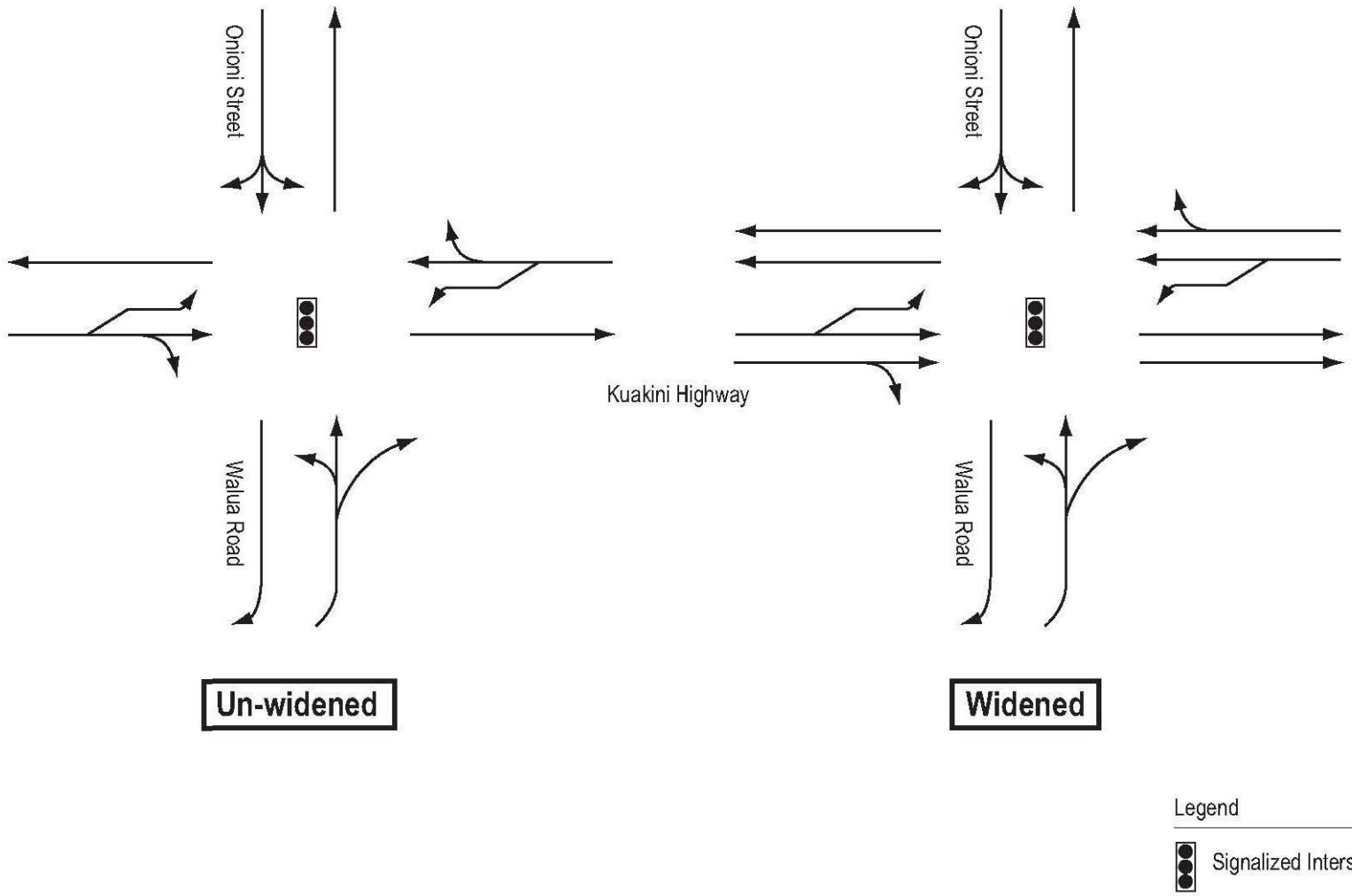
Signalized Intersection

NTS

Year 2020 Lane Configurations: Hualalai Road and Kuakini Highway

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

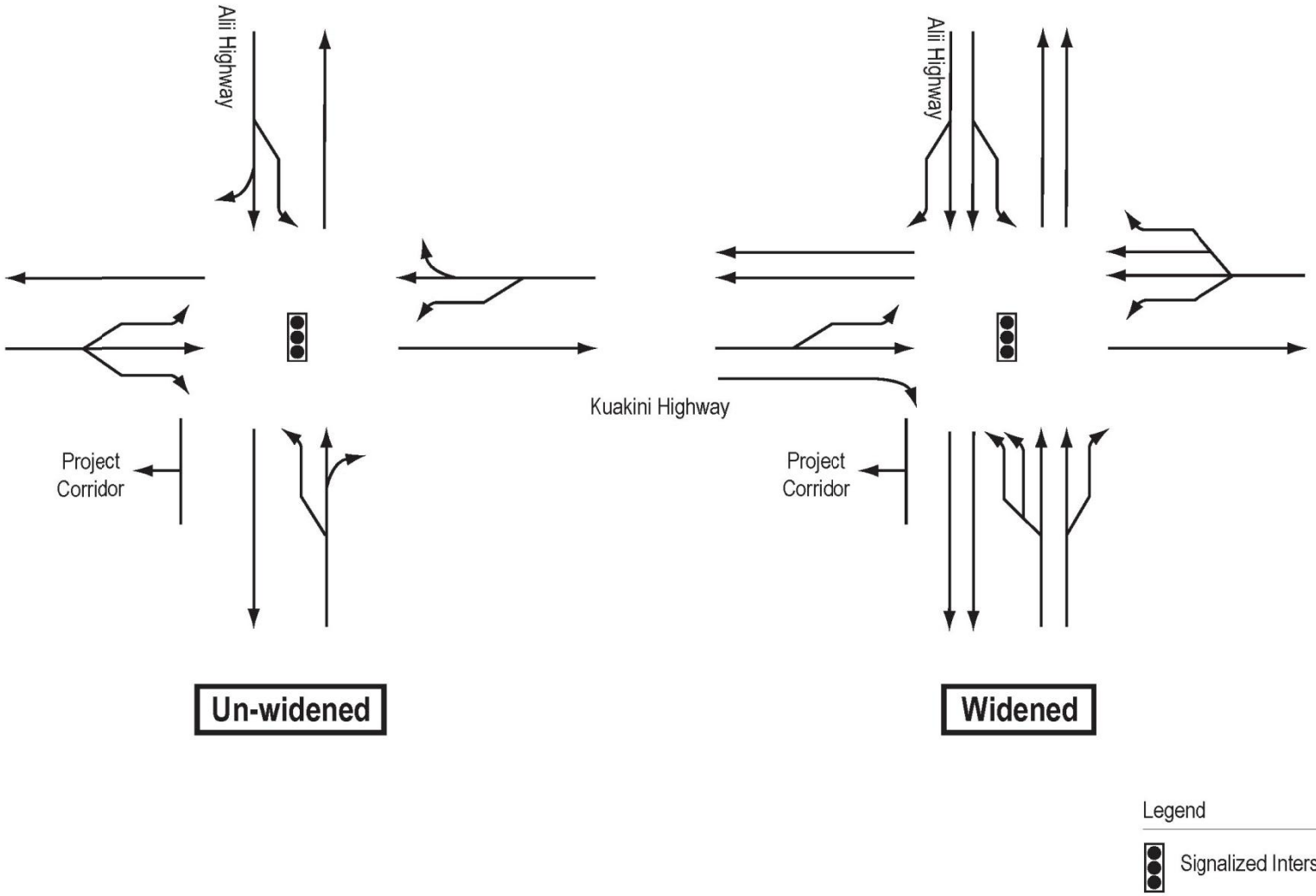
Figure 2-9



Year 2020 Lane Configurations: Onioni Street/Walua Road and Kuakini Highway

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

Figure 2-10



Year 2020 Lane Configurations: Alii Highway and Kuakini Highway

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

Figure 2-11

- At the intersection of Kuakini Highway and Ali‘i Highway:
  - Provide two northbound through lanes, a right turn lane, and a left turn lane on Kuakini Highway just south of the project limits;
  - Provide two left turn lanes from Ali‘i Highway east (mauka)-bound to Kuakini Highway northbound and a right turn lane from Ali‘i Highway east (mauka)-bound to Kuakini Highway southbound; and
  - Provide right and left turn lanes from Ali‘i Highway west (makai)-bound to Kuakini Highway.

Mitigation for construction impacts is addressed in Section 2.14.

2.3.2 Cycling and Pedestrian Facilities

2.3.2.1 Existing Conditions

In the northern portion of the project limits, the ROW of Kuakini Highway includes curbs and sidewalks. The remaining sections of Kuakini Highway within the project limits currently do not have pedestrian facilities. There are no bicycle facilities on Kuakini Highway within the project limits. As noted by the Hawai‘i Cycling Club in a letter dated November 10, 2005, Kuakini Highway is used by local and visiting cyclists in addition to being a “major artery” for students at the University of Nations accessing downtown Kailua-Kona.

Bike Plan Hawai‘i, A State of Hawai‘i Master Plan (September 2003) (hereafter referred to as “State bike plan”) prepared by HDOT provides recommendations for improving bikeway systems statewide. This plan serves as guidance to HDOT and county agencies when new roadway construction or improvements to existing roadways are considered. The State bike plan recommends the construction of bike lanes/bike paths on Kuakini Highway within the project limits. It also recommends that Queen Ka‘ahumanu Highway and Ali‘i Drive be signed as shared roadways (bike routes).

2.3.2.2 Potential Impacts

Under the No-Build Alternative, no additional pedestrian or cycling facilities would be provided on Kuakini Highway.

Under the Build Alternative, sidewalks and bike lanes would be provided on both sides of the roadway. Thus, the Build Alternative would fulfill the recommendations contained in the State bike plan regarding Kuakini Highway within the project limits.

2.3.3 On-Street Parking

2.3.3.1 Existing Conditions

The nearest public parking lot is located off Palani Road, about 0.4-mile north of Hualālai Road. On-street parking currently occurs in clusters along Kuakini Highway, predominantly in front of residential buildings, but also in association with commercial properties. The majority of such parking is not lawful. Vehicles parked diagonally or perpendicular to the direction of travel are not lawfully parked. In addition, some areas lack sufficient paved area beyond of the edge of the traveled lane for parking in an appropriate and safe manner. Vehicles parked beyond the paved area track gravel onto the road creating maintenance problems and safety hazards.

Some park across the street from the generator business or residence, which creates demand for pedestrian crossing where there is no crosswalk available.

Most notable areas of on-street parking are as follows, from north to south:

- Near Hualālai road intersection on mauka side of road; this area provides up to 5 lawful parking spaces.
- In front of Kailua Village Condominium (makai side). Typically vehicles park perpendicular to the direction of movement, which is not lawful; furthermore, there is insufficient paved area for lawful parallel parking.
- In front of Kona Islander Inn condominium (makai side). Typically vehicles park perpendicular to the direction of movement, which is not lawful; furthermore, there is insufficient paved area for lawful parallel parking.
- In front of Hawai‘i Federal Credit Union (mauka side). Typically vehicles park perpendicular to the direction of movement, which is not lawful. This area provides up to 3 lawful parallel parking spaces.
- South of the Mazda and Subaru car dealership on the mauka side, primarily during the daytime. Up to 3 vehicles park in this area although the pavement width is insufficient.
- In front of the Ali‘i Sunset Plaza on the makai side, there is sufficient paved area in most of this area to allow for 6 lawful parking spaces.
- In front of Kona Pacific condominium on the makai side. Typically vehicles park perpendicular to the direction of movement, which is not lawful; furthermore, there is insufficient paved area to accommodate the observed use.
- Across from Kona Mansion condominium, fronting the vacant lots on the mauka side of the road. Parking both perpendicular and parallel to the direction of movement is observed, there is sufficient paved area to allow parallel parking in this area. Although the pavement is rough, this area provides up to 10 parking spaces to accommodate the observed use.

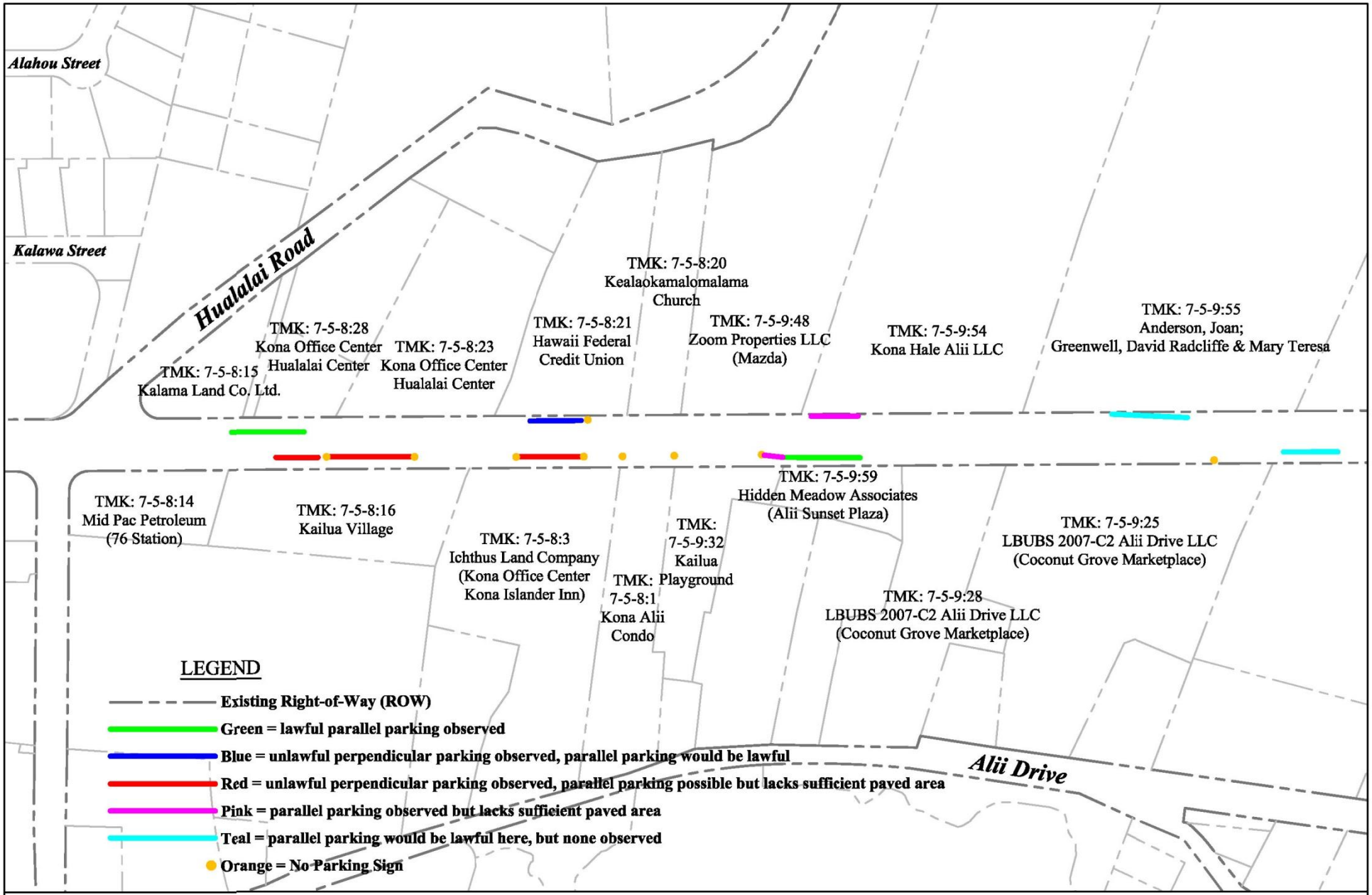
See Figure 2-12, Figure 2-13, and Figure 2-14 for a depiction of parking areas.

2.3.3.2 Potential Impacts

Under the No-Build Alternative, on-street parking conditions would not change.

Under the Build Alternative (regardless of Design Alternative), all existing street parking would be eliminated.

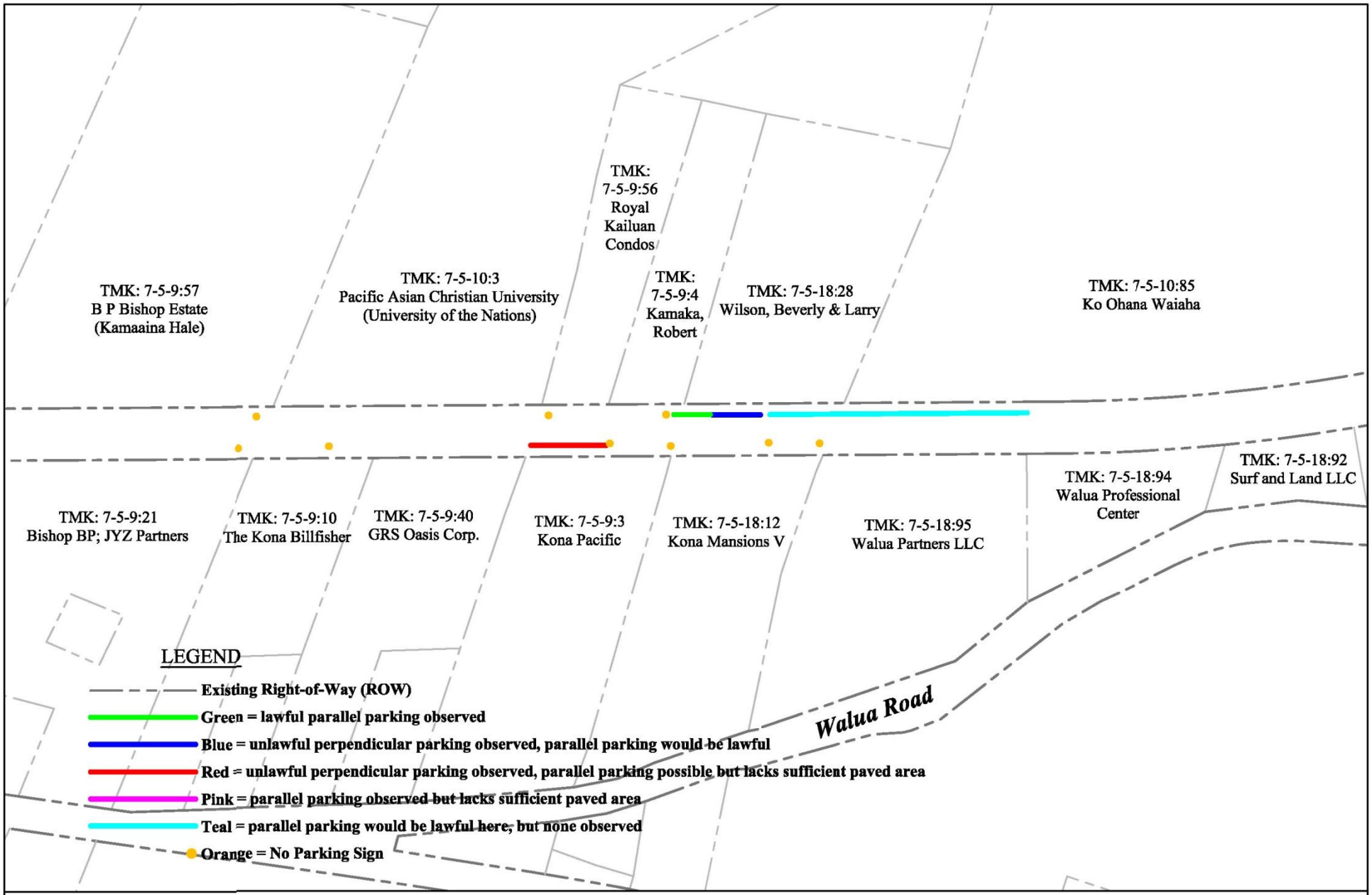
Existing on-street parking along Kuakini Highway is considered displaced by the proposed project only where (a) not designated “no parking”, (b) there is an observed demand, and (c) there is sufficient pavement beyond the white line marking the edge of the travelway to accommodate parallel parking. Therefore, up to 24 lawful on-street parking spaces are expected to be displaced by either Build alternative.



Parking Inventory - Section 1

Kuakini Highway Improvements Project, Phase 2; Kailua-Kona, Hawaii

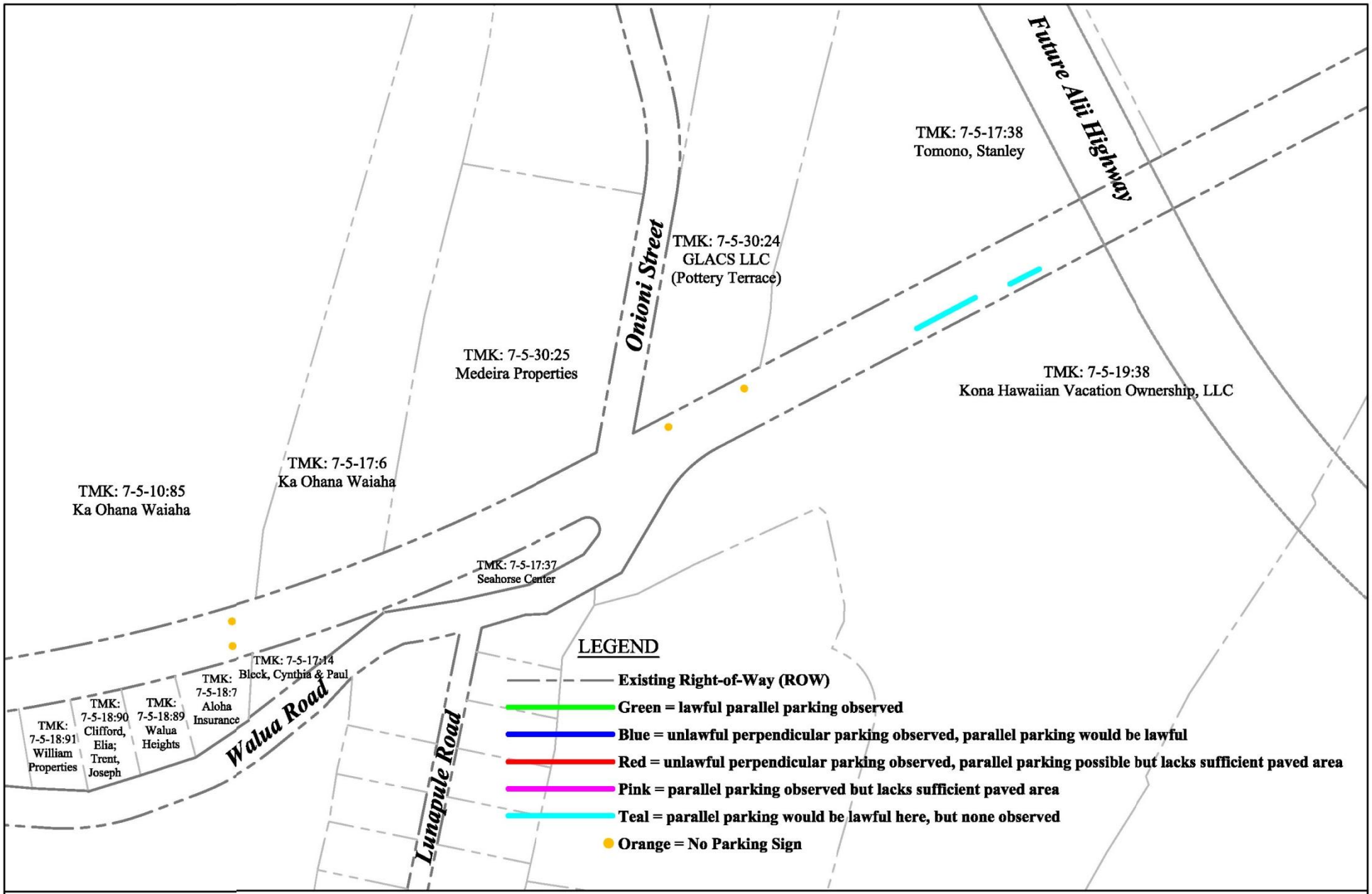
Figure 2-12



Parking Inventory - Section 2

Kuakini Highway Improvements Project, Phase 2; Kailua-Kona, Hawaii

Figure 2-13



Parking Inventory - Section 3

Kuakini Highway Improvements Project, Phase 2; Kailua-Kona, Hawaii

Figure 2-14

2.3.3.3 Mitigation Measures

No mitigation of on-street parking loss is proposed under this project. The existing right-of-way width cannot support both on-street parking and the proposed street improvements. Acquiring additional right-of-way to accommodate on-street parking abutting and near properties with current demand would be expensive and may result in the loss of a greater number of off-street parking spaces.

2.3.4 Utilities and Infrastructure

2.3.4.1 Existing Conditions

Kuakini Highway's ROW is used for aerial electrical, telephone, and cable television (cable) lines on both sides of the roadway. Electrical lines including high voltage 69 kV and 12 kV lines mounted on the mauka side of the highway. Several primary and secondary overhead crossings provide electric service to customers on the makai side. Hawaiian Telcom and Time Warner Oceanic Cable lines are mounted on wood poles on the makai side of Kuakini Highway, with several overhead crossings to provide service to the mauka side of the roadway. Roadway street lamps are currently provided only on the northern section of the project limits near the town core and at intersections on both sides of the roadway.

In Phase 1 of the Kuakini Highway Improvements between Palani and Hualālai Roads, the County replaced overhead utilities on both sides of the highway with an overhead line on the mauka side of the highway supported on 80-foot tall steel poles. Underground crossings were provided to the makai side. New streetlight poles and luminaries were installed on the makai side of the highway, and new streetlight luminaries mounted on bracket arms were installed on the new steel poles on the mauka side.

Water, sewer, and gas lines are also buried within the ROW. In 2006 the County of Hawai'i Department of Water Supply installed a 16-inch water line on the mauka side of the ROW from Hualālai Road to Nakukui Drive, a distance of about 10,000 linear feet. A private developer (Kona Hawaiian Village Time Share project) has also installed about 1,000 feet of line near where Ali'i Highway would connect with Kuakini Highway. Eight-inch and 20-inch waterlines are also present. A 12 inch waterline was also installed from Kuakini Highway through parcel 94 to Walua Road.

2.3.4.2 Potential Impacts

Under the No-Build Alternative, there would be no impact on utilities.

Under the Build Alternative, all overhead utilities – electric, telephone, and cable - would be relocated and placed on the type of 80-foot tall steel poles placed along the mauka side of the highway used in Phase 1. Existing street lamps would be relocated. Streetlights would be placed on both sides of the highway. The proposed action has been designed to minimize impacts on water, sewer, and gas utilities. The only impacts are expected to be construction period impacts, which are addressed in Section 2.14.

During the design phase, options for adjusting utility pole heights would be considered. Visual impacts of utility poles are addressed in Section 2.8.

The option to underground utilities completely was considered but rejected due to cost (see Section 1.5).

2.3.4.3 Mitigation Measures

All improvements to utilities would be coordinated with the appropriate utility company and addressed during project design and construction. Specific design details may be similar to those implemented in the Phase 1 widening of Kuakini Highway, and the specific configuration will be determined during final design. The maximum pole height and base diameter is roughly 80 and 3, respectively.

Mitigation for construction impacts is addressed in Section 2.14.

2.4 WATER RESOURCES

2.4.1 Existing Conditions

North Kona is characterized by underdeveloped, shallow, and poorly defined drainageways due to the steep topography, porous geology, and relatively recent volcanic activity. In times of intense rainfall or storms, extensive overland sheet flow often occurs. In addition, drainage systems are often unable to contain storm waters during intense rain storms.

Two major drainageways, Keōpū and Waiaha Streams, cross Kuakini Highway within or near the project limits (see Figure 2-15). They are described below:

- Keōpū Stream, and tributary Hienaloli drainageway, cross Kuakini Highway just south of Hualālai Road, within the project area. The stream is shown as an intermittent stream on the U.S. Geographic Survey (USGS) topographic map. The Flood Insurance Rate Map (FIRM) shows the Keōpū Stream 100-year flood zone is approximately 750 feet wide where it crosses Kuakini Highway. There are dual 36-inch drain pipes near Hualālai Road and a 6-foot by 12-foot box culvert for Keōpū Stream near the project's northern terminus. The U.S. Army Corps of Engineers is currently conducting studies for the Keōpū-Hienaloli Streams flood control project, and anticipates controlling the flow upstream so that the box culvert at Kuakini Highway would not need to be resized.
- Waiaha Stream crosses Kuakini Highway at three locations: the main channel, Splitflow #2 south of the main channel (originates mauka of Queen Ka‘ahumanu Highway Extension), and Splitflow #3 north of the main channel (originates at Kuakini Highway). Only Splitflow #3 is within the project area. The stream is shown as an intermittent stream on the U.S. Geographic Survey (USGS) topographic map. A splitflow occurs during high water when the stream jumps its main channel and flows into alternate channels that split from the main channel; splitflows are more common in relatively uneroded terrain such as the project area. Waiaha Stream Splitflow #3 starts where the main channel crosses Kuakini Highway; there are culverts allowing the stream to flow beneath the highway at the main channel, but they are undersized for a 100-year storm. Splitflow #3 flows north along the mauka side of the highway until reaching a point approximately 1,000 feet north of the main Waiaha Stream channel. At that point it crosses the highway in a 100-year floodplain over 100 feet wide. There is a 42-inch culvert for the Splitflow #3 crossing located approximately 160 feet north of southern extent of project. After crossing the highway, Splitflow #3 rejoins the main channel prior to flowing into the Pacific Ocean.

  DPW plans to address drainage issues related to Waiaha Stream under the Ali‘i Highway project under development. Because Ali‘i Highway is planned to be constructed before the southern segment (phase 2B) of the Kuakini Highway

Improvements, it is anticipated that new culverts associated with the main flow of Waiaha Stream south of the project area would be appropriately sized and eliminate Splitflow #3.

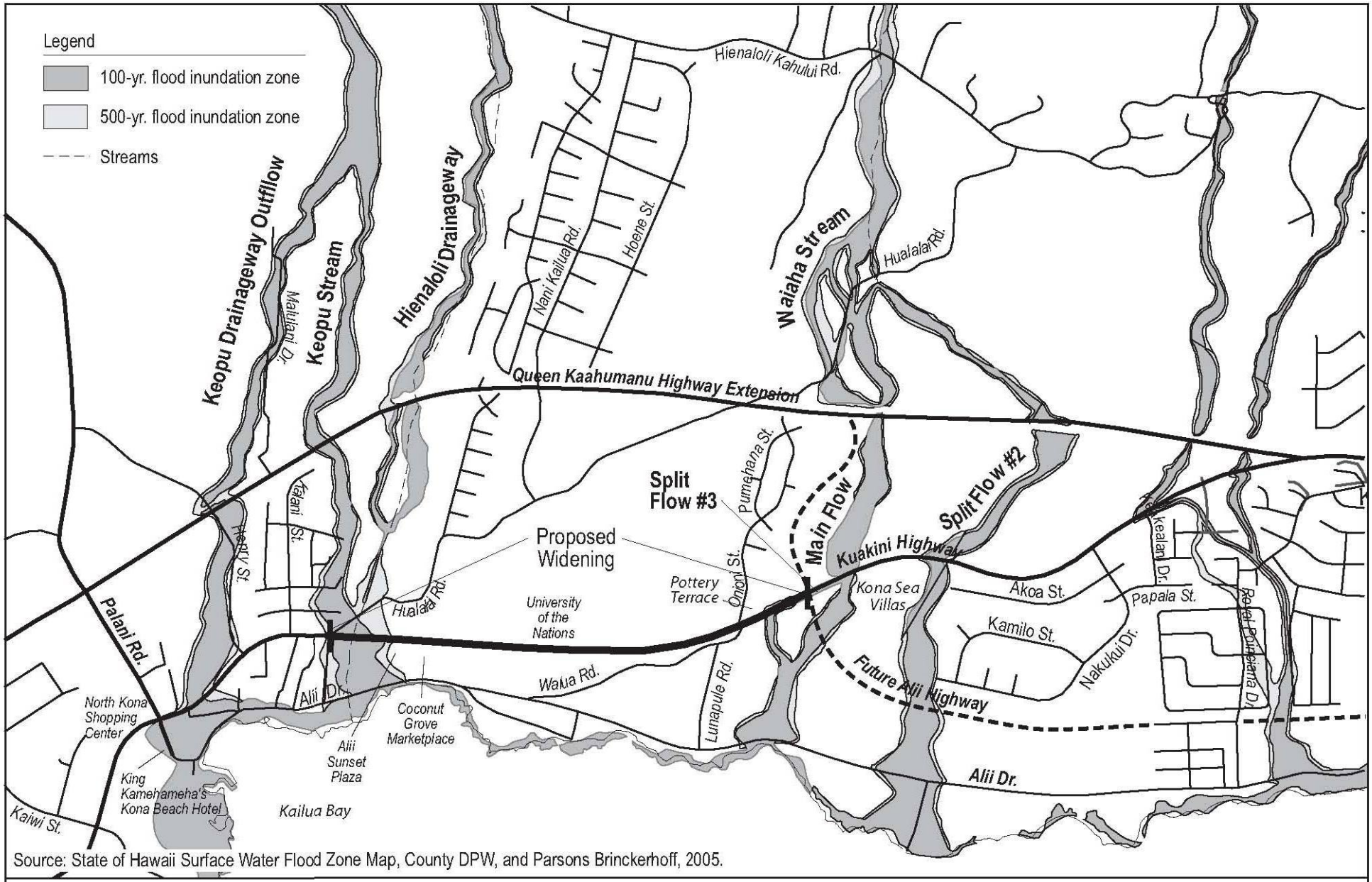
Kuakini Highway within the project area currently has a limited stormwater collection system near the northern/town-center end, consisting of gutters draining into the two 36-inch drain pipes associated with Keōpū Stream. South of this more developed area, Kuakini Highway has no stormwater collection facilities. However, a number of smaller drainage culverts cross the existing highway, including a 24-inch culvert north of the Walua Road intersection that handles drainage from mauka areas, and directs flow into drywells on private property between Kuakini Highway and Walua Road.

The portion of Kuakini Highway widened as part of Phase I, between Palani Road and Hualālai Road north of the project area, includes drywells to manage stormwater.

The project area does not contain wetlands. Both streams crossing the project alignment have been altered. The culverts at these stream crossings are steep enough such that standing water does not accumulate, the substrate in these culverts contain little to no organic material, and no facultative or obligate hydrophyte plant species were observed.

Given the geology of the project area, no interaction with groundwater is anticipated during construction because the deepest excavation is likely to be approximately 10 feet below ground surface to install new utility poles and light standards (Geolabs, 2006).

Coordination with the U.S. Army Corp of Engineers (USACE) is being conducted in accordance with Section 404 of the Clean Water Act. See Section 3.1 and Appendix A for records of coordination. The USACE has not yet determined whether Waters of the U.S. exist within the project limits.



Source: State of Hawaii Surface Water Flood Zone Map, County DPW, and Parsons Brinckerhoff, 2005.

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Surface Water Resources and Flood Zones

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

Figure 2-13

Groundwater within the project area is characterized as a thin, buoyant, unconfined lens of brackish water floating on saltwater, due to proximity to the coastline. The basal lens is dynamic, and can be affected by drought, ocean tides, and groundwater withdrawal from wells.

2.4.2 Potential Impacts

As a result of road widening, more pavement and, therefore, more roadway runoff is anticipated. However, given the amount of developed properties in this area of Kailua-Kona, the impacts of the additional impervious surfaces created by the project would be negligible. Moreover, the proposed action includes construction of a roadway stormwater collection system. As part of the proposed action, drywells would be placed underneath the roadway to handle roadway runoff, as shown in Figure 1-3 (typical section). Runoff would not be discharged to streams, but would flow to the side of the roadway in gutters and be directed to the drywells.

Before the Final EA is completed, DPW would confirm with the USACE if a Department of Army permit, such as a Section 404 permit, applies to this project.

As described in Section 1.4.2, one culvert would be relocated. To the extent possible, off-site drainage would also be accommodated. Larger regional off-site drainage issues are being covered by studies conducted in the context of other projects: the Army Corps of Engineers is studying Keōpū Stream drainage, and DPW plans to address the Waiaha Stream crossing within the context of the on-going Ali‘i Highway project. Floodplain mapping may be revised by these other projects, and a Conditional Letter of Map Revision (CLOMR) may be obtained by one or both of these projects. The proposed Kuakini Highway project would be designed to be consistent with the findings or changes determined by these other projects. In particular, the northern portion of the Ali‘i Highway project would address drainage issues with Waiaha Stream. However, if Phase 2B of the project is implemented prior to the construction of the northern portion of Ali‘i Highway, then the project would extend the existing 42-inch culvert that conveys the Waiaha Stream Splitflow #3 across the highway to maintain the existing flow pattern.

As discussed in Section 2.2, development pressures in Kailua-Kona are changing the landscape. Although the area around Keōpū Stream is already developed, the Waiaha Stream area is largely undeveloped. A private resort timeshare development project is planned in the immediate vicinity of the Waiaha Stream crossing and the future Ali‘i Highway intersection. These private developers would address the stream and floodplain impacts, including re-visiting the floodplain mapping of this area and submitting a CLOMR. Therefore, it is anticipated that third parties would address the Waiaha Stream floodplain issues in advance of and separate from the Kuakini Highway widening project.

2.4.3 Mitigation Measures

Coordination with USACE would continue to determine the need for a Department of Army permit, such as a Section 404 permit. Construction impacts and mitigation are discussed in Section 2.14.

2.5 BIOLOGICAL RESOURCES

2.5.1 Existing Conditions

"Endangered" species are those that are in danger of extinction throughout all or a significant part of their ranges. A "threatened" species is likely to become an endangered species in the foreseeable future. "Candidate" species are those for which the U.S. Fish and Wildlife Service (USFWS) has evidence of vulnerability, but there are not enough data to support formal proposal as an endangered or threatened species. These species are often collectively referred to as "protected" species. The following discussion highlights those biological resources that fall into these categories, as well as selected native/indigenous resources and introduced resources.

A botanical survey for this project was performed in 2005 (see Appendix F) and reported that no protected species were observed within a 200-foot wide corridor centered around the existing highway's centerline (100 feet on either side). The study area is urbanized with a few undeveloped parcels remaining. Portions of the area are landscaped and others, primarily the undeveloped parcels, are overgrown and unmaintained. The following observations were made:

- Indigenous plants such as Uhaloa (*Waltheria indica*), Koali`awa (*Ipomoea indica*), and *Sida rhombifolia* observed in the project area are common along roadsides and trails on the west side of the island of Hawai'i. Two native ferns, Sword fern (*Nephrolepis exaltata*) and Cretan Brake (*Pteris cretica*), were also observed on or next to the roadway shoulder.
- Large trees along the project corridor are limited. Most trees along the roadway are in unmaintained, undeveloped parcels, and consist of such common, introduced, scrubby trees as haole koa (*Leucaena leucocephala*), Kiawe (*Prosopis pallida*), and the Autograph tree (*Clusia rosea*). Trees in the landscaped areas primarily included palm trees such as the Pygmy Date Palm (*Phoenix roebelenii*) and the coconut palm (*Cocos nucifera*) and Royal Poincianca (*Delonix regia*) trees.
- Other common species observed in both the landscaped and unmaintained areas included bougainvillea (*Bougainvillea spp.*) and plumeria (*Plumeria spp.*).

The faunal community in the project area is typical of urban areas in Hawai'i. Terrestrial mammals typically found in the project area are all introduced, such as mice, mongoose, rats, feral cats, and dogs. Because the area has been extensively modified from its original state, it has little value as native bird habitat. A field study conducted for the Lako Street extension project, which is located about one mile south of the project limits noted the common mynah, sparrows, cardinals, finches, egrets, and doves - all introduced species common in Hawai'i. The study noted that native birds, such as the Hawaiian Hawk (Io), Hawaiian Owl (Pueo), the Pacific Golden Plover (Kolea), and the Ruddy Turnstone (Akeake) may occasionally fly over the region.

Consultation with the U.S. Fish and Wildlife Service (USFWS) was initiated per requirements of the federal Endangered Species Act of 1973 (16 U.S.C. 1531-1543). The State of Hawai'i Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) was also contacted for information on the possible presence of threatened and endangered species. Correspondence with USFWS and DOFAW is summarized in Section 3.2.2, and copies of correspondence are located in Appendix A.

In a letter dated November 4, 2005, the USFWS stated that there is no designated critical habitat for protected species in the area. Records show the Hawaiian hoary bat (*Lasiurus cinereus semotus*) and the native palm tree (Loulu palm, *Pritchardia affinis*) within 1/3-mile of the project area. The 2005 botanical report found no Loulu palms in the study area. Although previous documentation by other projects in the area indicated that two species of migrating seabirds may fly through the project area, the USFWS wrote that they have no records of the endangered Hawaiian dark-rumped petrel (*Pterodroma phaeopygia sandwichensis*) and the threatened Newell's shearwater (*Puffinus newelli*) occurring within 1/3-mile of the proposed Kuakini Highway project area. These birds reportedly fly between ocean feeding grounds and inland nesting areas. At night, shearwater fledglings are attracted to bright lights and headlights of cars. They become momentarily blinded by the lights and are unable to see utility wires, or sometimes become confused, landing on the roadway or brightly lit areas.

In a letter dated November 3, 2005, DOFAW reported that it is doubtful the project would encounter endangered species.

2.5.2 Potential Impacts

There would be no impacts with the No-Build Alternative, above and beyond those by other development projects already planned in this roadway corridor.

Based on input from the USFWS and DOFAW, the results of the botanical survey, and additional research, no adverse interactions with protected species are anticipated. Because plants in the study area are common and are associated with disturbed areas, removal of roadside vegetation under the Build Alternative would have minimal biological impacts. Moreover some of this vegetation is likely to be removed first by other development projects in this corridor.

Some existing landscaping would be lost as a result of proposed ROW acquisition under Design Alternative 2; only landscaping within the ROW would be affected under Design Alternative 1. (For details of ROW acquisition, see Section 2.2.3.) Lost landscaping under the more extensive build scenario (Design Alternative 2) consists predominantly of palms, plumeria, shrubbery, and scrub trees. Section 2.8 discusses landscaping impacts and mitigation.

No adverse impacts to faunal resources are expected. Faunal species conditions and abundance are unlikely to change because ample similar habitat would exist, regardless of whether the proposed action is implemented.

2.5.3 Mitigation Measures

Road lighting would be properly designed to minimize impacts on shearwaters and other protected species that potential fly over the region. Streetlight luminaries or lamps, where provided, would be designed to reduce glare and shield light from migrating birds. When possible, the DPW would use "The Newell's Shearwater Light Attraction Problem, A Guide for Architects, Planners, and Resort Managers" in designing the luminaries.

During the construction phase, if work is to be conducted during the shearwater nesting season of mid-April through November, construction would be limited to daylight hours as much as possible. Night work, if necessary, would be accomplished without the use of bright lights.

A landscaping plan would be prepared during the project design phase (see also Section 2.8). Due to the minimal amount of large vegetation along this roadway, it is anticipated that the landscaping plan would result in placing plants and shrubs in the proposed sidewalk planter

strips which will be a significant enhancement to the current condition. Existing trees may be moved and replanted if deemed appropriate, but most scrub-dominated vegetation would not be replaced.

2.6 AIR QUALITY

The following sections summarize local meteorology and study methods and findings.

2.6.1 Local Meteorology

In addition to its tropical latitude, the climate of the Hawaiian Islands is affected by a system of persistent winds that blows from northeast to southwest, known as trade winds. These winds are almost constant during the spring and summer months. The interaction between the trade winds and the mountainous topography of the islands produces differences in meteorological conditions from one region to another within the same island.

Because Kona is located on the leeward side of the Big Island, its climate has characteristics similar to other leeward regions throughout the State. In addition, its relatively large land mass and proximity to the ocean produce a land-sea breeze effect, which is created where land and water create variations in pressure due to differences in the way these two bodies heat and cool. The leeward location of the project site means that average annual rainfall is limited, typically 20 inches or less annually. Temperatures average in the mid-70s.

2.6.2 Clean Air Act Requirements

As required by the 1977 Clean Air Act (CAA), National Ambient Air Quality Standards (AAQS) were established by the U.S. Environmental Protection Agency (USEPA) for seven major air pollutants: carbon monoxide (CO), nitrogen oxides (NOx), ozone (O_3), particulate matter smaller than 10 microns (PM_{10}), particulate matter smaller than 2.5 microns ($PM_{2.5}$), sulfur oxides (SOx), and lead. Current standards for ozone and $PM_{2.5}$ were established in September 1997. The State of Hawai‘i has also established its own standards for these pollutants. Both the National and State AAQS are listed in Table 2-4.

CAA Section 107 requires the USEPA to publish a list of geographic areas that are not in compliance with the National AAQS, and these areas are called non-attainment areas. Areas that have insufficient data to make a determination are unclassified, and are treated as attainment areas until proven otherwise. The designation of an area is made on a pollutant-by-pollutant basis.

Table 2-4: National and State Ambient Air Quality Standards

Pollutant	Standards		
	Hawai'i State	Federal Primary[a] (Health)	Federal Secondary[b] (Welfare)
Carbon Monoxide (CO)			
1 Hour[1]	9 ppm	35 ppm	----
8 Hour[1]	4.4 ppm	9 ppm	----
Nitrogen Dioxide (NO_2)			
1 Hour	----	0.1 ppm	----
Annual Mean	----	0.053 ppm	0.053 ppm
Annual Average	70 ug/m^3 (0.04 ppm)	----	----
PM10[c]			
24 Hour[3]	150 ug/m^3	150 ug/m^3	150 ug/m^3
Annual (Arithmetic)[2]	50 ug/m^3	----	----
PM2.5[d]			
24 Hour[5]	----	35 ug/m^3	35 ug/m^3
Annual (Arithmetic)[4]	----	15 ug/m^3	15 ug/m^3
Ozone (O_3)			
8 Hour Rolling Average	157 ug/m^3 (0.08 ppm)	0.075 ppm	0.075 ppm
Sulfur Dioxide (SO_2)			
1 Hour	----	0.075 ppm	----
3 Hour[1]	0.5 ppm	----	1,300 ug/m^3 (0.5 ppm)
24 Hour Block Average	0.14 ppm	0.14 ppm	----
Annual Average	80 ug/m^3 (0.03 ppm)	80 ug/m^3 (0.03 ppm)	----
Lead (Pb)			
3 Months (Arithmetic)	1.5 ug/m^3	0.15 ug/m^3	0.15 ug/m^3
Hydrogen Sulfide (H_2S)			
1 Hour	0.025 ppm	----	----

Source: State of Hawai'i, Department of Health, Clean Air Branch – Hawai'i Administrative Rules, Chapter 59. Code of Federal Regulations, Title 40, Part 50, January 2007 and EPA. http://epa.gov/air/criteria.html

Note:
- a Designated to prevent against adverse effects on public health
- b Designated to prevent against adverse effects on public welfare, including effects on comfort, visibility, vegetation, animals, aesthetic values, and soiling and deterioration of materials.
- c Particulate matter 10 microns or less in diameter
- d Particulate matter 2.5 microns or less in diameter.
- (1) Not to be exceeded more than once per year.
- (2) 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).
- (3) Not to be exceeded more than once per year on average over 3 years.
- (4) 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.
- (5) 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).

2.6.3 Existing Conditions

The State of Hawai'i is designated as an attainment area for CO, ozone (O3), PM_{10}, and $PM_{2.5}$. There are occasional National AAQS exceedences in the project area for Sulfur Dioxide and $PM_{2.5}$; such exceedences are more common in Pahala and Ocean View. These exceedences are primarily attributed to volcanic activity (known as vog), and occasionally brush fires.

2.6.4 Potential Impacts

The pollutants relevant to evaluating the air quality impacts of a roadway project are those contained in motor vehicle emissions. Vehicles emit carbon monoxide (CO), volatile organic

compounds (VOCs), the six priority mobile source air toxics (MSAT), nitrogen oxide (NOx), and lead (lead levels have decreased substantially and will continue to do so due to the mandated elimination of lead in gasoline). Those pollutants can react in the atmosphere to generate PM_{10} and $PM_{2.5}$ on a regional basis. CO air pollution is generally considered to be a microscale problem that can be addressed locally to some extent. The other pollutants degrade air quality at a regional scale.

Regional air quality impacts related to VOC, the six priority MSAT, NOx, PM_{10}, and $PM_{2.5}$ are primarily dependent on changes in vehicle miles traveled (VMT), vehicle hours traveled (VHT), and vehicle mix (gasoline-fueled cars vs. diesel-fueled trucks and buses). None of these factors are predicted to change due to building the project. Therefore, the build alternative would have similar impacts as the no-build.

Vehicle speed is the primary factor governing potential microscale CO impacts. An analysis of the expected travel patterns within the project indicate that the level of service (LOS) would not fall below level D at any of the intersections within the project. Therefore, the project does not meet the State or Federal guidelines requiring a detailed microscale analysis. Given this, the project is not predicted to cause or exacerbate a violation of the State or National AAQS.

2.6.5 Mitigation Measures

Implementing air quality mitigation measures for long-term traffic-related impacts are unnecessary and unwarranted because no significant variation of VMT, VHT, and vehicle mix is expected between the No Build and Build Alternatives. In addition, CO concentrations are expected to remain well within the National and State AAQS because a LOS of D or better would be maintained under the Build Alternative.

2.7 NOISE

A Traffic Noise Impact Study was performed for this project and is presented in Appendix G. The following sections summarize study methods and findings.

2.7.1 Characteristics and Measurement of Sound

Several characteristics of sound affect the impact it has. These include the sound level (loudness), frequencies involved, period of exposure to the noise, and changes or fluctuations in the noise levels during exposure.

Loudness is measured in decibels. Since the human ear does not perceive all pitches or frequencies equally, noise levels are adjusted, or weighted, to correspond to human hearing. This adjusted unit is known as the A-weighted decibel, or dBA.

Since dBA describes a noise level at just one moment, and very few noises are constant, ways of describing noise over extended periods are needed. One way is to describe fluctuating noise observed over a period as if it were a steady, unchanging sound. This type of an average is called the equivalent sound level, Leq. Leq is the constant sound level that, for a given situation and time period (e.g., 1-hour, Leq(1); hourly, Leq(h); or 24 hours, Leq(24)), conveys the same sound energy as the actual time varying sound.

2.7.2 Noise Abatement Criteria

The Federal Highway Administration (FHWA) has developed Noise Abatement Criteria (NAC), which were adopted by the State of Hawai‘i (see Table 2-5). According to the SDOT’s Noise

Analysis and Abatement Policy (Noise Policy), a noise impact would occur when predicted traffic noise levels approach or exceed the NAC, or when predicted traffic noise levels substantially exceed the existing noise levels.

Table 2-5: FHWA Noise Abatement Criteria

Activity Category	NAC L_{eq}(h) for Noisiest Traffic Hour	Description of Activity Category
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B.
D	----	Undeveloped lands
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Notes: Interior noise level standards apply to:
1. Indoor activities for those parcels where no exterior noise sensitive land use or activities have been identified; and
2. Situations where the exterior activities are either remote from the highway or shielded so that while the exterior activities remain undisturbed, noise nevertheless affects interior activities.

Source: Federal Aid Highway Program Manual (FHPM), 23 CFR Part 772 "Procedures for Abatement of Highway Traffic Noise," 1982.

In terms of the one-hour L_{eq}(h) noise descriptor, a noise impact could potentially require mitigation if either of the following conditions is predicted to occur:

- Future year traffic noise approaches or exceeds the FHWA NAC; or
- Future year traffic noise substantially exceeds (15 dBA or more) the existing ambient noise level.

2.7.3 Existing Conditions

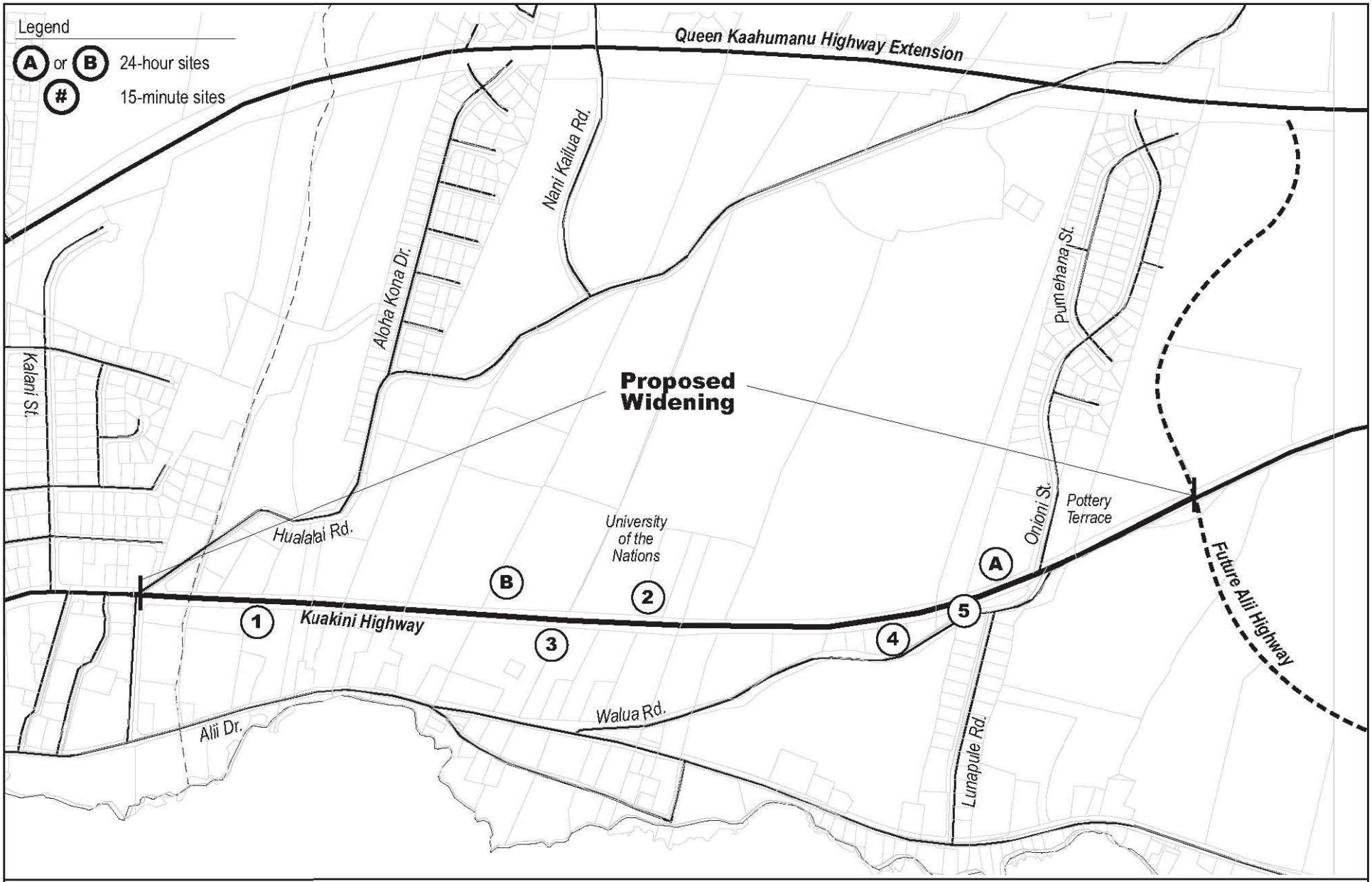
Existing and future noise sensitive land uses and activities adjacent to the proposed corridor and nearby major roadways were identified from site inspections and existing mapping. These land use activities include residences, recreation and park areas, and institutions such as schools and churches. All of these activities are considered Category B, which has an exterior NAC of L_{eq}(h) 67 dBA and are considered Category B.

In November 2005, noise level measurements were conducted for a 15 to 30-minute period at 5 sites (Sites 1 through 5). Long term (24 hour) noise measurements were conducted at 2 sites to determine the noisiest traffic hours within the project area (Sites A and B). The measurement sites are illustrated on Figure 2-16. Using those results, the noise level at additional sites was modeled to supplement the measurement sites and evaluate noise levels at locations closer to residential receptors. The results of the noise monitoring and modeling of current conditions are summarized in Table 2-6.

Table 2-6: Existing Worst Hour Traffic Noise Levels

Site	Location	Type of Develop-ment	Date and Time of Measure-ment	Length of Measure-ment	Number of Receivers Represented	NAC*	Measured Hourly Leq(h), dBA	Modeled Worst-Hour Leq(h), dBA
1	Kona Islander Inn	Hotel	11-17-05 1:30 p.m.	15 min	10	B	57.9	57.5
2	Royal Kailuan Condominium	Residential	11-17-05 2:10 p.m.	15 min	44	B	**66.7**	64.7
2A	Royal Kailuan Condominium	Residential		Modeled	44	B	n/a	61.4
3	Bill Fisher Condominium	Residential	8-9-05 11:30 a.m.	15 min	12	B	**66.4**	**66.4**
3A	Bill Fisher Condominium	Residential		Modeled	12	B	n/a	56.2
4	5921 Walua Road	Residential	8-9-05 12:30 p.m.	15 min	2	B	52.9	52.9
5	5885 Walua Road	Residential	11-17-05 12:20 p.m.	15 min	2	B	62.7	63.9
5A	5885 Walua Road	Residential		Modeled	2	B	n\a	53.5
5B	5885 Walua Road	Residential		Modeled	2	B	n\a	58.0
A	Residence north of Onioni Street	Residential	8-9-05	24 hrs	2	B	n\a	60.2
B	Kama'aina Hale Condominium	Outdoor	8-9-05	24 hrs	8	B	n\a	65.5
B-M-1	Kama'aina Hale Condominium	Outdoor		Modeled	8	B	n\a	64.3
B-M-2	Kama'aina Hale Condominium	Outdoor		Modeled	8	B	n\a	65.5

Note: See Table 2-5 for descriptions of Noise Abatement Categories (NAC).
Bold = level approaches or exceeds the NAC.
A "Receiver" is an area of frequent human outdoor activity, homes, apartments, motel, hotels, etc.
Modeled worst hour Leq(h) values are within 2 dBA of measured values indicating the model is correctly calibrated.



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Noise Monitoring Locations

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

Figure 2-14

2.7.4 Potential Impacts

The FHWA Traffic Noise Model (TNM) was used to model the noise levels in 2020 at 10 sites. The traffic forecast presented in Section 2.3.1.2 was used to establish the volume and speed of traffic in year 2020. The vehicle fleet mix (auto, medium truck, and heavy truck percentages) was assumed to be the same as current conditions: 99 percent automobile and 1 percent medium trucks.

Under the No-Build Alternative, predicted 2020 traffic noise levels at the receiver sites are expected to be in the range of no change to a 3 dBA increase over the existing peak hour noise levels. The NAC of L_{eq}(h) 67 dBA is predicted to be approached or exceeded at two receivers at the Kama'aina Hale Condominium: Sites B and B-M-2 (Table 2-7).

Table 2-7: No-Build Alternative Worst Hour Traffic Noise Levels in 2020

Site	Location	Modeled Existing Worst-Hour Leq(h), dBA	Modeled No-Build 2020 Worst-Hour Leq(h), dBA	Leq(h), dBA Increase (+) or Decrease (-)	Noise Abatement Category (Criterion)	Impact Type* (S, A/E, or None)
1	Kona Islander Inn	57.5	60	+2	B	None
2A	Royal Kailuan Condominium (Modeling Site)	61.4	64	+3	B	None
3A	Bill Fisher Condominium (Modeling Site)	56.2	59	+3	B	None
4	5921 Walua Road	52.9	56	+3	B	None
5A	5885 Walua Road (Modeling Site)	53.5	56	+2	B	None
5B	5885 Walua Road (Modeling Site)	58.0	61	+3	B	None
A	Residence north of Onioni Street	60.2	63	+3	B	None
B	Kama'aina Hale Condominium	65.5	**68**	+2	B	A/E
B-M-1	Kama'aina Hale Condominium	62.3	64	+2	B	None
B-M-2	Kama'aina Hale Condominium	63.5	**66**	+2	B	A/E

Note: **Bold** = level approaches or exceeds the NAC.
*Impact Type: S = Substantial Increase (15 dBA or more), A/E = Approach or Exceed NAC

Predicted 2020 traffic noise levels for the Build Alternative are expected not to increase over the No-Build noise levels. The NAC of L_{eq}(h) 67 dBA is predicted to be approached or exceeded at three receivers: Site B, Site B-M-1, and B-M-2 (Table 2-8), all of which are located at the Kama'aina Hale Condominiums.

Table 2-8: Build Alternative Worst Hour Traffic Noise Levels in 2020

Site	Location	Modeled 2020 No-Build Worst-Hour Leq(h), dBA	Modeled 2020 Build Alternative Worst-Hour Leq(h), dBA	Leq(h), dBA Increase (+) or Decrease (-)	Noise Abatement Category (Criterion)	Impact Type* (S, A/E, or None)
1	Kona Islander Inn	60	61	+1	B	None
2A	Royal Kailuan Condominium (Modeling Site)	64	65	+1	B	None
3A	Bill Fisher Condominium (Modeling Site)	59	60	+1	B	A/E
4	5921 Walua Road	56	57	+1	B	None
5A	5885 Walua Road (Modeling Site)	56	57	+1	B	None
5B	5885 Walua Road (Modeling Site)	61	63	+2	B	None
A	Residence north of Onioni Street	63	64	+1	B	None
B	Kama'aina Hale Condominium	**68**	**68**	0	B	A/E
B-M-1	Kama'aina Hale Condominium	64	**66**	+2	B	A/E
B-M-2	Kama'aina Hale Condominium	66	**67**	+1	B	A/E

Note: **Bold** = level approaches or exceeds the NAC.
*Impact Type: S = Substantial Increase (15 dBA or more), A/E = Approach or Exceed NAC

2.7.5 Mitigation Measures

No mitigation measures would be employed under the No-Build Alternative because no construction would take place.

The Build Alternative would result in the noise level at the Kama'aina Hale Condominiums (represented by sites B, B-M-1, and B-M-2), to approach or exceed the NAC of L_{eq}(h) 67 dBA by 2020. Possible noise mitigation measures at this site were evaluated. Due to the number of receivers at the Kama'aina Hale Condominiums, the level of noise reduction a noise wall would provide, and the estimated cost of such a noise wall, it was found that a noise wall of 8 to 10 feet placed along the edge of the shoulder would be feasible. The noise wall would be approximately 500 feet long and stretch from one end of the Kama'aina Hale Condominiums to the other with a gap for the driveway.

If residents affected by the noise do not want noise barriers due to other considerations (such as visual impact), then they do not have to be installed. The County would coordinate with those directly affected at the Kama'aina Hale Condominiums as to whether a noise wall should be installed and, if so, to what height.

2.8 VISUAL AND AESTHETIC RESOURCES

2.8.1 Existing Conditions

Identifying viewsheds is an important step in assessing a project's potential visual effects. A viewshed can be described as all surface areas visible from an observer's viewpoint. Within the project limits, mauka (east) and makai (west) views are available at selected locations. Where available, the upslope (mauka) viewshed provides a view of Hualālai Volcano, which provides a dramatic backdrop to all of Kailua-Kona. The downslope (makai) viewshed provides expansive views of the coastline and the Pacific Ocean in areas not blocked by buildings or vegetation. Overhead utility lines detract from this particular aesthetic quality.

Within or adjacent to the roadway, abundant vegetation within undeveloped properties abutting the highway currently creates somewhat of a country road environment, but as described in Section 2.2 most of these parcels have development plans.

2.8.2 Potential Impacts

Under the No-Build Alternative, Kuakini Highway would have a more urbanized appearance along the entire alignment. Development plans along Kuakini Highway indicate that existing vegetation buffers would not be present in the year 2020.

Compared to the No-Build condition, the Build Alternative may enhance Kuakini Highway's appearance. The proposed action would partially underground the overhead utility lines. While overhead lines would remain on the mauka side, the crossings over the road would be eliminated, thereby improving the road's appearance. The utility poles on the mauka side of the road would be significantly taller than current poles (approximately 80 feet vs. 40 feet) and would closely resemble the conditions in the previously widened portion of Kuakini Highway north of the proposed project. The new utility poles would be steel poles instead of the wood poles currently present. Additional paving and diminished vegetated areas abutting the roadway would be mitigated by landscaping enhancements along Kuakini Highway.

Conversely, retaining walls and noise walls would be required under the Build Alternative. These retaining walls would not block any existing views but would change the character of the roadway. Retaining walls would not impact the makai view from any property. Walls on the upslope side would be noticeable to roadway users looking mauka. Downslope walls would be less noticeable from the roadway but may be visible from some more makai areas in Kailua-Kona. An anticipated improvement resulting from the presence of some of the downslope walls would be enhanced makai views from the roadway. Both build alternatives utilize retaining walls; however, Design Alternative 1 requires higher, longer, and more numerous retaining walls. In both cases the tallest retaining wall would be 16 feet high; in Design Alternative 1 the 16 foot tall wall is more extensive.

Unlike the retaining walls, the noise walls have the potential to obstruct makai views where they are installed. Noise walls would be installed between Kuakini Highway and the Kama'aina Hale Condominiums to a height of 8 to 10 feet. Retaining walls on the mauka side of the widened highway in this area would reach 9 feet high and the natural slope is such that the Kama'aina Hale Condominiums are approximately 11 feet higher than both the current and widened roadway surface. As such, the noise walls would extend 0 to 2 feet above the grade where human activity generally occurs at the Kama'aina Hale Condominiums. Therefore, the noise walls would likely minimally obstruct makai views from the Kama'aina Hale Condominiums.

2.8.3 Mitigation Measures

Under the Build Alternative, retaining walls and noise walls would be designed to blend in with the surrounding environment as much as possible, and a landscaping plan would be prepared during the design phase. Lava rock walls, walls resembling rock walls, walls colored and patterned to blend in with the surrounding environment, or walls covered with vegetation would be incorporated into designs wherever possible. Retaining walls on both the mauka and makai sides would receive such treatment so as to improve the appearance of the roadway.

While needing to consider structural requirements for walls, the County commits to considering public input regarding wall treatment details throughout the project's design phase.

Steel utility poles would be painted to blend in with the surrounding environment as much as possible.

If residents affected by the noise do not want noise barriers due to other considerations (such as visual impact), then they do not have to be installed. The County would coordinate with those directly affected at the Kama'aina Hale Condominiums as to whether a noise wall should be installed and, if so, to what height.

2.9 SOCIAL, ECONOMIC, AND CULTURAL CONDITIONS

2.9.1 Existing Conditions

2.9.1.1 Local Economy

Plantation agriculture and ranching were the dominant economic activities on the Big Island through the early and mid-20th century, but were overtaken by the visitor industry by the 1970s. Diversified agriculture, however, remains an important industry, and Kona is famous for coffee bean cultivation. Coffee and macadamia nut orchards are located in elevations well above Kuakini Highway where soil and climatic conditions are more favorable for these types of crops. Other agricultural products grown in Kona include high value flowers, foliage, and nursery plants.

The economy of West Hawai'i and Kailua-Kona is largely dependent on the visitor industry. Hotels in Kailua Village are located mostly along the more tourist-oriented Ali'i Drive, which runs parallel to Kuakini Highway along the coastline. Ali'i Drive also supports a large number of restaurants and shops that cater to visitors, and is a cruise ship stop. The commercial and light industrial businesses along Kuakini Highway from Palani Road extending south into the project limits consist of those that support the visitor industry and/or cater to local residents. Warehousing and industrial activities are located north of Palani Road. Big box retailers that include Wal-Mart, K-Mart, and Costco are centered along Queen Ka'ahumanu Highway generally north and mauka of the project site.

The University of Nations college campus is located on Kuakini Highway. Adjacent to the campus, developers propose building a residential complex (Hualālai Village) and a new visitor attraction, both of which would positively impact the local economy by providing housing and jobs.

2.9.1.2 Demographic Data

The economic prosperity of Kona, largely supported by tourism and real estate development, has resulted in an almost eight-fold increase in population in 40 years from 1970 to 2010, as shown in Table 2-9.

Table 2-9: Population of North Kona, 1970 to 2010

Year	Population
1970	4,839
1980	13,738
1990	22,284
2000	28,543
2010	37,875

Source: U.S. Census Bureau

2.9.1.3 Cultural Practices

According to the Cultural Impact Assessment (CIA) (see Appendix H), consultation with cultural informants indicates that burials are the most important native Hawaiian cultural resource in the area. Known burials and possible inadvertent finds of additional burials are discussed in Section 2.11. Otherwise, no known traditional cultural activities were documented in the study area, including those of non-Hawaiian cultures. Although several other archaeological or historic properties have been identified (see Section 2.11), they do not appear to be associated with active traditional cultural practices. Multiple native Hawaiian *heiau* (temples) and shrines are located in the general vicinity of Kailua-Kona (see archaeological inventory survey in Appendix E for more details), although none are located directly adjacent to the proposed project.

2.9.1.4 Community Services

A fire and ambulance station are located on Palani Road a few blocks mauka from its intersection with Kuakini Highway. A police station is approximately two miles north of Kuakini Highway on Queen Ka‘ahumanu Highway.

2.9.2 Potential Impacts

Growth is anticipated to continue in Kailua-Kona. As it becomes a more urbanized community and economic vitality increases, the town’s infrastructure needs will grow correspondingly.

The No-Build Alternative would not address the need for additional transportation infrastructure, and therefore is likely to result in degraded quality of life, as well as hindrance of the community’s economic vitality. Access to essential community and emergency services such as police, fire, and ambulance, may be diminished in the No-Build scenario because traffic congestion would not be addressed. No impacts to burials or cultural resources are foreseen, beyond what may occur as a direct result of other development along the Kuakini Highway corridor.

In contrast, the Build Alternative would better address the growing regional transportation needs. It would facilitate access to community resources and services by reducing congestion, while also creating a more walkable community and thus enhancing the quality of life. Emergency services would be better able to serve the community. More motorists may be encouraged to use this travel corridor, rather than discouraged by congested traffic as already

exists in some parts, increasing opportunities for existing and future businesses on Kuakini Highway. Construction activity would also temporarily contribute to the local economy.

It is anticipated that none of the *heiau* in the Kailua-Kona area would be directly or indirectly affected by the proposed project. Known burials on Kuakini Highway would not be affected by the proposed action. As yet unknown burials may be discovered during project construction and would likely be relocated (Section 2.11).

2.9.3 Mitigation Measures

No mitigation measures are needed to address socio-economic impacts of the Build Alternative, which are generally assumed to be positive. The potential cultural impact on burials and appropriate mitigation measures are described in Section 2.11 as part of historic/archaeological resources.

2.10 ENVIRONMENTAL JUSTICE

Executive Order (EO) 12898 regarding Environmental Justice (EJ) requires federal agencies to take appropriate and necessary steps to identify and address disproportionately high and adverse effects of federal projects on minority and low-income populations' health or environment. Because of expected federal participation in the construction funding of this project, the project must comply with EO 12898.

There appear to be no minority populations in the study area in accordance with the minority definition contained in "FHWA Actions to Address Environmental Justice in Minority and Low-Income Populations (December 2, 1998)". Moreover, it should be noted that because Hawai‘i is unique in having a majority of traditionally-defined "minority" residents, who are otherwise not marginalized, the ethnicity criterion under EJ is often meaningless when applied to Hawai‘i.

A more revealing EJ criterion for Hawai‘i is income. Census tract-level analysis indicates that Kailua-Kona is either on par with or more affluent than the County of Hawai‘i norm. However, small residential areas have been identified along the project corridor as possible low-income neighborhoods. These areas are 1) Kama‘aina Hale, a low-income housing project owned by the Housing and Community Development Corporation of Hawai‘i (HCDCH) and operated by Hawai‘i Affordable Properties, and 2) the so-called Duarte Apartments, a cluster of rental properties near the northeast intersection of Kuakini Highway and Onioni Street.

Because these areas were identified early in project planning, a concerted effort was made to reach out to these communities, provide timely information about the project, and extend invitations to a public informational meeting, including soliciting the assistance of owners/managers of these properties to hand-deliver notices of the public meeting to each residence. A summary of public outreach activities to date is provided in Section 3.1.

A noise impact would occur at Kama'aina Hale Condominium and a noise wall is proposed as mitigation. Outreach to Kama'aina Hale Condominium residents and owners would be conducted during the design and construction phases.

No other disproportionate or adverse effect on a low-income or minority population is foreseen as a result of this project.

2.11 HISTORIC AND ARCHAEOLOGICAL RESOURCES

2.11.1 Regulatory Requirements

Section 106 of the National Historic Preservation Act requires that federal agencies consider the effect of their projects (referred to as "undertakings" in Section 106) on any resource listed on or eligible for the National Register of Historic Places. In accordance with regulations provided in 36 Code of Federal Regulations (CFR) 800, 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 historic properties. Chapter 6E of the Hawai'i Revised Statutes, as described in regulations provided in Title 13, Chapter 275 of the Hawai'i Administrative Rules, places similar responsibilities on State agencies to evaluate their projects. Since the project involves both federal and State agencies, both regulations apply to the project.

After initiating the Section 106 process, the federal sponsoring or regulating agency identifies whether there are any historic properties in the project's Area of Potential Effect (APE); assesses whether properties identified in the APE would be adversely affected by the proposed project; and resolves adverse effects, if necessary. The APE is defined as the geographic areas within which an undertaking may directly or indirectly cause changes in the character of historic properties, if any such properties exist. Adverse effects, if any, are resolved through a Memorandum of Agreement with the SHPO, which may include the ACHP.

For a district, site, building, structure, or object to be considered eligible (or be considered "historic" or a "historic property") for the NRHP, it must be at least 50 years old and meet any one of the following criteria:

1. The site reflects major trends or events in the history of the State or nation;
2. The site is associated with the lives of persons significant in our past;
3. The site is an excellent example of a site type/work of a master; or
4. The site has yielded or may likely yield information important in prehistory or history.

The Hawai'i Register of Historic Places (Hawai'i Register) provides an additional criterion:

5. The site has traditional cultural significance to an ethnic group.

Under Section 106, the federal agency – in this case, FHWA – is responsible for assessing the effects of the project (i.e., Build Alternative) on all eligible historic properties within the APE. Pursuant to Section 106 (36 CFR 800), FHWA can render one of the following three possible findings:

- no historic properties affected;
- no adverse effect; or
- adverse effect.

"No historic properties affected" means that either there are no historic properties present, or there are historic properties present but the undertaking would have no effect upon them of any kind (that is, neither harmful nor beneficial).

"No adverse effect" means that there could be an effect, but the effect would not be harmful to those characteristics that qualify the property for inclusion in the National Register.

An "adverse effect" means an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property.

The Section 106 consultation process for the proposed project is on-going but would be completed before the Final EA. It is anticipated that the HRS Chapter 6E review would be concluded by SHPD in conjunction with the Section 106 process. Chapter 3, Appendix A, and the cultural impact assessment in Appendix H provide details of coordination conducted to date with the SHPD and cultural informants, pursuant to Section 106 and HRS Chapter 6E-8.

2.11.2 Area of Potential Effect and Study Methods

The APE was selected to be a 200-foot wide corridor centered on the center of the existing Kuakini Highway. Therefore, the APE extends 100-feet mauka and makai from the center line of the existing roadway. This APE was selected for the following reasons:

- The APE incorporates the entire existing Kuakini Highway ROW. The ROW is 80 feet wide; therefore, the APE extends 60 feet beyond the ROW into neighboring parcels.
- The APE incorporates all additional ROW that would be acquired. Design Alternative 1 requires no new acquisitions but Design Alternative 2 requires up to 10 feet of new ROW be acquired (Section 2.2).
- The APE incorporates the entire limits of new roadway construction, including driveway modifications on adjacent parcels.
- Because the highway already exists, effects to historic properties beyond the immediate vicinity of the highway are not anticipated.
- Although the APE incorporates all construction areas, some potential construction staging areas could extend beyond the area surveyed. If land beyond the archaeological study area is needed for construction staging, it would be the responsibility of the contractor to survey and clear through an environmental review process the additional area (see Section 2.11.5).

To assist in identifying historic properties in the APE, International Archaeological Research Institute, Inc. (IARII) conducted an archaeological inventory survey (See Appendix E). The survey included a historic background survey and fieldwork to identify any undiscovered historic properties in and around the project site. IARII documented all sites found within the 200-foot APE corridor in its inventory survey.

In addition to the inventory survey, project planners invited early coordination comments from persons and organizations that might have knowledge of historic resources in the project area. The results of this early coordination were also useful for developing the APE. Coordination included the State Historic Preservation Division (SHPD), the Office of Hawaiian Affairs (OHA), Hui Malama I Na Kupuna O Hawaiʻi Nei, Kona Hawaiian Civic Club, and the Hawaiʻi Island Burial Council (HIBC), among others (See Appendix A for records of correspondence and Section 3.2 for a summary). Other consultation and public outreach was conducted via a public informational meeting held in Kailua-Kona on November 16, 2005, and interviews with cultural informants for the cultural impact assessment (CIA) prepared in conjunction with the inventory survey. The CIA is included as Appendix H of this EA, and is described in Section 2.9. A separate informational presentation to the Hawaiʻi Island Burial Council was made on January 18, 2006 in Kailua-Kona.

The following sections discuss archaeological resources encountered using their site numbers. Site numbers are the official designations by the SHPD. All the site numbers listed in this document have been shortened to exclude the prefix "50-10-28," which indicates the USGS topographic quadrangle for the area (Kailua, Hawai'i). Therefore, site 50-10-28-11059 has been shortened to site 11059.

2.11.3 Existing Conditions

This section describes the historic properties identified in the project's APE. A historic property is any district, site, building, structure, or object that is on or eligible for the NRHP or the Hawai'i Register.

A total of 21 sites, some with multiple features, were recorded. The sites and features identified by IARII have been separated into the following categories:

A. Historic sites on which FHWA has determined the project would have no effect (not discussed in this report – see Appendix E for discussion):
   - Rock clearing pile, Site 11059 feature 4 (Figure 2-18)
   - Ranching wall, Site 15514 (Figure 2-18)
   - Rock outcrop, Site 22045 (possible) (Figure 2-18)
   - Rock wall, Site 22053 (possible) (Figure 2-18)
   - Wall remnants, Site 22054 (possible) (Figure 2-18)
   - Agricultural landscape, Site 23686 features 187, 188, 189, 190, 191, and 197 (Figure 2-18)
   - Rock mound, temporary Site 1 (Figure 2-19)
   - The four burials encountered during 16-inch diameter water line installation (they have been relocated outside the APE)
   - Coral/boundary walls, Site 23662 (Figure 2-18)
   - Rock outcrop/quarry, temporary Site 3 (Figure 2-18)
   - Lava blister, temporary Site 4/Site 25032 (Figure 2-18)

B. Sites evaluated in the IARII report and found to be modern or not meeting any of the criteria for NHRA eligibility (not discussed in this report – see Appendix E for discussion):
   - Modern rock wall on makai side of Kuakini Highway, Site 22057 (Figure 2-17, Figure 2-18, and Figure 2-19)
   - Modern rock wall on mauka side of Kuakini Highway, Site 23666 (Figure 2-17, Figure 2-18, and Figure 2-19)
   - Boundary wall, Site 23665 (rebuilt with concrete) (Figure 2-18)

C. Historic site on which FHWA has determined the project would have no effect, but further evaluation is necessary:
   1. Laniākea Cave, Site 7248 (Figure 2-17)

D. Historic sites on which FHWA has determined the project would have no effect, but avoidance and/or protection may be necessary:
   2. Temporary habitation site, temporary Site 2/Site 25030 (Figure 2-19)
   3. Kuakini's Wall, Site 6302 (Figure 2-19)

4. Memorial and burial, Site 21189 (Figure 2-17)
5. Platforms and occupation area, Site 5608 features BBB, CCC, DDD, and WWW (Figure 2-17)

E. FHWA has determined that the proposed project would have an adverse effect on the historic sites in this group; however, no mitigation is required because they have been fully documented and preservation is not deemed necessary:

6. Boundary and ranching wall, Site 6300 (Figure 2-19)
7. Kamehameha V LCA boundary wall, Site 11059 feature 8 (Figure 2-18)
8. Ranching boundary wall, Site 15508 (Figure 2-18)

All the sites listed above are discussed in detail in the IARII report (Appendix E) and illustrated in Figure 2-17, Figure 2-18, and Figure 2-19. Sites in category A are not discussed in the body of this EA because the project would not have any effect on them. Sites in category B are not discussed in the body of this EA because it was determined that they are not historic sites.

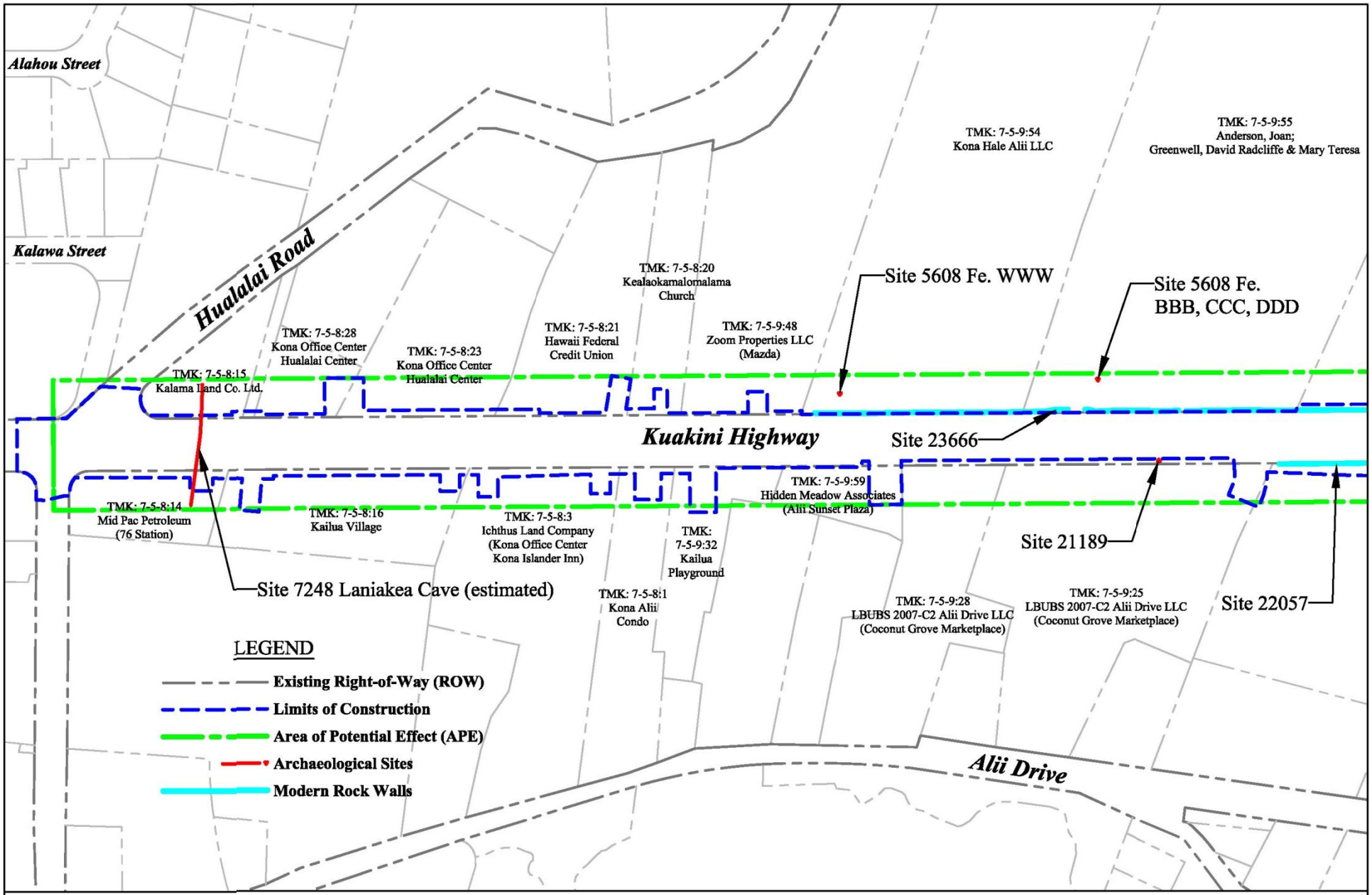
The numbered sites and features listed in categories C, D, and E are summarized in Table 2-10 and discussed briefly in Section 2.11.4.

A project to replace the water line beneath Kuakini Highway was completed in 2007. Four burials were inadvertently encountered during construction. One of those burials is discussed in the IARII report. Since discovery and the IARII report, an Archaeological Recovery Plan was prepared for the water line project and approved by SHPD. The burials had been removed and relocated.

Table 2-10: Historic Properties within APE

#	Site No.	Description/Function	NRHP Significance Criteria*	Hawai'i Register Significance Criteria*	Likely Effect	Recommended Action
1	7248	Laniākea Cave; possibly used for concealment/refuge (Figure 2-17)	D	D, E	None (protection during construction)	Preservation
2	25030 (Temp 2 in inventory survey)	C-shaped wall; temporary habitation (Figure 2-19)	D	D	None, protection needed	Avoidance; mitigation measures necessary if avoidance not possible
3	6302	Kuakini's Wall; boundary (Figure 2-19)	B, C, D	B,C,D,E	None, protection needed	Preservation
4	21189	Modern memorial, marking inadvertent discovery of human remains (Figure 2-17)	None	E	None, protection needed	Preservation
5	5608, Features BBB, CCC, DDD, and WWW	Platforms (habitation and probable burial features) and occupation area (Figure 1A)	D	D (all), E (features BBB, CCC, and DDD)	None, protection needed	Preservation required by County zoning; provide protection and limit access after construction
6	6300	Wall; ranching, boundary (Figure 2-19)	D	D	Adverse effect; removal within ROW	None (site fully documented)
7	11059, Feature 8	Rock wall; boundary marker (Figure 2-18)	D	D	Adverse effect; removal within ROW	None (site fully documented)
8	15508	Rock wall; boundary (Figure 2-18)	D	D	Adverse effect; removal within ROW	None (site fully documented)

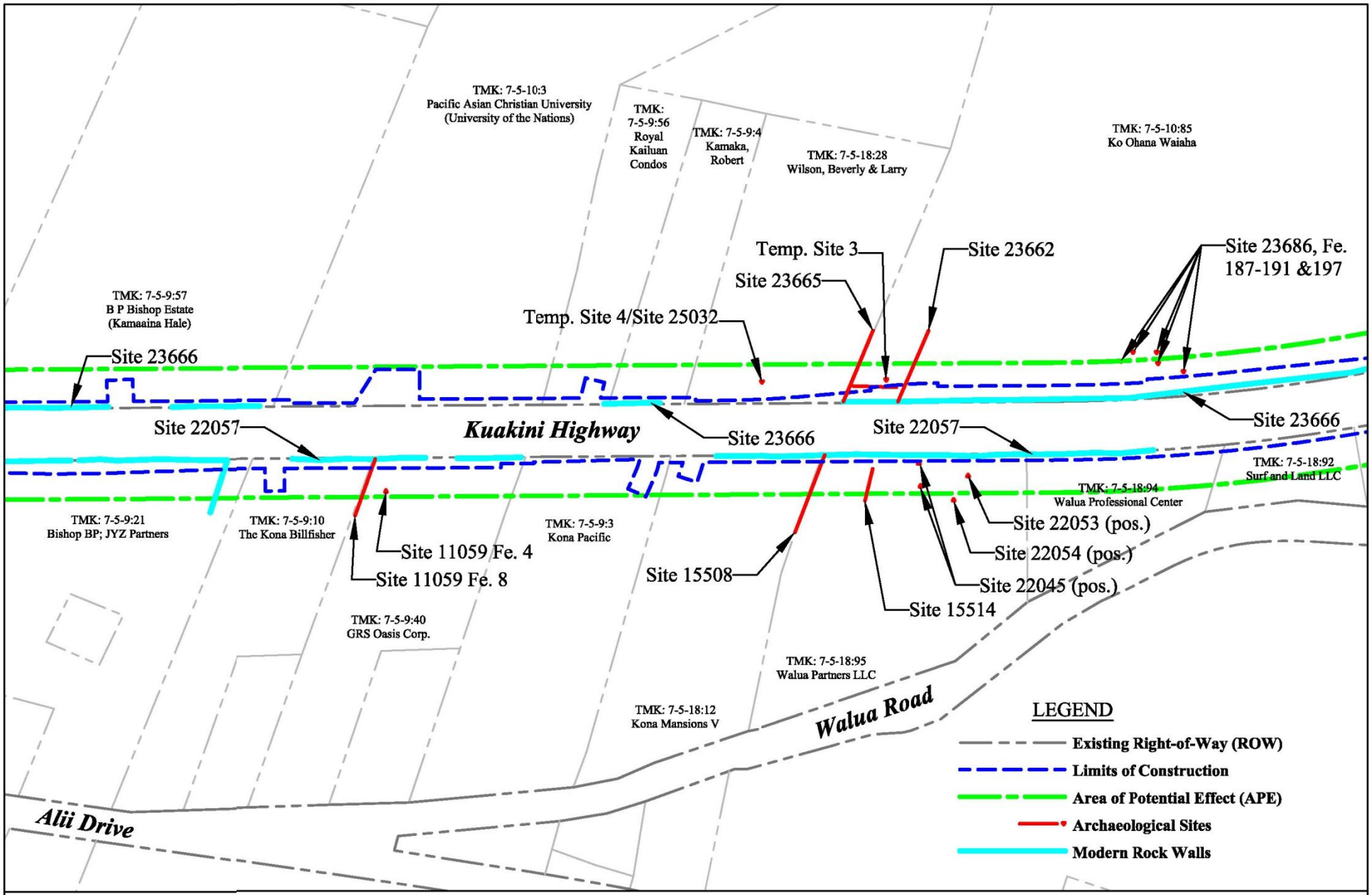
Source: International Archaeological Research Institute, Inc., July 2008.
Notes: * = State or National Register significance criteria, as follows:
B - Site is associated with the lives of persons important in our past.
C - Site embodies distinctive characteristics of a type, period, or method of construction, represents the work of a master, possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction.
D - Site has yielded, or is likely to yield, information important for research on prehistory or history.
E - Site has important historical cultural value to an ethnic group of the State (State criterion only).



Historic Properties in APE - Section 1

Kuakini Highway Improvements Project, Phase 2; Kailua-Kona, Hawaii

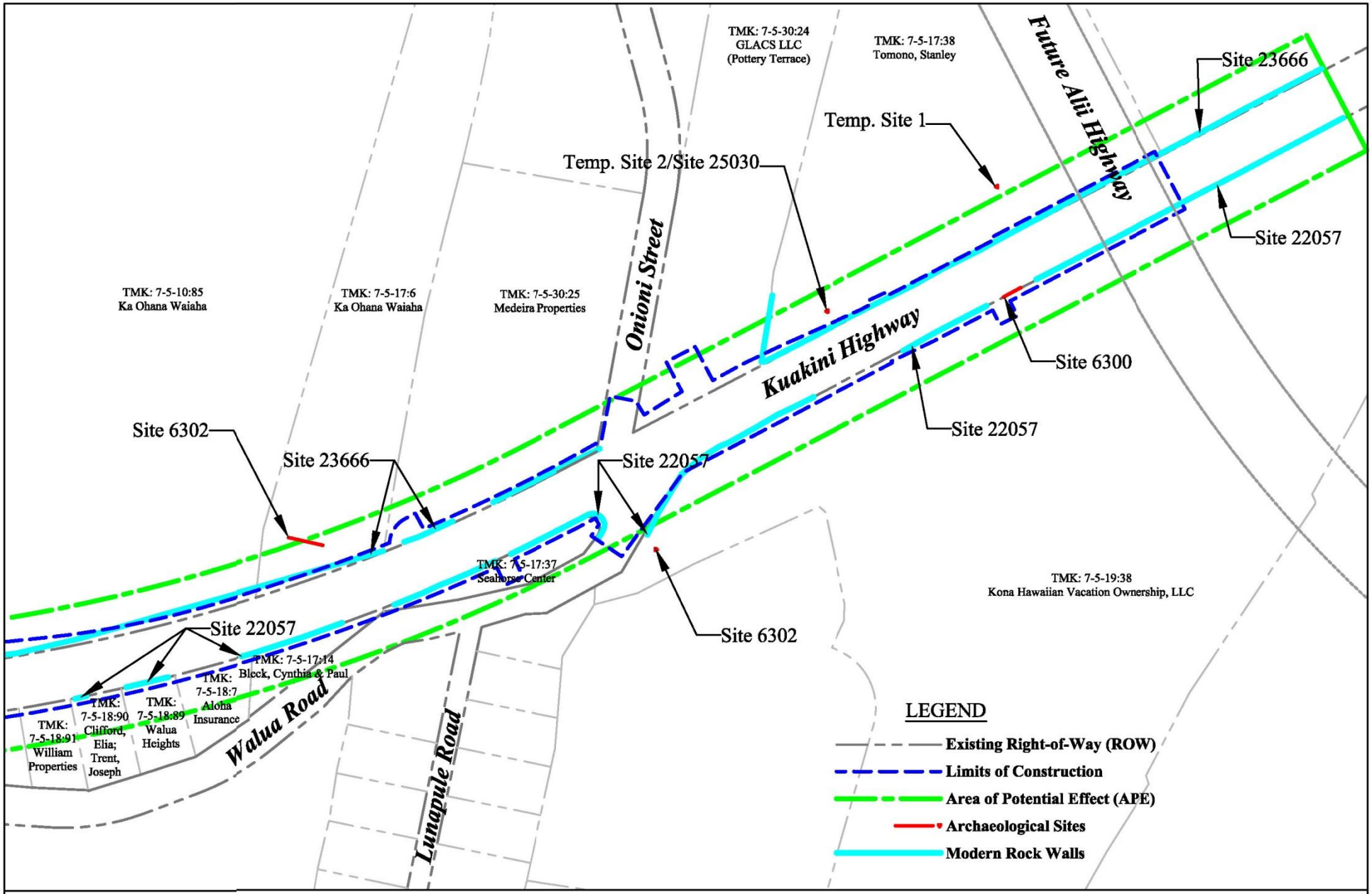
Figure 2-17



Historic Properties in APE - Section 2

Kuakini Highway Improvements Project, Phase 2; Kailua-Kona, Hawaii

Figure 2-18



Historic Properties in APE - Section 3

Kuakini Highway Improvements Project, Phase 2; Kailua-Kona, Hawaii

Figure 2-19

2.11.4 Potential Impacts

The following discussion describes each resource in categories C, D, and E, its significance criteria, and how it may be affected by the project. The descriptions and recommendations below are summarized from the "Archaeological Inventory Survey for the Kuakini Highway Improvements Project, Phase 2" (IARII, July 2008; Appendix E). In accordance with NHPA Section 106, significance evaluations and FHWA's effect determinations for each historic property are provided below. These determinations also apply to HRS Chapter 6E-8.

Under the No-Build Alternative, no historic properties would be affected.

Under the Build Alternative, the following historic properties in the APE may be affected by the project.

2.11.4.1 Laniākea Cave at Thurston House, Site 7248

Laniākea Cave is a lava tube associated with the historic Thurston House ruins. Consultation with cultural informants yielded information that the cave may have been used as a refuge or for concealment by soldiers during times of war (Cultural Surveys Hawai'i, Inc., 2005). Although Thurston House itself is not included in the APE, Laniākea Cave has been identified as a resource potentially affected by the project because its path crosses under Kuakini Highway. Its exact path is unclear, but the cave is known to connect an entrance near the ruins of Thurston House (some 800 feet beyond the archaeological survey area) with Hale Halawai on the coast of Kailua-Kona. According to surveys performed in recent times (Cultural Surveys Hawai'i, Inc., 2005), the cave does not intersect Keōpū stream or the concrete drainage structures downstream, but may come within 25 feet of the drainage canal. The cave is eligible for the NRHP under Criterion D, and the Hawai'i Register under Criteria D and E.

During Phase 1 of the Kuakini Highway Improvements Project (from Palani Road to Hualālai Road), it was assumed that that project would not have an adverse effect on Laniākea Cave. SHPD issued a Section 106 compliance letter that states a field inspection conducted by Marc Smith, SHPD staff archaeologist, and Thomas Pack, DPW, noted that "It appears to us that the roof of the cave (a lava tube) is far enough below surface that the proposed work will have "no effect" on this significant historic site." A project to install a 16-inch diameter water line at a depth of three feet below ground level (total excavation depth during installation was approximately 5 feet below ground level) on the makai shoulder of the highway did not encounter the cave. Furthermore, Kuakini Highway and surrounding buildings has been present at this location, presumably above a portion of the cave, without the cave being encountered or the improvements being damaged.

Attempts were made to contact the Laniākea Foundation, stewards of the cave, but no response has been received.

For these reasons, the FHWA has rendered a "no effect" determination for Laniākea Cave. This determination was reached based on available evidence indicating the cave is at a sufficient depth that it would not be affected by the project. However, during the design phase, project engineers would make reasonable efforts to inspect the cave to verify the cave's alignment and depth beneath the project area, particularly where relatively deep excavations would be necessary for items such as utility and light poles. A cave skylight covered by a concrete slab and grate, located southeast of the Hualālai Road intersection on TMK 7-5-008:015 is a potential entry point for the future inspection. If necessary, the roof of the cave would be bridged, as described in Section 1.4.2.

2.11.4.2 C-Shaped Structure, Site 25030/Temp Site 2

This C-shaped structure is located in the vacant parcel adjacent to Pottery Terrace, and is at least 14 feet from the limits of construction. It is constructed of stacked pebble and cobble-sized *a'a* clinkers, and is built on the edge of an *a'a* lava flow. It may have served as temporary habitation. The site was surrounded by dense vegetation. It is deemed eligible for the NRHP and the Hawai'i Register under Criterion D. The inventory survey recommended avoidance of this site.

The FHWA has rendered a "no effect" determination for this site. It should not be directly affected by construction, but due to its proximity to the construction site construction fencing would be installed as a precautionary measure during construction to ensure it is avoided and protected.

2.11.4.3 Kuakini's Wall, Site 6302

Two segments of Kuakini's Wall, also known as the Great Wall of Kuakini, were found on either side of Kuakini Highway near the Onioni Street/Walua Road intersection with Kuakini Highway. The existing Kuakini Highway appears to have breached this wall. The wall is eligible for the NRHP and the Hawai'i Register under Criteria B, C, D, and E (Hawai'i Register only).

The wall is a well-recorded and important archaeological feature, spanning about 5.6 miles from Kahaluu to Keahuolu and averaging 8 feet in height. The wall appears to have been expanded or rebuilt from an older wall by Governor Kuakini in the 19th century to keep cattle out of homes and gardens.

The FHWA has rendered a "no effect" determination for this historic wall. The distance of this site from the limits of construction indicates that there would be no direct construction-period impacts on this wall. Due to the importance of this wall, installing construction fencing around the closest termini of these wall segments is recommended as a protective measure during the widening of Kuakini Highway.

2.11.4.4 Burial, Site 21189

This burial lying within the Kuakini Highway ROW was an inadvertent discovery in 1998 during the construction of Coconut Grove Marketplace. The human remains were not directly associated with an individual or a specific family in the area. The remains were left in place, and a stone memorial was erected on the sidewalk which now fronts the shopping center. The remains are a little more than 2 feet (about 70 centimeters) below the surface. This site is not eligible for the NRHP, but is eligible for the Hawai'i Register under Criterion E.

The proposed project would not disturb this feature or the sidewalk on which the memorial is placed. The pavement adjacent to the sidewalk would be removed to about a two-inch depth to prepare the roadway for new pavement; the roadway's base course would not be disturbed. Therefore, no effect is anticipated for this burial and monument.

2.11.4.5 Platforms and Occupation Area, Site 5608 Features BBB, CCC, DDD, and WWW

Features BBB, CCC, and DDD of Site 5608 are located east (mauka) of the roadway, across from Coconut Grove Marketplace. The features are described as platforms, which are likely to be eligible for NRHP under Criterion D, and eligible for the Hawai'i Register under Criterion D and E. Feature WWW is described as an occupation area, noted by a scatter of coral and

marine shells on a pahoehoe outcrop. This feature appears to have been disturbed by bulldozing. It is likely to be eligible for NRHP and the Hawai'i Register under Criterion D. None of the features are within the Kuakini Highway right-of-way; features BBB, CCC, and DDD are roughly 50 feet from mauka of the anticipated limits of construction (LOC), and feature WWW is roughly 30 feet from the LOC.

A County zoning ordinance passed in 2005 stipulated that all sites on in these parcels (TMK 7-9-5:55 and portion of 54) are to be protected as an archaeological preservation area.

The archaeological inventory survey (Appendix E) indicates that features BBB, CCC, and DDD should be regarded as particularly sensitive, because they are likely to be traditional Hawaiian community features that may contain burials. The primary concern for these features is disturbance during or after construction, because of increased visibility and ease of access when the road is widened, and because the existing rock walls along the road (modern Site 23666) would be removed by construction activities.

The FHWA has rendered a "no effect" determination for this site. It would not be directly affected by construction due to its distance from construction activities. To protect the features, as recommended by the survey, the following precautions would be taken:

- Install temporary construction fencing between the features and the LOC to protect the features during construction.
- Install rock walls along the highway ROW in the vicinity of the features, if no retaining wall 4 feet high or higher is required by the project, to create a physical barrier preserving a buffer area of at least 30 feet between widened Kuakini Highway and the features.

2.11.4.6 Boundary and Ranching Wall, Site 6300

This wall is located on the makai side of the southern project terminus. It is likely to be eligible for NRHP and the Hawai'i Register under Criterion D. It is a ranching wall and a boundary, which helped keep cattle out of house lots and gardens. The wall is eroding and/or collapsed, and has several large breaches which were likely made by the original construction of Kuakini Highway.

Under both Design Alternatives 1 and 2, this wall would need to be removed because it coincides with the edge of the existing ROW. The archaeological inventory survey indicates this wall has been fully documented and does not recommend any mitigation. Because a small portion of the wall would be removed, the FHWA has rendered an "adverse effect" determination for the historic wall. However, no mitigation is proposed because the wall has been fully documented.

2.11.4.7 Rock Wall, Site 11059, Feature 8

This feature at the site is eligible for the NRHP and the Hawai'i Register under Criterion D. According to the inventory survey, the feature consists of rock walls associated with a land claim award (LCA) in the ahupua`a of Pua`a. It abuts another wall (modern Site 22057) that lies parallel to the edge of Kuakini Highway.

Because the modern highway walls in this section are likely to be removed, feature 8 would also be removed where it is within the highway right-of-way. The archaeological inventory survey indicates this wall has been fully documented and does not recommend any mitigation. Similar to Site 6300, the FHWA has rendered an "adverse effect" determination for the historic wall

because a small section of it would be removed. However, no mitigation is proposed because the wall has been fully documented.

2.11.4.8 Rock Wall, Site 15508

Site 15508 is a ranching wall that may also have been an ahupua`a boundary wall. It is eligible for the NRHP and the Hawai'i Register under Criterion D. Similar to Site 11059, this wall also abuts the modern wall (Site 22057) running alongside the highway. The portion of the wall within the highway ROW would be removed.

Similar to Sites 6300 and 11059, the FHWA has rendered an "adverse effect" determination for the historic wall because a small section of it within the highway ROW would be removed. However, no mitigation is proposed because the archaeological survey indicates the wall has been fully documented.

2.11.4.9 Additional Resources

Inadvertent discovery of subsurface cultural deposits is possible during construction. If a burial is encountered during construction, all work in that area would be temporarily halted, and the proper agencies and organizations would be notified, including the SHPD.

2.11.5 Mitigation Measures

Archaeological monitoring would be conducted during construction. A monitoring plan would be prepared and submitted to SHPD for approval prior to construction.

Should the selected contractor require a construction staging area beyond those areas already surveyed, it would be an obligation of the contractor to conduct additional archaeological survey for any areas not previously addressed by this or other projects. Mitigation similar to that specified below for similar resources would be implemented for any sites found in the new survey area.

2.11.5.1 Laniākea Cave at Thurston House, Site 7248

During the design phase, project engineers would inspect the cave and the location of the reported opening possibly adjacent to Kuakini Highway. If it is determined that cave does pass underneath the roadway and is deemed to be shallow, which current information does not support, the roof of the cave would be bridged, as described in Section 1.4.2.

2.11.5.2 Temporary Habitation Site, Temporary Site 2/Site 25030

Construction fencing would be installed as a precautionary measure during construction to ensure this site is avoided and protected.

2.11.5.3 Kuakini's Wall, Site 6302

No adverse effect on this wall is anticipated. However, as a precaution during construction, temporary construction fencing would also be placed around this feature. Because this site is located on property to be developed for the Hualālai Village/Pacific Islands Cultural Center, mitigation for the Kuakini Highway Improvements project would be made consistent with the relevant portions of the treatment and mitigation plan that would be developed by the other project.

2.11.5.4 Memorial and Burial, Site 21189

Care would be taken during construction to avoid and preserve the burial by limiting the depth of disturbance in the area.

2.11.5.5 Platforms and Occupation Area, Site 5608 Features BBB, CCC, DDD, and WWW

As mentioned above, a preservation plan by third parties is anticipated for Site 5608, Features BBB, CCC, DDD, and WWW. This site and features are part of a property protected by County Ordinance as a historic preservation area. Therefore, a third party is slated to develop an archaeological preservation plan covering TMKs 7-9-5:55 and 54, including the historic properties within Kuakini Highway's APE. In the event that the preservation plan is not completed by third parties prior to DPW proceeding with the proposed roadway improvements, DPW would:

- Install temporary construction fencing between the features and the limits of construction to protect the features during construction.
- Install rock walls along the highway ROW in the vicinity of the features, if no retaining wall 4 feet high or higher is required by the project, to preserve a buffer area of at least 30 feet between widened Kuakini Highway and the features.

2.11.5.6 Rock Walls, Sites 6300, 11059, and 15508

Although these sites may be damaged or dismantled during construction of the proposed project, no preservation or other mitigation measure is proposed. According to the inventory survey, these sites have been fully documented and no further work or preservation is deemed necessary.

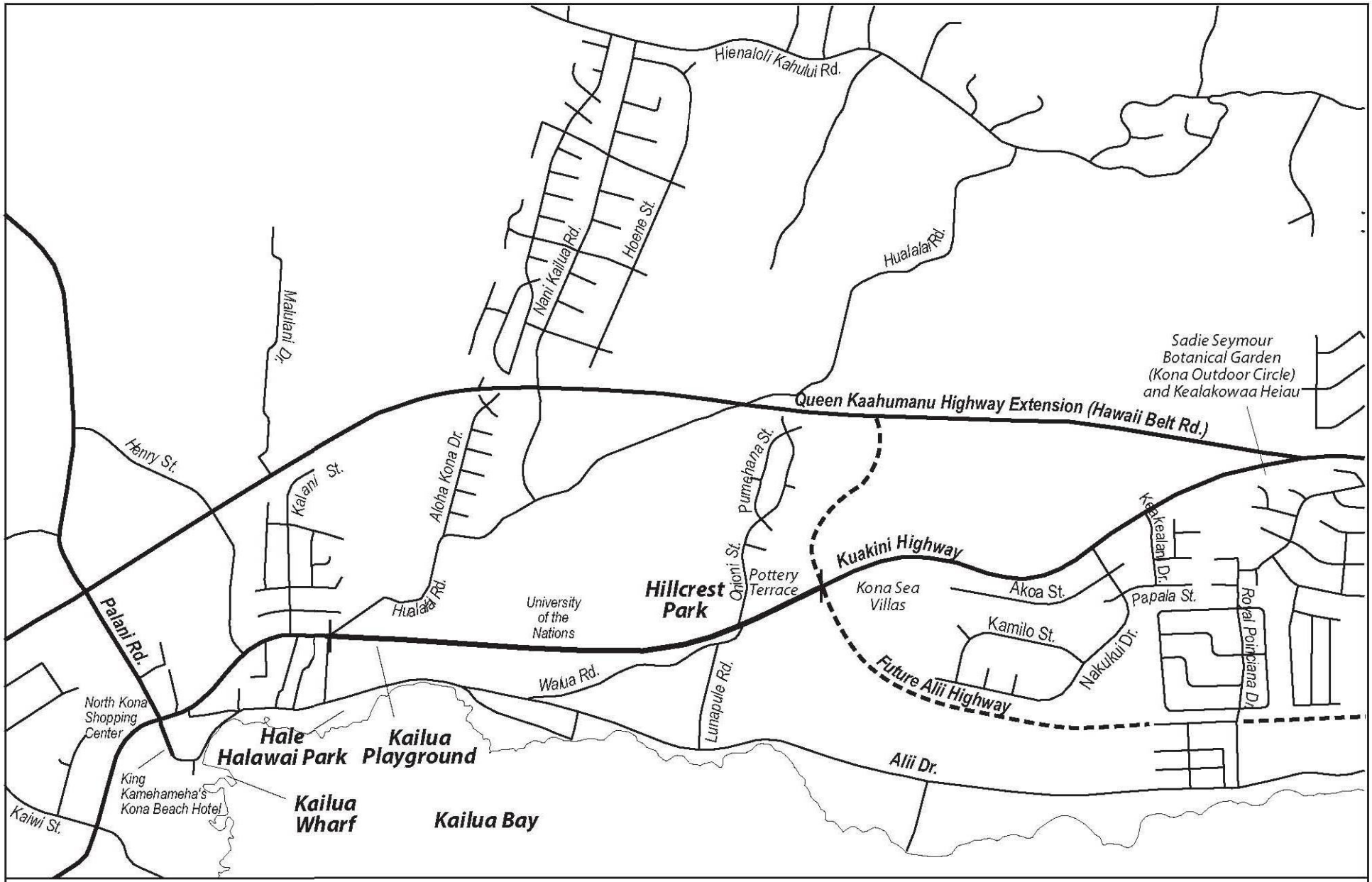
2.11.5.7 Additional Resources

Archaeological monitoring would be conducted during construction. A monitoring plan would be prepared and submitted to SHPD for approval prior to construction. Generally, if a burial is encountered during construction, all work in that area would be temporarily halted, and the proper agencies and organizations would be notified, including the SHPD. It is anticipated that any new burials would be relocated similarly to those encountered during the water line work within the Kuakini Highway right-of-way.

2.12 PARKS AND RECREATIONAL RESOURCES

2.12.1 Existing Conditions

In Kailua-Kona, coastal recreation is an important element to the visitor industry as well to the quality of life of local residents. Coastal recreational resources and properties near the project site include Kailua Bay, Kailua Wharf and Ramp, and Hale Halawai Park. Kailua Bay is the starting point for the world-famous Iron Man Triathlon. Parks near the project limits include Kailua Playground and Hillcrest Park (see Figure 2-20). Access to the 0.7-acre Kailua Playground is from Kuakini Highway, via a steep driveway because the facility is roughly 11 feet below the roadway. The County-owned park includes a basketball court, tennis court, and a comfort station. Hillcrest Park is located within the Hillcrest residential subdivision flanking Onioni Street, which intersects with Kuakini Highway. It lies about 500 feet mauka of the intersection of Kuakini Highway and Onioni Street.



Parks and Recreational Resources

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

Figure 2-20

2.12.2 Potential Impacts

The proposed road widening would bring the edge of Kuakini Highway closer to Kailua Playground. As a result, the park access road would have to be reconfigured; the driveway would become slightly steeper, going from a grade of 17 percent to 18 percent, and the slope of the driveway would extend further into the park. Currently the base of the driveway matches the overall playground grade approximately 42 feet west (makai) of the Kuakini Highway ROW; after widening, the driveway would match park grade approximately 74 feet west (makai) of the ROW. This driveway modification would result in a loss of 1,280 square feet of level ground within the parking area of the playground (an area 32 feet long by 40 feet wide). Even at the new grade of 18 percent the park access road would meet federal driveway criteria. Aside from this change to the existing driveway, playground amenities would be unaffected.

Hillcrest Park is not adjacent to Kuakini Highway and would not be impacted by the widening project.

2.12.3 Mitigation Measures

Under the Build Alternative the park access road as reconfigured would be steeper than before the highway widening. The construction of a new park access route through the shopping center was considered but rejected because the new driveway grade of 18 percent would still meet federal driveway criteria.

2.13 SECTION 4(F) EVALUATION

Section 4(f) of the Department of Transportation Act, 49 U.S.C. 303 and 23 U.S.C. 138 (referred to hereafter as “Section 4(f)”), permits the use of land for a transportation project from a significant publicly-owned public park, recreation area, wildlife and waterfowl refuge, or a historic site only when the FHWA has determined that:

- There is no feasible and prudent alternative to such use; and
- The project includes all possible planning to minimize harm to the property resulting from such use.

The purpose of Section 4(f) is to preserve significant parkland, recreation areas, refuges, and historic/archaeological sites by limiting the circumstances under which such land can be used for transportation projects. The word “use” in this case means:

- Land is permanently incorporated into a transportation facility;
- There is a temporary occupancy of land that is adverse in terms of preservation of the resource; or
- The project’s proximity to the site substantially impairs those functions that qualify the site as a Section 4(f) resource even though no land is permanently or temporarily acquired. This is called “constructive use.”

As noted in Section 2.12, the proposed action would not take lands from publicly-owned public parks or recreational facilities, but does require a modification of the driveway into the park from Kuakini Highway (Section 1.4.2.1). The project area does not contain wildlife and waterfowl refuges. Several historic sites would be affected, as discussed in Section 2.11, but none of the affects are considered “adverse” as defined by regulation.

Section 3.2.4 of this EA describes regulatory coordination activities conducted for this project, pursuant to Section 4(f).

2.13.1 Kailua Playground

As discussed in Section 2.12, neither design alternative of the project would take any land from Kailua Playground but both design alternatives would require the driveway access be modified (Section 1.4.2.1). The project is considered to avoid the playground because no playground land would be acquired. The driveway modification would constitute a temporary occupancy of the playground; however, it is not deemed an adverse impact because the modification would restore and preserve the only access into the playground. The project is not considered a constructive use of the playground because Kuakini Highway already boarders the playground and provides access to the playground.

Driveway modifications would result in a loss of approximately 1,280 square feet of level ground within the parking area of the playground. Playground amenities, such as basketball courts, would be unaffected. Because the playground amenities would be unaffected and the park would not lose any area, the impact to Kailua Playground could be categorized as a *de minimus* impact. A *de minimus* impact is defined as an impact that does not "adversely affect the activities, features, and attributes" of the Section 4(f) resource, in this case the playground. The USDOT generally considers any parking lot encroachment or similar type of land use to be a *de minimus* impact.

As described in Section 3.2.4 of this EA, the FHWA has contacted the County of Hawai'i Department of Parks and Recreation to solicit their assessment of the project's impacts to Kailua Playground. If the Department of Parks and Recreation agrees that the impact to the playground is a *de minimus* impact, then the requirements of Section 4(f) would be complete. If the Department of Parks and Recreation feels the impact is beyond a *de minimus* impact, then further consultation and mitigation of the impact would be pursued.

2.13.2 Historic Resources

An historic site falls within the protection afforded by Section 4(f) only if it is on or eligible for the National Register of Historic Places. Section 4(f) does not apply to archeological sites where the Administration, after consultation with the SHPO, determines that the archeological resource is important chiefly because of what can be learned by data recovery and has minimal value for preservation in place.

Neither design alternative would have an adverse effect on any historic resource. As discussed in Section 2.11, some historic rock walls would be dismantled where they are within the Kuakini Highway ROW; preservation or avoidance is not deemed necessary because they have been fully documented. Other historic resources within the project APE, such as Kuakini's Wall and Laniākea Cave, would be avoided and protected to prevent an adverse affect. Modern memorials marking the discovery of human remains during other recent construction projects would not be affected by the project; in addition, they are not eligible for the National Register of Historic Places and therefore do not fall under the provisions of Section 4(f).

As described in Section 3.2.4 of this EA, the FHWA determination of no adverse affect on historic resources has been submitted to the SHPD for concurrence. If the SHPD agrees that there would be no adverse affect to historic resources, then the requirements of Section 4(f) would be complete. If the SHPD disagrees with FHWA's determination, then further consultation and potentially mitigation would be pursued.

2.14 CONSTRUCTION IMPACTS

2.14.1 Maintenance of Traffic

Construction activities would cause motorists, bicyclists and pedestrians traveling on Kuakini Highway to experience delay and inconvenience for approximately 2 years, the estimated duration of construction. To minimize traffic and access problems on Kuakini Highway and adjacent side streets, construction phasing, pedestrian control plans, traffic control plans, and maintenance of driveway access plans would be developed and implemented. Traffic would probably be shifted as required to the makai side, then later to the mauka side of Kuakini Highway. Local access to residences and businesses and turning movements at intersections would be maintained as much as possible during all phases of construction. Pedestrian movements would be maintained but may be temporarily relocated to provide safe passage through work areas.

Construction activities which could not maintain two lanes of traffic would be restricted to off-peak hours whenever feasible. Lane closures during non-peak periods may occur during clearing and grubbing, cold-planing, resurfacing, restriping, and when traffic control devices, such as portable traffic barriers, are being secured. It is anticipated that reconstruction of the existing roadway will be necessary in most areas; however, during the project design phase the possibility of using overlay pavement in some areas to shorten and minimize lane closures will be considered.

All properties with a driveway access to Kuakini Highway would be affected by driveway re-alignment. The contractor would coordinate all driveway work with property owners and occupants prior to start of construction. Driveway re-construction work would take one to two weeks per driveway depending on site specific conditions. Steeper driveways may take longer. Traffic access would be maintained as much as possible, but some sites may require access restrictions for short durations. Driveway closures would be coordinated with owners and/or occupants, as necessary.

2.14.2 Air Quality

Air quality impacts during roadway construction generally consist of fugitive dust and mobile source emissions from construction equipment.

Fugitive dust is airborne particulate matter, of usually large particle size, generated by construction vehicles operating around construction sites and from material blown from uncovered haul trucks, stockpiles, and exposed areas. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately because its generation varies greatly depending upon the type of soil, the amount and type of dirt-disturbing activity, the moisture content of exposed soil, and wind speed.

Frequent watering would control fugitive dust at construction sites. In addition, wind screens may be used in areas near residences and commercial districts, as well as limiting the areas of disturbance at any given time. Landscaping would be established as early as possible. To prevent haul trucks from tracking dirt onto paved streets, tire washing or road cleaning may be appropriate. State regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting wind-erodible materials.

Construction vehicles would emit engine exhaust. The largest of this equipment is usually diesel-powered, which emit relatively high levels of NOx in comparison to gasoline-powered

equipment. However, standards for such pollutants are set on an annual basis and would therefore not likely be violated by short-term construction equipment emissions.

2.14.3 Noise

Construction noise is discussed in detail in the Traffic Noise Impact Technical Report included in Appendix G. Construction would involve the use of heavy machinery that may cause temporary noise impacts to adjacent noise sensitive land uses. Table 2-11 presents maximum noise levels (Lmax) of heavy mobile construction equipment and compressors measured at a distance of 50 feet. Construction would normally occur during daylight hours when occasional loud noises are more tolerable. In addition, most of the construction site would not be near noise sensitive land uses. Therefore, extended noise disruptions to normal activities are not anticipated.

Table 2-11: Construction Equipment Noise Levels

Source	Lmax (dBA) at 50 Feet	Model Tested
Backhoe	85	John Deere 609A
Front Loader	84	Caterpillar 980
Dozer	84	Caterpillar D7e
Grader	91	Caterpillar 16
Scraper	92	Caterpillar 660
Compressor	80-89	Various Tested
Pile Driver	95-100	Various Tested

Source: Federal Highway Administration, Highway Construction Noise: Measurement, Prediction, and Mitigation, 1976.

Since HDOH maintains community noise control standards (HAR Section 11-46) that apply to construction noise, these specifications would be followed. A noise permit would be obtained for construction activities performed during standard work hours. If certain construction activities require work beyond standard work hours (Monday through Friday 7am through 6pm and Saturday 9am through 6pm), a noise variance will be obtained.

2.14.4 Water Resources

The primary potential for construction-phase water resource impacts would be associated with erosion and sedimentation associated with the project's clearing and earthmoving activities, and alteration of existing drainage patterns.

Storm water runoff and erosion during project construction and landscaping would be mitigated through the use of construction Best Management Practices (BMPs) established and permitted before work begins. Generally accepted BMPs likely applicable to this project include:

- Silt curtains and fences;
- Minimizing areas of disturbance;
- Covering of stockpiles;
- Stabilizing highly erodible/critical areas using vegetation and/or mulching as soon as possible; and
- Construction of dikes or diversions to avoid runoff across erodible areas.

Because the construction area is larger than one acre, the specific BMPs to be implemented would be approved by the HDOH when they issue the National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge Permit for this project.

2.14.5 Solid Waste Management and Hazardous Waste

Good housekeeping practices would be required of the contractor, such as ensuring that:

- All waste materials be collected and stored in securely lidded dumpsters that are emptied before becoming overly full and not buried on site;
- Materials stored on-site be stored in a neat, orderly manner in appropriate containers (i.e., per manufacturers recommendations);
- All on-site vehicles be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage; and
- A spill prevention and clean-up plan is prepared and implemented if needed.

All sanitary waste generated during the construction phase would be collected from portable units as required and directed to a HDOH-permitted treatment facility.

As stated in Section 2.1.1.3, hazardous materials contamination is not likely to be uncovered during construction. However, during construction personnel should be alert for signs of potential petroleum contamination when soil is excavated. The contractor should be aware that petroleum products are stored in underground tanks in the area and undocumented releases could have occurred. If contamination were identified during construction, the contractor would report it immediately to DPW and HDOH. Handling of hazardous materials and possible site remediation would be required in accordance with applicable State and federal laws, specifying the handling, treatment, and disposal of contaminated materials.

2.14.6 Historic and Archaeological Resources

As detailed in Section 2.11, the contractor would be instructed to (a) implement mitigation measures such as the use of orange construction fencing around sensitive sites, and (b) have an archaeological monitor on site during ground disturbing activities.

Construction activities have the potential to encounter undocumented burial and archaeological sites. If such a site were uncovered during construction, work would stop and the appropriate authorities, including SHPD, would immediately be notified. Construction would resume upon approval of the appropriate authorities.

2.14.7 Utilities

As stated in Section 2.3.3.3, a number of utilities would require relocation. During design and construction, substantial planning and coordination with utility providers would occur to minimize interruptions in utility service to customers. Disruptions to utility service, if necessary, would be restricted to short-term localized events. Careful scheduling of these disruptions and prior notification to occupants of affected properties would mitigate these impacts.

2.15 SECONDARY AND CUMULATIVE IMPACTS

2.15.1 Potential Secondary Impacts

Urban development will proceed in Kailua-Kona regardless of the widening of Kuakini Highway. While widening Kuakini Highway would help improve the regional roadway network, factors affecting development such as demand, property prices and disposable income levels are likely to have a far greater effect on development pressures. Given the factors above and the

coverage of the existing roadway network, this roadway widening is not constraining proposed development, and proceeding with the project would have only a minor effect on overall development trends in Kailua-Kona. Therefore, the proposed project would not induce secondary land uses.

In addition to the direct impacts of eliminating unlawful on-street parking, lack of parking may have secondary impacts on some commercial shopping areas/and or other properties along and near Kuakini Highway. More vehicles may be parked in those areas because of the high demand for parking in the area. Private parking in the area may experience more demand, and possibly unauthorized use, due to the removal of the unlawful street parking.

DPW does not anticipate additional secondary impacts that would otherwise not occur. This project is intended to be a proactive planning effort to address transportation infrastructure needs created by continued growth in Kailua-Kona.

2.15.2 Potential Cumulative Impacts

This project would not result in commitments to implement other projects. The Ali‘i Highway project is proceeding concurrently, regardless of the proposed Kuakini Highway widening. The proposed project also would not result in cumulative effects on the environment. Kuakini Highway is an existing piece of the transportation network, and its widening has been planned and anticipated by the community. The Kuakini Highway corridor will become gradually more urbanized, but development in the Kailua-Kona region is reflected in existing planning documents and County zoning. Transportation improvements are needed to help address existing traffic congestion and future travel demand in the region.

As regional development progresses, historic properties, including burials, are likely to continue to be discovered throughout the Kailua-Kona area. Although the Kuakini Highway Improvements Project may contribute to the discovery and disturbance of such historic properties, DPW commits to the appropriate treatment and mitigation of such impacts, as addressed in Section 2.11.

CHAPTER 3
COMMENTS AND COORDINATION

3.1 AGENCY AND STAKEHOLDER CONSULTATION

3.1.1 Pre-Assessment Consultation

The agencies, organizations, and landowners listed in Table 3-1 were contacted by letter (see Appendix A) and asked if they were aware of any environmental or social issue associated with the proposed project, or if they had any such concerns. The table also indicates with an asterisk (*) those parties that responded to the request for comments. Copies of the responses are also provided in Appendix A. Section 3.1.3 provides a brief summary of these and other comments received during the preparation of this Draft EA. An acknowledgement letter or postcard was sent to all responding parties on January 30, 2006.

Table 3-1: Pre-Assessment Consultation List

Agency	Date of Response*	Other Consultation Conducted
FEDERAL		
Federal Emergency Management Agency, Hazard Identification Branch		
U.S. Army Corps of Engineers (USACE)	11/1/05	See Section 3.2.3
U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS)	11/9/05	
U.S. Department of the Interior, U.S. Geological Survey, Water Resources Division		
U.S. Department of the Interior, Fish and Wildlife Service (USFWS)	11/4/05	See Section 3.2.2
U.S. Environmental Protection Agency (EPA), Pacific Islands Contact Office		
STATE		
Department of Accounting and General Services (DAGS)		
Department of Agriculture		
Department of Business, Economic Development & Tourism		
Office of Planning		
Office of Planning, Hawai‘i CZM Program		
Department of Defense		
Department of Education (DOE)		
Department of Health (HDOH)		
Clean Water Branch	11/4/05	
Environmental Health Administration		
Environmental Management Division		
Noise Radiation and Indoor Air Quality		
Solid and Hazardous Waste Section	11/17/05	
Department of Land and Natural Resources (DLNR)		
Division of Forestry and Wildlife	11/3/05	See Section 3.2.2
State Historic Preservation Division		See Section 3.2.1
Department of Transportation		
Office of Environmental Quality Control		
Office of Hawaiian Affairs	11/30/05	
University of Hawai‘i		
Environmental Center		

Agency	Date of Response*	Other Consultation Conducted
Water Resources Research Center		
COUNTY OF HAWAI'I		
Bicycle / Pedestrian Safety Committee		
Civil Defense Agency		
Department of Environmental Management	11/3/05	
Department of Parks and Recreation		
Department of Parks Maintenance		
Department of Water Supply	11/3/05	
Hawai'i Fire Department	11/23/05	
Hawai'i Police Department	11/10/05	
Mass Transit Agency		
Office of Housing and Community Development		
Office of the Mayor		
Planning Department		
UTILITIES		
The Gas Company		
Hawaiian Telcom		1/9/06 (phone and email)
Hawai'i Electric Light Company	11/1/05	12/30/06 (email)
Hawaiian Electric Industries, Inc. (HEI)		
Oceanic Time Warner Cable		1/10/06 (phone and email)
ELECTED OFFICIALS		
Councilmember K. Angel Pilago		
Councilmember Virginia Isbell		
The Honorable Congressman Ed Case (2nd District)		
The Honorable Senator Daniel Akaka	12/6/05	
The Honorable Senator Daniel Inouye		
OTHER ORGANIZATIONS		
American Lung Association of Hawai'i		
Big Island Visitors Bureau		
Daughters of Hawai'i		
Hawai'i Audubon Society		
Hawai'i Bicycle League		
Hawai'i Cycling Club	11/10/05	
Hawai'i Grotto of the NSS		
Hawai'i Hotel Association		
Hawai'i Island Community Development Corporation		
Hawai'i Island Economic Development Board		
Hawai'i Leeward Planning Conference		
Hawai'i Speleological Survey	11/12/05	
Historic Hawai'i Foundation		
Kailua-Kona Chamber of Commerce		
Kailua Village Design Commission		
Kailua Village Improvement Association		
Ka Lahui Hawai'i		
Kona Board of Realtors		
Kona Community Safety Lane		
Kona Hawaiian Civic Club		
Kona-Kohala Chamber of Commerce		

Agency	Date of Response*	Other Consultation Conducted
Kona Outdoor Circle		
Kona Soil and Water Conservation District		
Kona Traffic Safety Committee		
Laniākea Foundation		
Na Ala Hele Big Island Council		
Native Hawaiian Legal Corporation		
PATH - Peoples Advocacy for Trails Hawai‘i		
Plan to Protect Kona		
Pulama Ia Kona Heritage Preservation Council		
Sierra Club Hawai‘i Chapter		
West Hawai‘i Committee		

Note: * Dates of any written correspondence and/or verbal comments received.

The column “Other Consultation Conducted” in Table 3-1 notes coordination and consultation conducted beyond the initial pre-assessment consultation phase. For example, project subconsultants MK Engineers consulted utility agencies and found that in some cases the pre-assessment consultation information had not reached the appropriate staff. Some also expressed disappointment that they had not been informed of this Phase 2 earlier, which would have influenced design details related to utility re-design for the Phase 1 portion. Preliminary information about the proposed project was exchanged with these utilities about Phase 2, but additional coordination meetings would be necessary during the design phase of this project.

Additional consultation efforts, particularly those concerning regulatory matters, are described in Section 3.2.

3.1.2 Public Meeting #1

A public information meeting for the general public was held on November 16, 2005, at Kahakai Elementary School in Kailua-Kona.

Newspaper advertisements were published in three papers: Hawai‘i Tribune-Herald (November 13 and 15, 2005), West Hawai‘i Today (November 13 and 15, 2005), and Hawai‘i Island Journal (November 16, 2005).

Using direct mail, and in some cases hand-delivery, an attempt was made to reach all property owners and occupants/residents who abut Kuakini Highway within the proposed project limits. All residents of Kona Hillcrest subdivision were included in this distribution because this subdivision’s only exit is via Onioni Street onto Kuakini Highway. A sample copy of the letter mailed to owners and occupants is included in Appendix A.

The project team developed one mailing list of approximately 730 individuals from property ownership and/or County tax records. Where the property address did not match the owner’s mailing address, a second list was developed assuming that the property may be occupied by non-owners (e.g. rental property). For such parcels, notices were also mailed to the physical street address of the property to reach the current occupant. Around 525 entries were on this second mailing list, although several letters were returned as undeliverable. An additional 60 notices were mailed to Hawai‘i Affordable Properties to be distributed to residents of Kama‘aina Hale, which Hawai‘i Affordable Properties manages.

At the public meeting, the project team made a brief presentation to the public, distributed preliminary information sheets about the project, and solicited public comments, both orally and

in writing. Comments received both during and after the public meeting were incorporated into this EA. The following section briefly summarizes these comments.

3.1.3 Summary of Agency and Public Comments

A limited number of comments were received in response to the pre-assessment consultation and notice of public meeting. Fifteen written responses were received from agencies, including regulatory correspondence, four of which contained no substantive comments. Nineteen written comments were received from members of the public or community organizations and businesses; six individuals also made oral comments at the public meeting, one of whom also submitted written comments.

Comments received fell into the following general categories:

- purpose and need for the project, including observations about traffic conditions and coordination with Ali‘i Highway;
- suggestions of additional project alternatives to consider;
- project design, phasing/scheduling, and implementation;
- recommendations for agency coordination, possible permits, and/or outreach; and
- potential environmental impacts – predominantly visual impact concerns.

Questions of whether this project should be a priority use of County funds are addressed in the purpose and need discussion in Section 1.2 of this EA. Alternatives suggested were incorporated into Sections 1.4 and 1.5 of this EA. Project phasing and scheduling is outlined in Sections 1.4.2 and 1.6.2.3. Agency coordination is documented in the earlier part of this chapter (Section 3.1) and in Appendix A.

3.1.4 Other Outreach Efforts

On May 2, 2006, DPW and its consultants attended a meeting called by the State Historic Preservation Division (SHPD) to address inadvertent finds of burials in the roadway ROW of Kuakini Highway. The discoveries were made during work by the County’s Department of Water Supply (DWS) to install a new 16-inch line. DPW attended this meeting at the invitation of SHPD with the intent of gathering information about burials in the project area. DPW did not participate in the decision-making process to determine the appropriate handling of these burials. See Section 2.11 for a discussion of burials, as well as historic properties.

After completion of the Cultural Impact Assessment (CIA), additional individuals identifying themselves as lineal descendents of the project area were added to the project mailing list to receive a copy of the Draft EA, including the CIA.

3.2 REGULATORY COORDINATION

Since the project would require compliance with specific environmental laws and regulations, additional coordination and consultation was conducted as described below. Appendix A contains copies of relevant correspondence.

3.2.1 Section 106 of the National Historic Preservation Act and Hawai‘i Revised Statutes Section 6E-8

Section 106 of the National Historic Preservation Act requires that actions that are federally funded, authorized or carried out 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. Hawai‘i Revised Statutes Section 6E-8 is the State's law protecting historic resources.

The following consultation and coordination activities were conducted on behalf of the project.

- State Historic Preservation Officer / Division (SHPO/SHPD):
  - October 27, 2005, pre-assessment consultation and Section 106 initiation letter from DPW to SHPO.
  - November 16, 2005, meeting with SHPD staff to describe the undertaking and discuss potential adverse effects.
  - January 26, 2006, phone conversation with Ms. Anne Maigret, regarding guidance on selecting the appropriate Area of Potential Effect (APE).
  - April 3, 2007, Section 106/Section 6E-8 effect determination letter from FHWA to SHPO.
  - October 9, 2007, SHPD provided comments and requests regarding the effect determination, the Archaeological Inventory Survey (AIS) report and the CIA report.
  - April 29, 2009, FHWA responded to the SHPD comments and provided revised AIS and CIA reports.
  - June 24, 2009, SHPD responded that there were still a few outstanding issues before they could concur with the no effect determination.
- Mr. Keola Lindsey of DLNR's Burials Program was also consulted numerous times in the context of identifying or reaching cultural informants, and also coordinating the presentation to the HIBC.
- Native Hawaiian Organizations and other stakeholders:
  - December 20, 2005, letter informing the following Native Hawaiian organizations and other potential stakeholders of project details and requesting relevant coordination and comments on historic properties:
    - Hawai‘i Island Burial Council (HIBC)
    - Office of Hawaiian Affairs (OHA)
    - Daughters of Hawai‘i
    - Historic Hawai‘i Foundation
    - Historic Kealakowaa Heiau Preservation Council
    - Hui Malama I Na Kupuna O Hawai‘i Nei
    - Ka Lahui Hawai‘i
    - Kona Hawaiian Civic Club
    - Laniākea Foundation (sent August 31, 2006, due to difficulty determining contact information)
  - December 27, 2005, phone message from Ms. Jo-Anne Kahanamoku-Sterling to PB offering assistance, and acknowledgement email from PB.

- January 10, 2006, letter from OHA, suggesting consultation with OHA's Kailua-Kona representative, and requesting assurance of appropriate action in the case a burial is discovered. Ms. Ruby McDonald was notified of the public meeting in November 2005, contacted multiple times during the preparation of the cultural impact assessment (CIA), and is a named cultural informant in the CIA.

It should also be noted that an informational presentation was made to the HIBC on January 18, 2006, and a request made to its members to provide any additional pertinent information. This presentation was not deemed part of Section 106 consultation by the HIBC. Meeting minutes from this presentation are available on the SHPD website.

Native Hawaiian Organizations that have expressed interested in this project or have otherwise responded to earlier communications have been added to the project mailing list and will receive a copy of this Draft EA. Those organizations include HIBC, OHA, Historic Kealakowaa Heiau Preservation Council, and Kona Hawaiian Civic Club.

3.2.2 Section 7 of the Endangered Species Act and Chapter 195D of the Hawai'i Revised Statutes

This law requires that actions that are federally funded, authorized or carried out be done in a manner that would not jeopardize the continued existence of any plant or animal species listed as threatened or endangered, or destroy or adversely modify any designated critical habitat. The following consultation and coordination activities were conducted on behalf of the project:

- U.S. Fish and Wildlife Service (Service)
  - October 27, 2005, pre-assessment consultation and Section 7 coordination letter from PB to the Service requesting a species list for the project area.
  - November 4, 2005, USFWS reply to PB that there is no designated critical habitat in the area. Hawaiian hoary bat and Loulu palm tree do occur, but there are no records of the endangered Hawaiian dark-rumped petrel or the threatened Newell's shearwater (*Puffinus newelli*) within 1/3-mile of the project area.
- State of Hawai'i Department of Land and Natural Resources, Division of Forestry and Wildlife (DLNR-DOFAW)
  - October 27, 2005, pre-assessment consultation and Chapter 195D coordination letter from PB to DOFAW.
  - November 3, 2005, DOFAW reply to PB that it is doubtful the project would encounter endangered species.

3.2.3 Section 404 of the Clean Water Act

Section 404 of the Clean Water Act prohibits the discharge of dredged materials into the waters of the U.S., which include non-navigable streams, wetlands and mudflats, unless the U.S. Army Corps of Engineers (USACE) provides a permit. The following consultation and coordination activities were conducted on behalf of the project.

- October 27, 2005, pre-assessment consultation letter from PB to USACE.

- November 1, 2005, comment letter from USACE to PB stating USACE is unable to issue a final determination on the need for a Department of Army Permit. Requested a copy of the Draft EA and design drawings for review.

3.2.4 Section 4(f) of the Department of Transportation Act of 1966

As stated in the Section 4(f) Evaluation in Section 2.13 of this EA, this regulation permits transportation projects to "use" land from a significant publicly-owned public park, recreation area, wildlife and waterfowl refuge, or a historic site only when the Federal Highway Administration (FHWA) has determined that:

- There is no feasible and prudent alternative to such use; and
- The project includes all possible planning to minimize harm to the property resulting from such use.

The FHWA believes that the Kuakini Highway Improvements Project would have a *de minimus* impact on the County-owned "Kailua Playground", a facility with tennis and basketball courts, and a comfort station. For more detail on the facility and anticipated impacts, see Section 2.12. On October 16, 2006, a letter was sent to the County of Hawai'i Department of Parks and Recreation to solicit their assessment of the project's impacts on the playground. Upon the release of this Draft EA no response from the Department of Parks and Recreation had been received. FHWA will continue to seek input from the Department of Parks and Recreation and complete the Section 4(f) process.

3.3 FUTURE PUBLIC OUTREACH

A public meeting will be held during the Draft EA review period. Additional public meetings would be held by DPW as the project proceeds through construction. Public meetings would be advertised in local newspapers.

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CHAPTER 4
ANTICIPATED FINDING OF NO SIGNIFICANT IMPACT

As the proposing agency, DPW anticipates rendering a Finding of No Significant Impact (FONSI) for the proposed project in accordance with the Hawai‘i Revised Statutes (HRS) Chapter 343 HRS and Hawai‘i Administrative Rules (HAR), Sections 11-200-9 and 11-200-11.2. This assessment is based on an evaluation of project impacts in relation to the “Significance Criteria” specified in HAR 11-200-12(b). The Significance Criteria appear below in italics, followed by a discussion of the project in relation to the specific criterion. The nature of the project’s potential impacts is discussed in detail in Chapter 2.

1. *Involves an irrevocable commitment to loss or destruction of any natural or cultural resource* – The proposed project would cause minor loss or destruction of a natural or cultural resource. Several historic and/or cultural properties are found in the project area. The project is being designed to avoid such resources to the extent possible. Unavoidable destruction of minor historic properties, such as rock walls, would occur and those impacts would be mitigated to the extent necessary based on coordination and agreements with representative agencies, such as SHPD. Significant historic properties within the APE would be treated and protected per the mitigation measures stated in Section 2.11 and no adverse affect to any significant historic resources is anticipated. The area that would be directly affected by construction does not contain important plants and animals. The project would only affect plants and animals that are common and found throughout the region, island, and State.
2. *Curtails the beneficial uses of the environment* – The project would not curtail beneficial uses of the environment, because it would have minimal impact beyond the existing roadway ROW. Short-term construction-phase traffic impacts would be minimized by the implementation of a traffic management plan.
3. *Conflicts with the State’s long-term environmental policies or goals and guidelines expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders* – The proposed project is consistent with the environmental goals and objectives of the State of Hawai‘i, as demonstrated in this chapter and in Chapter 2.
4. *Substantially affects the economic or social welfare of the community or State* – The proposed project would support and enhance the island’s economy by contributing to regional improvements in the transportation network and helping to address congestion. Pedestrian and bicycle facilities proposed would help make Kailua-Kona a more walkable and livable community.
5. *Substantially affects public health* – The proposed project would not adversely affect public health. On the contrary, it would benefit public health by improving roadway drainage conditions, improving air quality along the project alignment relative to the No Build Alternative, providing bicycling and pedestrian facilities for a more livable community, and reducing traffic congestion in the Kuakini Highway travel corridor.
6. *Involves substantial secondary impacts* – The proposed project is not expected to cause secondary impacts because urban development is proceeding in the project area and in the greater Kailua-Kona area. These developments are anticipated to occur regardless of the widening of Kuakini Highway. Therefore, the proposed project would not induce secondary land uses, nor would it result in related secondary impacts that would otherwise not occur. Therefore, this project

represents a proactive planning practice by providing necessary transportation infrastructure in an area slated for growth and development.

7. *Involves substantial degradation of environmental quality* – The proposed project would not result in a substantial degradation of environmental quality. The project would not result in adverse environmental conditions, as demonstrated in Chapter 2. In some cases, such as air quality and visual impacts, improvements are in fact anticipated. Moreover, most of the project footprint is already designated as roadway ROW.

8. *Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions* – The proposed project would not create a commitment for other actions by DPW or other agencies. The proposed project is a complete, independent project, with logical termini, and would not result in commitments for other roadway projects, nor result in cumulative, considerable effect on the environment. Development in the Kailua-Kona region is reflected in existing planning documents and County zoning. The Ali‘i Highway project would proceed regardless of the proposed Kuakini Highway widening. Transportation improvements are needed to address existing traffic congestion and future travel demand.

9. *Substantially affects a rare, threatened or endangered species,or its habitat* – It is anticipated that no rare, threatened or endangered plant or animal species would be substantially affected by the proposed action. No critical habitat for protected species was found in the project area. Coordination and consultation with resource agencies, including an informal consultation with the USFWS in accordance with Section 7 of the Endangered Species Act, indicates that little or no interactions with protected species would occur. As a precaution, mitigation measures such as protective street lighting would be implemented to avoid adverse effects to species such as Newell’s shearwater and the Hawaiian dark-rumped petrel.

10. *Detrimentally affects air or water quality or ambient noise levels* – The proposed project would not detrimentally affect air or water quality or noise levels. The project would comply with State of Hawai‘i and federal environmental regulations and standards. Not only would the project cause no violations of State or National Ambient Air Quality Standards, it would improve air quality along the project alignment. BMPs would be incorporated into project designs, in order to minimize water quality impacts from roadway runoff. No adverse noise impacts are anticipated as a result of mitigation measures proposed by the project.

11. *Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a floodplain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters* – The proposed project is not located in an environmentally sensitive area.

12. *Substantially affects scenic vistas and viewplanes identified in county or state plans or studies* – It is anticipated that the proposed project would not significantly affect any existing scenic views, nor obstruct such views. Proposed roadway improvements would be predominantly at ground level, and removal/minimization of the number of utilities poles along the roadway corridor is planned. The proposed roadway profile is similar to Phase 1 of Kuakini Highway widening between Palani Road and Hualālai Road, which was designed in close coordination with the community.

13. *Requires substantial energy consumption* – The project would not result in substantial energy consumption. While there would be short-term construction-phase energy consumption, it would be offset by the anticipated long-term benefits as vehicular traffic is able to travel more efficiently on Kuakini Highway and on the regional transportation network.

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CHAPTER 5
REFERENCES

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APPENDIX A CORRESPONDENCE

APPENDIX A-1
PRE-ASSESSMENT CONSULTATION LETTER

October 27, 2005

Name
Address
Address
City, State Zipcode

Subject: Proposed Kuakini Highway Improvements Project Phase 2
Kailua-Kona, Island of Hawaii, Hawaii; Pre-Assessment Consultation

Dear Mr./Ms.(name):

The County of Hawaii Department of Public Works (DPW), in cooperation with the U.S. Federal Highway Administration, proposes to widen the existing Kuakini Highway, between Hualalai Road and the future intersection with the proposed Alii Highway (see enclosed map). DPW proposes the widening to increase roadway capacity in the Kailua to Keauhou corridor.

Under the proposal, Kuakini Highway would be widened from its existing two-lane configuration to four lanes. Improvements may require construction of retaining walls, some cutting and filling of slopes, and/or the possibility of additional right-of way acquisition.

Parsons Brinckerhoff Quade & Douglas, Inc. (PB) has been contracted to assist DPW in preparing an environmental assessment (EA) for this project. If you have knowledge of any environmental or social issues associated with this project, or concerns about the project, we would very much appreciate receiving such information from you within 30 days of the date of this letter.

Please send any comments you may have in writing to the address listed above, to my attention. If you have any questions, I can be reached at (808) 531-7094.

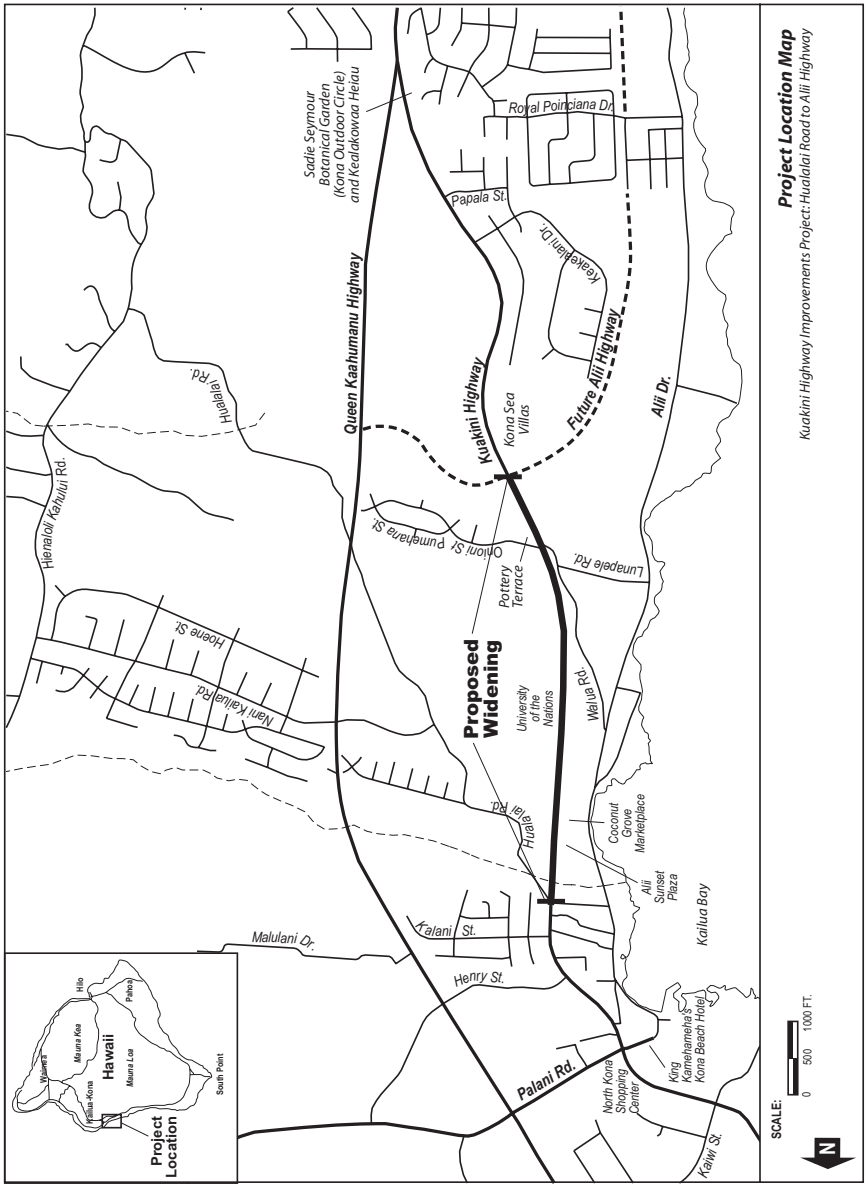
This letter also serves as a notice of a public information meeting for the subject project on November 16, 2005, from 6:30 pm to 8:00 pm, at Kahakai Elementary School cafeteria, at 76-147 Royal Poinciana Drive, Kailua-Kona. Representatives from DPW will be present to share information, answer questions, and receive public comments.

For more details on the meeting, or if you require special accommodations or auxiliary aid/services to participate in this meeting, (i.e. sign language interpreter, large print), please contact Mr. Kiran Emler of the DPW Kailua-Kona office at (808) 327-3530.

Sincerely yours,
PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

Nami Ohtomo
Environmental Planner

Attachment: Project location map



Ltc. David E. Anderson, District Engineer
Attn: Mr. George Young, Chief, Regulatory Branch
U.S. Army Corps of Engineers
Regulatory Branch
Pacific Ocean Division, Building 230
Fort Shafter HI 96858-5440

Mr. Gordon Tribble
District Chief
U.S. Department of Interior
USGS Water Resources Division
677 Ala Moana Blvd., Suite 415
Honolulu HI 96813

Mr. Michael K. Buckley, P.E.
Chief
Federal Emergency Management Agency
Hazard Identification Branch, Mitigation Directorate
500 C Street SW
Washington DC 20472

Ms. Sandra Lee Kunioka
Chairperson
Department of Agriculture
1428 S. King St
Honolulu HI 96814

Ms. Laura H. Thielen
Director
DBEDT
Office of Planning
P.O. Box 2359
Honolulu HI 96804

Ms. Patricia Hamamoto
Superintendent
Department of Education
P.O. Box 2360
Honolulu HI 96804

Mr. Laurence K. Lau, Esq.
Deputy Director
Department of Health
Environmental Health Administration
Kinau Hale P.O. Box 3378
Honolulu HI 96801

Mr. Lawrence T. Yamamoto
State Conservationist
U.S. Department of Agriculture
Natural Resources Conservation Service
PO Box 50004
Honolulu HI 96850

Mr. Dean Higuchi
Public Relations
U.S. Environmental Protection Agency
Pacific Islands Contact Office
300 Ala Moana Boulevard, Rm 5124
Honolulu HI 96850

Mr. Russ K. Saito
Comptroller
Attn: Ernest Lau, State Public Works Administrator
Department of Accounting and General Services
1151 Punchbowl Street
Honolulu HI 96813

Mr. Ted Liu
Director
DBEDT
Ofc of Planning, Hawaii Coastal Zone Mgmt Program
P.O. Box 2359
Honolulu HI 96804

Maj. Gen. Robert G.S. Lee
Adjutant General and Director of Civil Defense
Department of Defense
3949 Diamond Head Road
Honolulu HI 96816-4495

Mr. Denis R. Lau, P.E.
Chief
Department of Health
Clean Water Branch
919 Ala Moana Blvd., Rm. 301
Honolulu HI 96814

Mr. Thomas E. Arizumi, P.E., Chief
Attn: Barry Ching, Clean Air Branch
Department of Health
Environmental Management Division
P.O. Box 3378
Honolulu HI 96801

Ms. Grace Simmons
Department of Health
Hazardous Waste Section
P.O. Box 3378
Honolulu HI 96801

Mr. Russell S. Takata
Program Manager
Department of Health
Noise Radiation and Indoor Air Quality
P.O. Box 3378
Honolulu HI 96801

Ms. Genevieve Salmonson
Director
Office of Environmental Quality Control
235 S. Beretania Street, Suite 702
Honolulu HI 96813

Ms. Ruby MacDonald
Big Island CAC
Office of Hawaiian Affairs
75-5706 Hanama Place Suite 107
Kailua-Kona HI 96740

Dr. John Harrison
Environmental Coordinator
University of Hawaii
Environmental Center
Krauss Annex 19, 2500 Dole St
Honolulu HI 96822

The Honorable Harry Kim
Mayor
Office of the Mayor
County of Hawaii
75-5706 Kuakini Hwy. #103
Kailua-Kona HI 96740

Mr. Milton Pavao
Manager
Department of Water Supply
County of Hawaii
345 Kekuanaoa St. Suite 620
Hilo HI 96720

Ms. Chiyome Fukino, M.D.
Director
Department of Health
1250 Punchbowl St
Honolulu HI 96813

Mr. Peter Young
Director
Department of Land and Natural Resources
Kalanimoku Bldg., 1151 Punchbowl St. Room 130
Honolulu HI 96813

Mr. Clyde Namuo
Administrator
Office of Hawaiian Affairs
711 Kapiolani Blvd Suite 500
Honolulu HI 96813-5249

Mr. Rodney Haraga
Director
Department of Transportation
869 Punchbowl Street
Honolulu HI 96813-5097

Dr. Roger Fujioka
Director
University of Hawaii
Water Resources Research Center
2540 Dole Street
Honolulu HI 96822

Mr. Pete Hendricks
Deputy Managing Director
Office of the Mayor
County of Hawaii
75-5706 Kuakini Hwy. #103
Kailua-Kona HI 96740

Mr. Edwin Taira
Attn: Noel Fujimoto
Office of Housing & Community Development
County of Hawaii
50 Wailuku Drive
Hilo HI 96720

Ms. Patricia Engelhard
Director
Department of Parks And Recreation
County of Hawaii
25 Aupuni St.
Hilo HI 96720

Ms. Pamela Mizuno
Secretary / Contact Person
Bicycle / Pedestrian Safety Committee
County of Hawaii
101 Pauahi St. Suite 6
Hilo HI 96720

Ms. Barbara Bell
Director
Department of Environmental Management
County of Hawaii
25 Aupuni St. Room 210
Hilo HI 96720

Mr. Christopher J. Yuen
Planning Director
Planning Department
County of Hawaii
101 Pauahi St. Suite 3
Hilo HI 96720

Mr. Troy M. Kindred
Depratment Head
Civil Defense Agency
County of Hawaii
920 Ululani
Hilo HI 96720

The Honorable K. Angel Pilago
Councilmember, District 8
Hawaii County Council
County of Hawaii
75-5706 Hanama Place Suite 109
Kailua-Kona HI 96740

The Honorable Daniel Inouye
Senator, State of Hawaii
United States Senate
Senator
722 Hart Senate Office Building
Washington DC 20510

Mr. Darryl J. Oliveira
Fire Chief
Hawaii Fire Department
County of Hawaii
25 Aupuni St. Room 103
Hilo HI 96720

Mr. Lawrence K. Mahuna
Police Chief
Hawaii Police Department
County of Hawaii
349 Kapiolani St.
Hilo HI 96720

Mr. Steve Morifuji
Superintendent of Park Maintenance
Department of Parks Maintenance
County of Hawaii
35 Railroad Ave.
Hilo HI 96720

Mr. Tom Brown
Administrator
Mass Transit Agency
County of Hawaii
630 E. Lanikaula Street
Hilo HI 96720

The Honorable Virginia Isbell
Councilmember, District 7
Hawaii County Council
County of Hawaii
75-5706 Hanama Place Suite 109
Kailua-Kona HI 96740

The Honorable Ed Case
Congressman, 2nd District
United States House of Representatives
Congressman
5104 Prince Kuhio Federal Building
Honolulu HI 96850

The Honorable Daniel Akaka
Senator, State of Hawaii
United States Senate
Senator
141 Hart Senate Office Building
Washington DC 20510

Director of Environmental Health
American Lung Asociation of Hawaii
245 North Kukui Street
Honolulu HI 96817

Ms. Fanny AuHoy
Daughters of Hawaii
Huihe'e Palace
75-5718 Alii Drive
Kailua-Kona HI 96740

Hawaii Bicycle League
3442 Waialae Ave. Suite 1
Honolulu HI 96816

Mr. Ric Elhard
Chairman
Hawaii Grotto of the NSS
P.O. Box 6313
Ocean View HI 96737

Mr. Keith Kato
Hawaii Island Community Development Corporation
99 Aupuni Street, Suite 104
Hilo HI 96720

Mr. H. Peter L'Orange
President
Hawaii Leeward Planning Conference
P.O. Box 635
Kailua-Kona HI 96745-0635

Mr. David Scott
Director
Historic Hawaii Foundation
PO Box 1658
Honolulu HI 96806

Big Island Visitors Bureau
75-5751 Kuakini Highway, Suite 202
Kailua-Kona HI 96740

Hawaii Audubon Society
850 Richards St, Ste 505
Honolulu HI 96813-4709

Hawaii Cycling Club
P.O. Box 3246
Kailua-Kona HI 96745

Mr. Murray Towili
President
Hawaii Hotel Association
2270 Kalakaua Ave. #1103
Honolulu HI 96815

Ms. Paula Helfrich
Executive Director
Hawaii Island Economic Development Board
1999 Ainaola Drive
Hilo HI 96720

Mr. William R. Halliday
Hawaii Speleological Survey
101 Aupuni Street, #911
Hilo HI 96720

Ms. Marni Herkes
Executive Director
Kailua-Kona Chamber of Commerce
75-5737 Kuakini Hwy. Suite 207
Kailua-Kona HI 96740

Mr. J. Curtis Tyler III
Chairperson
Kailua Village Design Commission
c/o County of Hawaii Planning Dept
Aupuni Center, 101 Pauahi Street, Suite 3
Hilo HI 96720

Ka Lahui Hawaii
P.O. Box 4964
Hilo HI 96720

Mr. Scott Sharpe
President
Kona Community Safety Lane
77-363 Sunset Drive
Kailua-Kona HI 96740

Ms. Bev Fraser
Kona-Kohala Chamber of Commerce
75-5737 Kuakini Hwy. Suite #208
Kailua-Kona HI 96740

Mr. Phil Motooka
Chairman
Kona Soil and Water Conservation District
81-948 Waena'Oihana Loop #101
Kealakekua HI 96750

Mr. Mike Tomich
Chair
Na Ala Hele Big Island Council
72-3403 Mamalahoa Highway
Kailua-Kona HI 96740

Ms. Bettina Arrigoni
President
Attn: Ann C. Peterson, Executive Director
PATH - Peoples Advocacy for Trails Hawaii
P.O. Box 62
Kailua-Kona HI 96745

Mr. James S. Greenwell
President
Kailua Village Improvement Assocation
c/o 3465 Waialae Ave Suite 260
Honolulu HI 96816

Ms. Jacqueline Parkinson
Kona Board of Realtors
75-240 Nani Kailua Drive #157
Kailua-Kona HI 96740

Ms. Leimana Demate
President
Kona Hawaiian Civic Club
P.O. Box 4098
Kailua-Kona HI 96745

Ms. Betty Meyerson
President
Kona Outdoor Circle
76-6280 Kuakini Hwy.
Kailua-Kona HI 96740

Mr. Joel E. Gimpel
Chair, Public Affairs
Kona Traffic Safety Committee
75-344 Nani Kailua Dr.
Kailua-Kona HI 96740

Ms. Mahealani Kamauu
Executive Director
Native Hawaiian Legal Corporation
1164 Bishop St. Suite 1205
Honolulu HI 96813

Mr. Duane Erway
President
Plan to Protect Kona
74-5602-A Alapa St. Suite 725
Kailua-Kona HI 96740

Mr. Scott Seymour
President
Pulama la Kona Heritage Preservation Council
P.O. Box 398
Captain Cook HI 96704

West Hawaii Committee
P.O. Box 1761
Kailua-Kona HI 96740

Mr. Keith Yoshiro
Hawaiian TelCom
161 Kinoole St.
Hilo HI 96720

Mr. Allan Hirayama
Hawaiian Electric Industries, Inc. (HEI)
Transmission & Distribution Planning Deparment
P.O. Box 2750
Honolulu HI 96803

Mr. Jeff Mikulina
Sierra Club Hawaii Chapter
P.O. Box 2577
Honolulu HI 96803

Mr. Wayne Daimaru
Salesman
The Gas Company
74-5564 Kaiwi St.
Kailua-Kona HI 96740

Mr. Kevin Whitener
Hawaii Electric Light Company
74-5519 Kaiwi St.
Kailua-Kona HI 96740

Mr. Robert Moller
Construction Manager
Oceanic Time Warner Cable
74-5605 Luhia St. Suite B1
Kailua-Kona HI 96740

APPENDIX A-2
COMMENTS RESPONDING TO PRE-ASSESSMENT CONSULTATION LETTER

NRCS
Natural Resources Conservation Service
P.O. Box 50004
Honolulu, HI 96850
808-541-2600

United States Department of Agriculture

Our People...Our Islands...In Harmony

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NOV 1 5 2005
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

November 9, 2005

Ms. Nami Ohtomo, Environmental Planner
Parson Brickerhoff Quade & Douglas, Inc.
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, Hawaii 96813

Subject: Review of Proposed Kuakini Highway Improvements Phase 2

Dear Ms. Ohtomo,

We have reviewed the above mentioned document and have no comment at this time.

Thank you for the opportunity to comment.

Sincerely,

Shirley T. Nelson, acting for
LAWRENCE T. YAMAMOTO
State Conservationist for Hawaii &
Director of the Pacific Basin Area

The Natural Resources Conservation Service provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.

An Equal Opportunity Provider and Employer

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

November 1, 2005

Regulatory Branch

File No. POH-2005-599

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PARSONS BRINCKERHOFF
HONOLULU, HAWAII

Ms. Nami Ohtomo
Parsons Brinkerhoff Quade & Douglas, Inc
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, Hawaii 96813

Dear Ms. Ohtomo:

This responds to your request (letter dated October 27, 2005) for comments for preparation of a Draft Environmental Assessment (DEA) for widening of the existing Kuakini Highway between Hualalai Road and the future intersection of the proposed Alii Highway, Kailua-Kona, North Kona, Hawaii Island, Hawaii. We have reviewed the information you submitted with respect to the Corps' authority to issue Department of the Army (DA) permits pursuant to Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403) and Section 404 of the Clean Water Act (33 USC 1344).

Based on the preliminary information you provided, we are unable to reach a conclusive determination whether a DA permit would be required. It appears the project would not involve any discharge of dredge or fill material into waters of the United States, including wetlands; however, additional information will be required to issue a final determination. Please send us a copy of the DEA and design drawings for our review.

If you have any questions, please contact Ms. Laurene Silva by phone at 808-468-7023, by fax at 808-438-0460, or by electronic mail at *Laurene.L.Silva@usace.army.mil* and reference the above file number regarding this project in future correspondence.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

DANIEL K. AKAKA
HAWAII

WASHINGTON OFFICE:
141 HART SENATE OFFICE BUILDING
WASHINGTON, DC 20510
TELEPHONE: (202) 224-6361

HONOLULU OFFICE:
3106 PRINCE JONAH KUHIO
KALANIANAOLE FEDERAL BUILDING
P.O. BOX 50144
HONOLULU, HI 96850
TELEPHONE: (808) 522-8970

United States Senate

WASHINGTON, DC 20510–1103

COMMITTEES:
ARMED SERVICES
ENERGY AND NATURAL RESOURCES
HOMELAND SECURITY AND GOVERNMENTAL AFFAIRS
INDIAN AFFAIRS
VETERANS' AFFAIRS
SELECT COMMITTEE ON ETHICS

December 6, 2005

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PARSONS BRINCKERHOFF
HONOLULU, HAWAII

Ms. Nami Ohtomo
Environmental Planner
Parsons Brinckeroff Quade & Douglas, Inc.
1001 Bishop Street, #2400
American Savings Bank Tower
Honolulu, HI 96813

Dear Ms. Ohtomo:

Thank you for contacting me regarding the Kuakini Highway Improvements Project. I appreciate receiving this information. Again, mahalo for contacting me.

Aloha pumehana,

Daniel K. Akaka

DANIEL K. AKAKA
U.S. Senator

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LINDA LINGLE
GOVERNOR OF HAWAII

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

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

In reply, please refer to:
EMD / CWB

11012PKP.05

November 4, 2005

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NOV - 7 2005
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

Ms. Nami Ohtomo
Environmental Planner
Parsons Brinckerhoff Quade
& Douglas, Inc.
1001 Bishop Street, Suite 2400
Honolulu, Hawaii 96813

Dear Ms. Ohtomo:

Subject: Proposed Kuakini Highway Improvements, Phase 2
Kailua-Kona, Hawaii

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of the subject document, dated October 27, 2005. The CWB has reviewed the limited information contained in the subject document and offers the following comments:

1. The Army Corps of Engineers should be contacted at (808) 438-9258 for this project. Pursuant to Federal Water Pollution Control Act (commonly known as the "Clean Water Act" (CWA) Paragraph 401(a)(1), a Section 401 Water Quality Certification (WQC) is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may **result** in any discharge into the navigable waters..." (emphasis added). The term "discharge" is defined in CWA, Subsections 502(16), 502(12), and 502(6); Title 40, Code of Federal Regulations (CFR), Section 122.2; and Hawaii Administrative Rules (HAR), Chapter 11-54.

2. In accordance with HAR, Sections 11-55-04 and 11-55-34.05, the Director of Health may require the submittal of an individual permit application or a Notice of Intent (NOI) for general permit coverage authorized under the National Pollutant Discharge Elimination System (NPDES).

   a. An application for an NPDES individual permit is to be submitted at least 180 days before the commencement of the respective activities. The NPDES application forms may also be picked up at our office or downloaded from our website at http://www.hawaii.gov/health/environmental/water/cleanwater/forms/indiv-index.html.

b. An NOI to be covered by an NPDES general permit is to be submitted at least 30 days before the commencement of the respective activity. A separate NOI is needed for coverage under each NPDES general permit. The NOI forms may be picked up at our office or downloaded from our website at: http://www.hawaii.gov/health/environmental/water/cleanwater/forms/genl-index.html.

   i. Storm water associated with industrial activities, as defined in Title 40, CFR, Sections 122.26(b)(14)(i) through 122.26(b)(14)(ix) and 122.26(b)(14)(xi). [HAR, Chapter 11-55, Appendix B]

   ii. Construction activities, including clearing, grading, and excavation, that result in the disturbance of equal to or greater than one (1) acre of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. **An NPDES permit is required before the commencement of the construction activities.** [HAR, Chapter 11-55, Appendix C]

   iii. Discharges of treated effluent from leaking underground storage tank remedial activities. [HAR, Chapter 11-55, Appendix D]

   iv. Discharges of once through cooling water less than one (1) million gallons per day. [HAR, Chapter 11-55, Appendix E]

   v. Discharges of hydrotesting water. [HAR, Chapter 11-55, Appendix F]

   vi. Discharges of construction dewatering effluent. [HAR, Chapter 11-55, Appendix G]

   vii. Discharges of treated effluent from petroleum bulk stations and terminals. [HAR, Chapter 11-55, Appendix H]

   viii. Discharges of treated effluent from well drilling activities. [HAR, Chapter 11-55, Appendix I]

   ix. Discharges of treated effluent from recycled water distribution systems. [HAR, Chapter 11-55, Appendix J]

   x. Discharges of storm water from a small municipal separate storm sewer system. [HAR, Chapter 11-55, Appendix K]

   xi. Discharges of circulation water from decorative ponds or tanks. [HAR, Chapter 11-55, Appendix L]

3. In accordance with HAR, Section 11-55-38, the applicant for an NPDES permit is required to either submit a copy of the new NOI or NPDES permit application to the State Department of Land and Natural Resources, State Historic Preservation Division (SHPD), or demonstrate to the satisfaction of the DOH that the project, activity, or site covered by the NOI or application has been or is being reviewed by SHPD. If applicable, please submit a copy of the request for review by SHPD or SHPD's determination letter for the project.

4. Any discharges related to project construction or operation activities, with or without a Section 401 WQC or NPDES permit coverage, shall comply with the applicable State Water Quality Standards as specified in HAR, Chapter 11-54.

The Hawaii Revised Statutes, Subsection 342D-50(a), requires that "[n]o person, including any public body, shall discharge any water pollutants into state waters, or cause or allow any water pollutant to enter state waters except in compliance with this chapter, rules adopted pursuant to this Chapter, or a permit or variance issued by the director."

If you have any questions, please contact Mr. Alec Wong, Supervisor of the Engineering Section, CWB, at 586-4309.

Sincerely,

for Alec Wong

DENIS R. LAU, P.E., CHIEF
Clean Water Branch

KP:np

LINDA LINGLE
GOVERNOR OF HAWAII

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

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:
EMD/SHWB

November 17, 2005

S1117LO

Ms. Nami Ohtomo
Environmental Planner
Parsons Brinckerhoff Quade & Douglas, Inc.
1001 Bishop St., Suite 2400
Honolulu, HI 96813

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NOV 21 2005
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

Dear Ms. Ohtomo:

SUBJECT: Proposed Kuakini Highway Improvements Project Phase 2
Pre-Assessment Consultation

Thank you for providing us with the opportunity to provide comments during the pre-assessment phase of the above cited project. The Office of Solid Waste Management offers the following comments:

1. The developer shall ensure that all solid waste generated during project construction is directed to a Department of Health permitted solid waste disposal or recycling facility.

2. Hawaii Revised Statutes, Chapter 103D-407 stipulates that all highway and road construction and improvement projects funded by the State or a county or roadways that are to be accepted by the State or a county as public roads shall utilize a minimum of ten per cent crushed glass aggregate as specified by the Department of Transportation in all basecourse (treated or untreated) and subbase when the glass is available to the quarry or contractor at a price no greater than that of the equivalent aggregate.

Please contact Lane Otsu of the Office of Solid Waste Management with any questions regarding these comments.

Sincerely,

STEVEN Y. K. CHANG, P.E., CHIEF
Solid and Hazardous Waste Branch

PHONE (808) 594-1888

FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

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HRD05/2111

November 30, 2005

Nami Ohtomo
Environmental Planner
Parsons Brinckerhoff Quade & Douglas, Inc.
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, HI 96813

RE: Pre-Draft Environmental Assessment for Proposed Kuakini Highway Improvements Project Phase 2, Kailua-Kona, Hawai'i Island

Dear Nami Ohtomo,

The Office of Hawaiian Affairs (OHA) is in receipt of your October 27, 2005, request for comments on the above project, which would allow the County of Hawai'i Department of Public Works and the U.S. Federal Highway Administration to widen the existing Kuakini Highway between Hualalai Road and the future, planned intersection with the proposed Alii Highway. OHA offers the following comments and looks forward to the opportunity to review, and comment upon, the forthcoming Draft Environmental Assessment.

We request that you also contact, if you have not already, our Kona Community Resource Coordinator (address below), who can best advise you with whom else you should consult about ground disturbances in this area.

OHA further requests to be kept informed about this project, particularly as related to surface and subsurface cultural sites which may be adversely affected as the widening project nears the proposed Alii Highway intersection.

Nami Ohtomo
November 30, 2005
Page 2

Thank you for the opportunity to comment at this time. If you have any further questions or concerns please contact Heidi Guth at (808) 594-1962 or e-mail her at heidig@oha.org.

Sincerely,

Clyde W. Nāmu'o
Administrator

CC: Ruby McDonald
Community Resource Coordinator
OHA – Kona Office
75-5706 Hanama Place, Suite 107
Kailua-Kona, HI 96740

Harry Kim
Mayor

Barbara Bell
Director

Nelson Ho
Deputy Director

County of Hawaii
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
25 Aupuni Street, Room 210 • Hilo, Hawai'i 96720-4252
(808) 961-8083 • Fax (808) 961-8086
http://co.hawaii.hi.us/directory/dir_envmng.htm

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HONOLULU, HAWAII

November 3, 2005

Nami Ohtomo
Environmental Planner
PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.
1001 Bishop Street, Suite 2400
Honolulu, HI 96813

SUBJECT: Proposed Kuakini Highway Improvements Project Phase 2
Kailua-Kona, Island of Hawai'i, Hawai'i; Pre-Assessment Consultation

In response to your letter of October 27, 2005.

We have no comments to offer on the subject project.

Barbara Bell
DIRECTOR

cc: DPW

Hawai'i County is an equal opportunity provider and employer.

Harry Kim
Mayor

Lawrence K. Mahuna
Police Chief

Harry S. Kubojiri
Deputy Police Chief

County of Hawaii
POLICE DEPARTMENT
349 Kapiolani Street • Hilo, Hawaii 96720-3998
(808) 935-3311 • Fax (808) 961-2389

November 10, 2005

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PARSONS BRINCKERHOFF
HONOLULU, HAWAII

Nami Ohtomo
Environmental Planner
Parsons Brinckerhoff Quade & Douglas, Inc.
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, Hawaii 96813

Subject: Proposed Kuakini Highway Improvement Project Phase 2
Kailua-Kona, Island of Hawaii; Pre-Assessment Consultation

Dear Nami Ohtomo:

This is in response to your correspondence of October 27, 2005, requesting comments or concerns associated with this project.

Staff has reviewed the above-referenced project and submits the following comments:

Due to the severe traffic congestion that occurred during the Phase I project, we recommend consideration be given to have construction limited to non-peak hours whenever possible and periodic public meetings be conducted to allow the public to voice their concerns.

Should you or your staff require any further information regarding this matter, please contact Captain Paul Kealoha of the Kona Patrol Division at (808) 326-4646, extension 249.

Sincerely,

HARRY S. KUBOJIRI
DEPUTY POLICE CHIEF
ACTING POLICE CHIEF

cc: Bruce McClure, Director, Department of Public Works
Chris Yuen, Planning Director, Planning Department

"Hawai'i County is an Equal Opportunity Provider and Employer"

Harry Kim
Mayor

Darryl J. Oliveira
Fire Chief

Desmond K. Wery
Deputy Fire Chief

County of Hawai'i
FIRE DEPARTMENT
25 Aupuni Street • Suite 103 • Hilo, Hawai'i 96720
(808) 961-8297 • Fax (808) 961-8296

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HONOLULU, HAWAII

November 23, 2005

Nami Ohtomo
Parsons Brinckerhoff Quade & Douglas, Inc.
1001 Bishop Street, Suite 2400
Honolulu, Hawaii 96813

SUBJECT: PROPOSED KUAKINI HIGHWAY IMPROVEMENTS PROJECT PHASE 2
KAILUA-KONA, ISLAND OF HAWAII, HAWAII; PRE-ASSESSMENT CONSULTATION

We have no comments to offer at this time in reference to the above-mentioned Pre-Environmental Assessment Consultation.

DARRYL OLIVEIRA
Fire Chief

DJO:lpc

Hawai'i County is an Equal Opportunity Provider and Employer.

Hawaii Cycling Club

P.O. Box 3246, Kailua-Kona, Hawaii 96745

2005 Officers:

Chris Huber
President

Gary Shields
Vice President

Bob Schratz
Treasurer

Richard Scott
Secretary

Grant Miller
Director

Len Peddicord
Director

Tim Stewart
Director

website
www.hawaiicyclingclub.com

November 10, 2005

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PARSONS BRINCKERHOFF
HONOLULU, HAWAII

Nami Ohtomo
Parsons Brinkerhoff Quade & Douglas, Inc.
1001 Bishop Street, Suite 2400
Honolulu, HI 96813

RE: Proposed Kuakini Highway Improvements Project Phase II
Kailua-Kona, Island of Hawaii

Dear Ms. Ohtomo,

The Hawaii Cycling Club is a non-profit corporation representing recreational and professional bicyclists and triathletes on the Island of Hawaii. We are in receipt of your letter of October 27 on the above referenced subject.

The widening of Kuakini Highway between Hualalai and the proposed Alii Highway intersection will have a significant effect on bicyclists in Kailua-Kona. It is used by local residents and visitors, and is a major artery for students from the University of the Nations accessing the downtown business area on their bicycles.

The Hawaii Cycling Club would like to work with you and DPW to assure that the design of the proposed improvements is "bicycle friendly" and that the engineering for this project meets accepted standards. Specifically, we would like to assure that the road width is sufficient for the traffic plus a lane or shoulder for bicycles in each direction with appropriate on-pavement markings and signs, or alternatively, a separate bicycle path similar to the one to be constructed with the new section of the Queen K Highway.

The Hawaii Cycling Club will be represented by several of its officers and members at the public information meeting on November 16 who will be eager to hear about your plans. Should you wish to talk to a representative of our club who can work with you on this project, please contact Bob Schratz at 808-938-3266 or me at 808-936-3762.

Mahalo,

Chris Huber
President,
Hawaii Cycling Club

PB 100 YEARS

Parsons Brinckerhoff Quade & Douglas, Inc.
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, HI 96813
808-531-7094
Fax: 808-528-2368

October 27, 2005

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NOV 21 2005
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

Mr. William R. Halliday
Hawaii Speleological Survey
101 Aupuni Street, #911
Hilo HI 96720

Subject: Proposed Kuakini Highway Improvements Project Phase 2
Kailua-Kona, Island of Hawaii, Hawaii; Pre-Assessment Consultation

Dear Mr. Halliday:

The County of Hawaii Department of Public Works (DPW), in cooperation with the U.S. Federal Highway Administration, proposes to widen the existing Kuakini Highway, between Hualalai Road and the future intersection with the proposed Alii Highway (see enclosed map). DPW proposes the widening to increase roadway capacity in the Kailua to Keauhou corridor.

Under the proposal, Kuakini Highway would be widened from its existing two-lane configuration to four lanes. Improvements may require construction of retaining walls, some cutting and filling of slopes, and/or the possibility of additional right-of way acquisition.

Parsons Brinckerhoff Quade & Douglas, Inc. (PB) has been contracted to assist DPW in preparing an environmental assessment (EA) for this project. If you have knowledge of any environmental or social issues associated with this project, or concerns about the project, we would very much appreciate receiving such information from you within 30 days of the date of this letter.

Please send any comments you may have in writing to the address listed above, to my attention. If you have any questions, I can be reached at (808) 531-7094.

This letter also serves as a notice of a public information meeting for the subject project on November 16, 2005, from 6:30 pm to 8:00 pm, at Kahakai Elementary School cafeteria, at 76-147 Royal Poinciana Drive, Kailua-Kona. Representatives from DPW will be present to share information, answer questions, and receive public comments.

For more details on the meeting, or if you require special accommodations or auxiliary aid/services to participate in this meeting, (i.e. sign language interpreter, large print), please contact Mr. Kiran Emler of the DPW Kailua-Kona office at (808) 327-3530.

Sincerely yours,
PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

Nami Ohtomo
Environmental Planner

Attachment: Project location map

12 Nov. 2005
The only such caves in HSS files are those which have been described in the archeological literature. Mr. Douglas Medville may know of others. I will forward your letter to him. WRH

Over a Century of Engineering Excellence

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAI'I
345 KEKŪANAŌ'A STREET, SUITE 20 • HILO, HAWAI'I 96720
TELEPHONE (808) 961-8050 • FAX (808) 961-8657

November 3, 2005

Nami Ohtami, Environmental Planner
Parsons Brinckerhoff Quade & Douglas, Inc.
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, HI 96813

PROPOSED KUAKINI HIGHWAY IMPROVEMENTS PROJECT PHASE 2
KAILUA-KONA, ISLAND OF HAWAI'I, PRE-ASSESSMENT CONSULTATION

This is in response to your letter of October 27, 2005.

Please be informed that the Department is in the process of constructing a 16-inch waterline within the Kuakini Highway (Job No. 2003-821) extending from the Hualalai intersection to the Nakukui intersection on the Mauka side of the Kuakaini Highway approximately 9,000 lineal feet. The contract was awarded on June 28, 2005, to E. M. Rivera and Sons, Inc., and is expected to be completed on June 5, 2006.

For your information, there is also an existing 8-inch waterline and 20-inch waterline along the Kuakini Highway right-of-way with in your proposed scope of work.

We are enclosing a copy of the construction plans for your information.

Should there be any questions, please contact Mr. William Atkins of our Water Resources and Planning Branch at 961-8070, extension 254.

Sincerely yours,

Milton D. Pavao, P.E.
Manager

WA:sco

Enc.

copy – Department of Public Works

... Water brings progress...

The Department of Water Supply is an Equal Opportunity provider and employer. To file a complaint of discrimination, write: USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington DC 20250-9410. Or call (202) 720-5964 (voice and TDD)

MK Engineers, Ltd.
Consulting Electrical Engineers
286 Kalihi Street • Honolulu, Hawaii 96819
Telephone: (808) 848-8622 • Fax: (808) 848-5574
e-mail address: info@mkhawaii.com

RECORD OF TELEPHONE CONVERSATION

Between:	Maurice Hawaii County Traffic Division (808) 961-8341	Project No. Project:	05098 Kuakini Hwy Impr Hualalai to Alii
And:	Francis Hirakami MK Engineers, Ltd.	Date: Time: No. of pages:	January 11, 2006 8:20 a.m. 1

ITEMS OF DISCUSSION:

1. Phase 1 Kuakini Highway Improvement project:

- **New street light standards and underground wiring on makai side of highway.**
- **Street light fixtures to be placed on new jointly owned (HELCO, Hawaiian Telcom, Oceanic Cable, and street lighting) on mauka side of highway.**
- **County is paying 1/3 of steel pole costs as joint owner. Fortunately, Kuakini Highway is a county federal aid highway, so federal funds will help offset some of the costs.**
- **No costs available.**

2. Phase 2 Kuakini Highway Improvement project:

- **Use similar design as for Phase 1: new street light standards and underground wiring on makai side of highway, and new street light fixtures on new jointly owned steel poles on mauka side of highway. This assumes all the existing telephone poles on the makai side of the highway will be removed.**
- **Mentioned that the new steel poles may be spaced 150 feet apart. This is acceptable to Maurice as the public does not want additional poles to clutter the view along the highway. The new street light standards on the makai side can be staggered to cover some of the dark spots.**

END.

Hawaii Electric Light Company, Inc. • 74-5519 Kaiwi Street • Kailua-Kona, HI 96740-1684

CUST 3-3-1
H-W/G

November 1, 2005

RECEIVED
NOV - 3 2005
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

Nami Ohtomo
Parsons Brinckerhoff Quade & Douglas, Inc.
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, HI 96813

Dear Nami:

Subject: Proposed Kuakini Highway Improvements Project Phase 2

This is in response to your letter dated October 27, 2005 notifying Hawaii Electric Light Company (HELCO) of the planned project to continue widening Kuakini Highway. This letter is to state that HELCO has no knowledge of any direct environmental or social issues associated with the project. There may be indirect impacts when we relocate our electrical infrastructure and interrupt electrical service to customers along the proposed road widening area and beyond. Also, depending on the scope of work, taller poles may be required and therefore, some may consider it as a visual impact to the environment.

HELCO would like to further state that a project of this complexity requires our planning engineers to review circuiting, voltage, load flow and continuity of service impacts and may have to implement mitigation measures. For planning purposes, it would be prudent to plan approximately three years for completion assuming that HELCO will have to entirely relocate its 69KV transmission line and distribution facilities. This includes design, public hearings, obtaining permits, ordering poles and construction. The electrical planning effort will need to start before the design process and should take two months. The design period begins when we receive final drawings for the project and a request from DPW to proceed with the work.

In order to minimize the total project time, it is critical for HELCO to receive the project plans as soon as possible.

Thank you for your letter notifying HELCO of this project.

Best regards,

Kevin Whitener
Supervisor, Customer Engineering
Hawaii Electric Light Company, Inc.
(808) 327-0501

cc: Clyde H. Nagata
Hal Kamigaki

Francis Hirakami

From: Whitener, Kevin [kevin.whitener@helcohi.com]
Sent: Friday, December 30, 2005 9:41 AM
To: Francis Hirakami
Cc: Nagata, Clyde
Subject: RE: Kuakini right of entry letter

Francis,

Clyde has a policy of not allowing HELCO transmission drawings out of the Company. In order to provide these drawings, I will need specific permission from him to let them out.

The biggest problem with Kuakini Phase 1 is that the County struck out on their own early in the project and held community meetings without involving HELCO. Then, certain promises/agreements were made with the community to which HELCO had no input. This created poles being way taller than they needed to be; something that the County now laments because it made their streetlights way too high. So learning number one is that the County needs to involve HELCO and telephone sooner.

The statement about placing facilities underground on Phase 1 pertained only to distribution and not transmission. It would have been very little additional cost to place the distribution underground given the extensive amount of excavation that was done on this project. That would have made the poles even shorter and smaller in diameter. The public would have been much happier with the finished result. This same concept may or may not be applicable to Phase 2 since Phase 2 is in a much less populated area. For Phase 2 it probably makes more sense to put it all overhead. We would have to study it more closely and work with the County to understand the scope of the road widening to make a final recommendation.

Be careful using HECO's Phase 1 estimates to project Phase 2 costs. HECO under-estimated by about 50%.

If you like, just send Clyde an e-mail asking permission to have the transmission drawings. If he approves it, it is fine with me. Also, in the past we have required the consultant to make payment for the copies. (This should be minor.)

Best regards and happy New Year,

Kevin Whitener

From: Francis Hirakami [mailto:Francis@mkhawaii.com]
Sent: Friday, December 30, 2005 9:03 AM
To: Whitener, Kevin
Subject: FW: Kuakini right of entry letter

Hi, Kevin! I'm planning to visit Kona next week some time (most likely Thursday or Friday) to do some field work for the Kuakini Hwy Improvement project (Hualalai Rd to about 700 feet past Oni Oni St). I would appreciate it very much if you can run me a set of your power line plans for this stretch of highway. I will need to prepare pole line relocation estimates to Parsons by January 27th (including option for underground) and will be using your Kuakini Hwy Impr Ph. 1 numbers as a starting point. The concept for this project will be the same as for the Ph. 1 project in that the overhead line will remain on the mauka side of the highway and all services to the makai side will be underground.

Any "lessons learned" from the Ph. 1 project would be helpful. I recall you mentioning that if

you had to do the Ph. 1 project over again, you would go all underground. Well, I will need numbers to support going all underground, so if you have anything that would be helpful, would appreciate it.

Thanks, Kevin!

Francis Hirakami
MK Engineers
286 Kalihi Street
Honolulu, HI 96819-3937
Ph. (808) 848-8622

MK Engineers, Ltd.

Consulting Electrical Engineers
286 Kalihi Street • Honolulu, Hawaii 96819
Telephone: (808) 848-8622 • Fax: (808) 848-5574
e-mail address: info@mkhawaii.com

RECORD OF TELEPHONE CONVERSATION

Between:	Michael Chang Hawaiian Telcom (808) 329-7236	Project No. Project:	05098 Kuakini Hwy Impr Hualalai to Alii
And:	Francis Hirakami MK Engineers, Ltd.	Date: Time: No. of pages:	January 9, 2006 11:00 a.m. 1

ITEMS OF DISCUSSION:

1. **Mr. Chang expressed disappointment that he wasn't informed of this project earlier as he would have designed the intersection at Kuakini Highway and Hualalai Road for the Phase 1 project differently.**

2. **It may be possible to install a switch at the Kuakini Highway and Hualalai Road to enable use of fiber optic cables for Phase 2. The switch itself will cost about $1 million, but there will be savings in labor and materials if the copper cables had to be relocated from the makai side to the mauka side similar to Phase 1.**

3. **There will need to be underground crossings to maintain service along the makai side of the highway.**

4. **Mr. Chang will be out of town during the week of 1/16/06, so he may not be able to provide any rough cost estimate for Phase 2. If possible, he will forward the cost estimate for Phase 1 which can be adjusted for Phase 2.**

END.

MK Engineers, Ltd.

Consulting Electrical Engineers
286 Kalihi Street • Honolulu, Hawaii 96819
Telephone: (808) 848-8622 • Fax: (808) 848-5574
e-mail address: info@mkhawaii.com

RECORD OF TELEPHONE CONVERSATION

Between:	Robert Moeller Oceanic Time Warner (808) 331-4925	Project No. Project:	05098 Kuakini Hwy Impr Hualalai to Alii
And:	Francis Hirakami MK Engineers, Ltd.	Date: Time: No. of pages:	January 10, 2006 9:00 a.m. 1

ITEMS OF DISCUSSION:

1. **Mr. Moeller was not aware of this project and wanted to know the project boundaries. He was informed that it will extend from the Hualalai Road to the approximate area of the new Alii Drive extension (about 800 feet past Oni Oni Street), and will be similar to Phase 1 (telephone and CATV cables relocated from the makai side of the highway to the mauka side with underground crossings to the makai side).**

2. **Mr. Moeller stated that this section will probably not be as costly as Phase 1 since there will be less trunk cables along this stretch of highway as in Phase 1.**

3. **There may be some construction problems at the intersection of Hualalai and Kuakini. He currently needs to cross from the mauka side to the makai side for the Phase 1 project, but now will have to plan a way to transition back to the mauka side for the Phase 2 project.**

4. **Mr. Moeller will try to provide a rough cost estimate for the Phase 2 improvements by 1/20/06.**

END.

Francis Hirakami

From: Francis Hirakami
Sent: Monday, January 09, 2006 9:55 AM
To: 'michael.chang@verizon.com'
Subject: Kuakini Hwy Impr - Ph 2
Attachments: Kuakini Right-of-Entry ltr 4Aug05.PDF; Location Map.pdf

Hi, Mike! Per our phone conversation this morning, attached is some info on the next phase of the Kuakini Hwy Impr project. It will be similar to the first phase. I've been in contact with HELCO and they said that they would probably install steel poles again similar to the first phase. The County wants all utilities on the mauka side of the highway, so the telephone lines on the makai side will be removed and cables relocated to the mauka side.

If possible, I would like to get a rough ballpark cost estimate for the relocation of the Hawaiian Telcom cables. The cost estimates are due on January 27th, so would appreciate it if you can provide me with a rough cost by January 20th. I understand that you'll be out of the office next week, so anything will be of help. Even if you have to provide me with the estimate for the first phase and tack on a fudge factor, that would be better than anything I can come up with.

Thanks, Mike!

Francis Hirakami
MK Engineers
286 Kalihi Street
Honolulu, HI 96819-3937
Ph. (808) 848-8622

Francis Hirakami

From: Francis Hirakami
Sent: Tuesday, January 10, 2006 3:51 PM
To: 'robert.moeller@twcable.com'
Subject: Kuakini Hwy Impr, Ph. 2
Attachments: Kuakini Right-of-Entry ltr 4Aug05.PDF; Location Map.pdf

Hi, Robert! Thanks for returning my phone call concerning the subject project. Attached are some project info. I would appreciate some rough cost estimates for the relocation of the Oceanic CATV cables from the makai side of the highway to the mauka side similar to the Phase 1 improvement project. I need to submit the costs to Parsons by 1/27/06, so would appreciate your estimate by 1/20/06 if possible.

Thanks, Robert!

Francis Hirakami
MK Engineers
286 Kalihi Street
Honolulu, HI 96819-3937
Ph. (808) 848-8622

APPENDIX A-3
COMMENTS RECEIVED FOLLOWING NOVEMBER 16, 2005 PUBLIC MEETING

Harry Kim
Mayor

Bruce C. McClure
Director

Jiro A. Sumada
Deputy Director

County of Hawai'i
DEPARTMENT OF PUBLIC WORKS
Aupuni Center
101 Pauahi Street, Suite 7 • Hilo, Hawai'i 96720-4224
(808) 961-8321 • Fax (808) 961-8630

October 27, 2005

Dear Participant:

Subject: **Proposed Kuakini Highway Improvements Project Phase 2**
Kailua-Kona, Island of Hawaii, Hawaii
Job No. P-3718, FAP No. STP 1910(2)
Notice of Public Information Meeting

You are cordially invited to a public information meeting regarding the subject project. The County of Hawaii Department of Public Works (DPW), in cooperation with the U.S. Federal Highway Administration, proposes to widen the existing Kuakini Highway, between Hualalai Road and the future intersection with the proposed Alii Highway (see enclosed map). DPW proposes the widening to increase roadway capacity in the Kailua to Keauhou corridor.

Under the proposal, Kuakini Highway would be widened from its existing two-lane configuration to four lanes. Improvements may require construction of retaining walls, some cutting and filling of slopes, and/or the possibility of additional right-of way acquisition.

The public information meeting will be held on:

- **Wednesday, November 16, 2005, 6:30 pm to 8:00 pm**
- **Kahakai Elementary School cafeteria**
  76-147 Royal Poinciana Drive, Kailua-Kona

Representatives from DPW and its consultants will be on-hand to share information, answer questions, and receive public comments pertaining to this project.

For more details on the meeting, or if you require special accommodations or auxiliary aid/services to participate in this meeting, (i.e. sign language interpreter, large print), please contact Mr. Kiran Emler of the DPW Kailua-Kona office, at (808) 327-3530 or kemler@co.hawaii.hi.us, at least seven (7) days prior to the meeting.

Sincerely yours,

Bruce C. McClure
BRUCE C. McCLURE, P.E.
Director

Attachment: Project location map

County of Hawai'i is an Equal Opportunity Provider and Employer.

PUBLIC COMMENT SHEET
KUAKINI HIGHWAY IMPROVEMENTS PROJECT, PHASE 2:
Hualalai Road to Alii Highway

Your written comments will help us with the planning and design of this subject project. We appreciate your assistance. Please provide your comments below and feel free to attach additional sheets if necessary. **Please send comments by November 30th, 2005.**
PLEASE PRINT LEGIBLY. If your comments are not legible, they cannot be considered.

Name: David Nelson
Organization (if any):
Phone: 334-0503 day
Same eve

Address: 75-5919 Alii Dr. #-3
Kailua Kona

I feel that a four ~~way~~ lane widening for aprx two blocks would be sufficient to allow better flow thru the Hualalai intersection - then narrowing to a wide 2 lane w/ Turn Median and generous Bicycle + Sidewalks - Extra right Turn lanes could be used where necessary to remove those Turning right. I agree with some of the speakers that we have more pressing needs of getting traffic through Kailua Village than a very expensive Kuakini project. The above could be done without extensive excavation

Signature [signature] **Date** 11/16/05

Please mail comments to the address on the reverse. Comments may also be faxed to County of Hawaii Department of Public Works project engineer Mr. Kiran Emler at 327-3533, or sent by email to kemler@co.hawaii.hi.us.

PUBLIC COMMENT SHEET
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Hualalai Road to Alii Highway

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PLEASE PRINT LEGIBLY. If your comments are not legible, they cannot be considered.

Name: Dan Sabo
Organization (if any):
Address: 76-6306 Mahuahua Pl. Kailua-Kona, HI 96740
Phone: 326-4700 day
eve

- Please build with underground utilities only, at any cost.
- Make lanes wider – at least as wide as they are now. This is a real safety issue.
- Put a median strip in.
- Maybe we only need a 2 lane road w/ median strip

Signature Dan Sabo Date 11/16/05

Please mail comments to the address on the reverse. Comments may also be faxed to County of Hawaii Department of Public Works project engineer Mr. Kiran Emler at 327-3533, or sent by email to kemler@co.hawaii.hi.us.

PUBLIC COMMENT SHEET
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Hualalai Road to Alii Highway

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Name: George Sondusky
Organization (if any):
Address: 77-6300 Alii Dr Kailua Kona HI 96740
Phone: 938-1719 day
none eve

Why are we building a 4 ~~lane~~ lane road to a road that may never be built. (Alii Hwy)

If the road is not 4 lanes don't build it

We need traffic relief

Signature George Sondusky Date 11/16/05

Please mail comments to the address on the reverse. Comments may also be faxed to County of Hawaii Department of Public Works project engineer Mr. Kiran Emler at 327-3533, or sent by email to kemler@co.hawaii.hi.us.

PUBLIC COMMENT SHEET
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Hualalai Road to Alii Highway

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PLEASE PRINT LEGIBLY. If your comments are not legible, they cannot be considered.

Name: Todd Ussery
Organization (if any): self
Phone: 756-4446 day
eve

Address: 75-5851 Kuakini Hwy #301
Kailua Kona, HI 96740

I believe a crosswalk for pedestrians at or north of the University of Nations entrance is needed

Signature [signature] **Date** 11/16/05

Please mail comments to the address on the reverse. Comments may also be faxed to County of Hawaii Department of Public Works project engineer Mr. Kiran Emler at 327-3533, or sent by email to kemler@co.hawaii.hi.us.

PUBLIC COMMENT SHEET
KUAKINI HIGHWAY IMPROVEMENTS PROJECT, PHASE 2:
Hualalai Road to Alii Highway

Your written comments will help us with the planning and design of this subject project. We appreciate your assistance. Please provide your comments below and feel free to attach additional sheets if necessary. **Please send comments by November 30th, 2005.**
PLEASE PRINT LEGIBLY. If your comments are not legible, they cannot be considered.

Name: DOUG WILKERSON
Organization (if any):
Phone: 808 329-7165 day
808 329-7165 eve

Address: POB 1107
KAILUA-KONA, HI
96745

Any, and all intersections adjoining or within the proposed project should have well demarcated bike lanes and signage to facilitate the flow of bicycles into, through and out-of each intersection. These bike lanes should be consistent in look and markings.

Signature [signature] **Date** 11/16/05

Please mail comments to the address on the reverse. Comments may also be faxed to County of Hawaii Department of Public Works project engineer Mr. Kiran Emler at 327-3533, or sent by email to kemler@co.hawaii.hi.us.

NOV 2 5 2005

RECEIVED
NOV 28 2005
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

PUBLIC COMMENT SHEET
KUAKINI HIGHWAY IMPROVEMENTS PROJECT, PHASE 2:
Hualalai Road to Alii Highway

Your written comments will help us with the planning and design of this subject project. We appreciate your assistance. Please provide your comments below and feel free to attach additional sheets if necessary. **Please send comments by November 30th, 2005.**
PLEASE PRINT LEGIBLY. If your comments are not legible, they cannot be considered.

Name: Nancy Burns
Organization (if any):
Address: 73-1487 Hao St. Kailua Kona, HI 96740
Phone: 325-3182 day
325-3182 eve

I believe this project is much needed. It is wonderful to see the County planning for the future and not waiting until traffic has reached gridlock to expand roadway capacity. This roadway expansion will accommodate future traffic generated by projects already approved or under construction. The County has my full support on this and other roadway system improvements that will mitigate traffic congestion and improve the quality of life in Kona.

Signature Nancy E Burns **Date** 11-17-05

Please mail comments to the address on the reverse. Comments may also be faxed to County of Hawaii Department of Public Works project engineer Mr. Kiran Emler at 327-3533, or sent by email to kemler@co.hawaii.hi.us.

Rec'd 11/23/05 [illegible]

PUBLIC COMMENT SHEET
KUAKINI HIGHWAY IMPROVEMENTS PROJECT, PHASE 2:
Hualalai Road to Alii Highway

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PLEASE PRINT LEGIBLY. If your comments are not legible, they cannot be considered.

Name: PHIL TINGLEY
Organization (if any): Tingley Development
Address: PO BOX 9013 Kailua-Kona, HI. 96745
Phone: 329-8775 day
326-9601 eve

I strongly support proceeding with the Kuakini Highway widening as proposed - let me know how we can help!

Signature [illegible] **Date** 11/21/05

Please mail comments to the address on the reverse. Comments may also be faxed to County of Hawaii Department of Public Works project engineer Mr. Kiran Emler at 327-3533, or sent by email to kemler@co.hawaii.hi.us.

PUBLIC COMMENT SHEET
KUAKINI HIGHWAY IMPROVEMENTS PROJECT, PHASE 2:
Hualalai Road to Alii Highway

Your written comments will help us with the planning and design of this subject project. We appreciate your assistance. Please provide your comments below and feel free to attach additional sheets if necessary. **Please send comments by November 30th, 2005.**
PLEASE PRINT LEGIBLY. If your comments are not legible, they cannot be considered.

Name: KEN CLEWETT
Organization (if any): UNIV. OF THE NATIONS – KONA CAMPUS
Phone: 326-4447 day
329-2301 eve

Address: 75-5787 KAKALINA STREET
KAILUA-KONA, HI 96740

First, a big MAHALO for your holding such open, convenient, timely and informative meetings to allow the public to receive, share and provide suggestions relating to proposed road improvements. In my opinion, this is leading to a much healthier relationship between the County and the public and to improvements that are that much better and that much more supported by the public/taxpayers.

Regarding the proposed Kuakini Highway improvements project, it is suggested that you provide a projection of anticipated use of that highway for the next 5-10 years - if not beyond - to help the public realize the need. As demonstrated at the November 16 public information meeting, some people judge the merits of such a project strictly upon what they see as today's needs to the neglect of considering any long-range planning.

Particularly with the future Alii Highway feeding into Kuakini Highway, it seems to me that there is going to be a huge increase in traffic onto an already crowded Kuakini Highway, to heavily justify this proposed project.

Whatever action is taken, I urge early construction of sidewalks (or even a sidewalk on one side) along Kuakini Highway from Hualalai Road to at least the intersection of Kuakini Highway and Onioni Street (if not to the proposed Alii Highway intersection). Although currently unsafe for such activity, that area is used by large numbers of pedestrians from the many condominiums, hotels, university, and subdivision facing that section of Kuakini Highway. A sidewalk would further encourage pedestrian traffic and reinforce those complexes in reducing potential automotive traffic on Kuakini Highway by promoting walking on safe sidewalks to nearby locations and town, as an alternative.

Again, thanks very much for your genuine interest in resolving one of West Hawaii's greatest problems - automotive traffic congestion and lack of adequate sidewalks.

Ken Clewett
November 21, 2005

Rec'd 11/29/05 EC

PUBLIC COMMENT SHEET
KUAKINI HIGHWAY IMPROVEMENTS PROJECT, PHASE 2:
Hualalai Road to Alii Highway

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PLEASE PRINT LEGIBLY. If your comments are not legible, they cannot be considered.

Name: PETER PIPER
Organization (if any): PIPER DESIGNS
Phone: 331-2244 day
eve

Address: 75-5944 KUAKINI HWY.
KAILUA-KONA, HI 96740

I THINK KUAKINI HWY SHOULD BE WIDEND TO 4 LANES FROM THE HUALALAI RD INTERSECTION TO THE SOUTH END OF COCONUT GROVE MARKET-PLACE, THEN 2 LANES WITH A CENTER MEDIAN LANE FOR LEFT TURNS ALL THE WAY TO QUEEN KAAHUMANU HWY. THIS WOULD BE A BETTER USE OF THE MONEY THAN MAKING 4 LANES WHERE THEY ARE NOT NEEDED.

I THINK IT IS ALSO VERY IMPORTANT TO MAKE KUAKINI HWY. 4 LANES FROM THE PALANI RD. INTERSECTION TO KAIWI ST.

Signature Peter J Piper **Date** 11/28/05

Please mail comments to the address on the reverse. Comments may also be faxed to County of Hawaii Department of Public Works project engineer Mr. Kiran Emler at 327-3533, or sent by email to kemler@co.hawaii.hi.us.

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PUBLIC COMMENT SHEET
KUAKINI HIGHWAY IMPROVEMENTS PROJECT, PHASE 2:
Hualalai Road to Alii Highway

Your written comments will help us with the planning and design of this subject project. We appreciate your assistance. Please provide your comments below and feel free to attach additional sheets if necessary. **Please send comments by November 30th, 2005.**
PLEASE PRINT LEGIBLY. If your comments are not legible, they cannot be considered.

Name: PAUL BLECK
Organization (if any): PAUL BLECK, AIA LTD
Phone: 326 1598 day
989-3047 eve

Address: 75-5885 WALUA RD.
KAILUA-KONA, HI 96740

I DON'T SEE THE NEED TO EXTEND (4) LANES BEYOND COCONUT GROVE MARKETPLACE AT THIS TIME. IF THE PORTION OF THE ALII BYPASS HIGHWAY PHASE TWO THAT CONNECTS TO KUAKINI AND QUEEN K WERE ABOUT TO BEGIN CONSTRUCTION THEN FUNDING AND CONSTRUCTION FOR (4) LANES TO CONNECT TO THEM MAKES SENSE

I THINK MONEY WOULD BE BETTER SPENT ELSEWHERE AT THIS TIME. I DON'T SEE THE URGENCY WITH THE ALII BYPASS HIGHWAY STALLED.

Signature Paul M. Bleck Date 11/29/05

Please mail comments to the address on the reverse. Comments may also be faxed to County of Hawaii Department of Public Works project engineer Mr. Kiran Emler at 327-3533, or sent by email to kemler@co.hawaii.hi.us.

PUBLIC COMMENT SHEET
KUAKINI HIGHWAY IMPROVEMENTS PROJECT, PHASE 2:
Hualalai Road to Alii Highway

Your written comments will help us with the planning and design of this subject project. We appreciate your assistance. Please provide your comments below and feel free to attach additional sheets if necessary. **Please send comments by November 30th, 2005.**
PLEASE PRINT LEGIBLY. If your comments are not legible, they cannot be considered.

Name: General Construction Pacific
Organization (if any):
Phone: 331-1020 day
eve

Address: 75-5944 Kuakini Hwy.

THIS IMPROVEMENT WAS INTENDED, IT SEEM, TO BE A PART OF "ALII HWY," FEEDER OR CONNECTOR. WITHOUT ALII HWY IT IS A PROJECT WITH NO INTENT. A "DEAD END." THEIR IS NO BACKED UP TRAFFIC AT THIS END OF KUAKINI + I NEVER SEE MORE THAN A DOZEN PEOPLE WALKING ON SHOULDER TO REQUIRE SIDEWALKS. THIS PROJECT MONEY IS BEST USED WHERE TRAFFIC PROBLEMS EXIST + NOT ON A PROJECT KILLED "ALII HWY", OR IMPROVEMENT TO A PROJECT THAT FAILED

Signature Roger Pommer Date 11-30-05

Please mail comments to the address on the reverse. Comments may also be faxed to County of Hawaii Department of Public Works project engineer Mr. Kiran Emler at 327-3533, or sent by email to kemler@co.hawaii.hi.us.

TOTAL P.01

-----Original Message-----
From: George (Denny) Coffman [mailto:gdcman@verizon.net]
Sent: Wednesday, November 23, 2005 9:52 AM
To: Emler, Kiran
Subject: Comments: Kuakini Highway Improvements Project, Phase 2

RE: Comments: Kuakini Highway Improvements Project, Phase 2
Public Information Meeting #1 on Wednesday, November 16, 2005

I strongly support the proposed widening of Kuakini Highway from Hualalai road to the future Alii Highway. My support is based upon the fact that I believe that the Alii Highway will be built and connected to the (now on hold) road being built through the Hokuli'a development. Those two roads when joined will require a wider Kuakini Highway.

George D. Coffman
77-203 Maliko Street
Kailua Kona, Hawaii 96740
808-322-5076

-----Original Message-----
From: Clyde and Geri Jackson [mailto:clydengeri@yahoo.com]
Sent: Thursday, November 17, 2005 8:01 AM
To: Emler, Kiran
Subject: Kuakini Highway Widening

November 17, 2005
Kiran Emler, DWP Project Engineer
kemler@co.hawaii.hi.us
75-5706 Kaukini hwy
Room 107
Kailua-Kona, HI 96740
This letter is in regards to the eventual improvements/widening of Kuakini Highway south of Hualalai Road. Unfortunately, I could not attend the meeting on November 16. Below are some of the issues and concerns I have.

- How will the widening affect availability of on street parking? There is a significant requirement for on street parking in the first several hundred feet of Kuakini south of Hualalai Rd. Due to poor planning in years past; apartment complexes in this area are extremely lacking in parking. (Same poor planning seems to be ongoing today in new areas.) If on street parking is eliminated it will create great difficulty for area residents and guests. I suggest some mitigation be considered.
- Speeders are already a problem. In particular southbound traffic is an issue. Many vehicles appear to accelerate to 50MPH or more by the time, they pass my location. Perhaps another traffic light at Coconut Grove would help.
- Sidewalks are very important here. Students from the University of Nations and others walk this section of highway all day long. The worst section, due to lack of shoulder, is in front of Kailua Village and Hualalai Center.
- Lighting would be very helpful in this area. We have 1 street light now in front of Hualalai Center. This one has problems and often does not light, turn on at midnight or just glow. Weird stuff! When the light is out there are more fights, arguments, and drug dealing and so on in the Hualalai Center parking lot. Vehicles are vandalized when parked on the street.

Clyde W Jackson
Owner/Occupant
75-5766 Kuakini Hwy, Apt # 504
Kailua-Kona, HI 96740-1722
Cc: file

----- Original Message -----
From: Josephine Keliipio
To: 'Kiran Emler, Engineer'
Sent: Wednesday, November 30, 2005 8:58 AM
Subject: KUAKINI WIDENING / PHASE 2 - COMMENTS FOR CONSULTANT

Dear Mr. Emler,
The following are my comments regarding the Phase 2, Kuakini Widening project. I understand that today (11-30-05), is the last day for submitting comment.

The Phase 2 widening of Kuakini Highway (between Hualalai Road and the future Alii Parkway) should be designed to 2 lanes with left turning pockets ONLY for the following reasons:

1) Unlike the Phase 1 section of Kuakini Highway which is lined by commercial business establishments, the Phase 2 section of roadway will be lined by mostly residential neighborhoods (condos, apartments, etc) making a 2-lane highway for Phase 2 a more appropriate, residential-friendlier design over a wide, car oriented 4-lane highway.

2) Since Phase 2 will be lined by residential neighborhoods, then a 2-lane highway will better accommodate pedestrians from these residential neighborhoods by providing them with wider sidewalks (no less than 10 feet wide on BOTH sides of the road) and more landscaping. This will not only give residents a safer and more comfortable walkway to and from the village but it will encourage people to walk more vs drive more.

3) We owe a 2-lane highway with wide pedestrian walkways and shady landscaping to the students from the University of the Nations who have been walking this roadway section for decades. We need to provide them with a safe roadway and the safest roadway for them is a 2-lane highway and not a 4-lane highway. In fact, a 2-lane highway would mean that a modern roundabout could be built at the campus entrance thus providing students with a safe way to cross the road since the 4-lane design will probably not provide students and pedestrians with any safe means to cross the roadway.

4) The 4-lane design means that pedestrians will have a dangerously harder time crossing this section of roadway. It also gives the county more excuses of why they cannot build any mid-block crosswalks for pedestrians. At least with a 2-lane roadway there is more of a chance of designing crosswalks into this section via appropriately placed roundabouts (U of N and Hillcrest intersection).

5) A 2-lane highway will blend into the current Alii Parkway design better since the Parkway is currently designed to also be 2-lanes.

In conclusion, I think 4-lane roads should be kept to a minimum in Kailua-Kona. Please do not ruin our village with more asphalted lanes. Two lane highways and roadways with wide sidewalks and lots of landscaping Keep Kona Kona and encourage people to get out and walk vs drive. Two lane highways are also safer for pedestrians as well as vehicles. At the meeting held earlier this month, a long time Kona resident, Wattie Mae Hedeman wisely recommended a 2-lane design with left turn pockets for Phase 2. Please honor her request and Keep Kona safe for all of us.

Mahalo,

Josephine Keliipio
76-168 Royal Poinciana Drive
Kailua-Kona, Hi 96740

-----Original Message-----
From: Bob Smith [mailto:smith6849@hawaii.rr.com]
Sent: Thursday, November 17, 2005 4:16 PM
To: Emler, Kiran
Subject: Kuakini Hwy. Widening

Aloha Kiran Emler,

I am in favor of the proposed widening of Kuakini Hwy south of Hualalai, especially if we think that the Alii Hwy will still be built some day. I think it makes more sense to make it 5 lanes instead of just 4 as a center lane for left turns will greatly help traffic flow. If you don't do it right and build it for the future, you will just end up re-doing it a couple of years later.

Additionally, I feel the plans should allow for bicycle and pedestrian traffic.

Thanks for considering my comments.

Mahalo,
Bob Smith

-----Original Message-----
From: Mellencs@aol.com [mailto:Mellencs@aol.com]
Sent: Thursday, November 17, 2005 4:52 PM
To: Emler, Kiran
Subject: comments on widening Kuakini Hwy

Aloha Kiran Emler,

Each time I drive southbound on the Queen Kaahumanu Hwy to Lako street in heavy traffic, I think about how nice it will be to have a widened Kuakini Hwy as an alternate route to the moderate to heavy traffic found daily on the Queen.

I am strongly in favor of the proposed widening of Kuakini Hwy south of Hualalai to the proposed Alii Parkway. Hopefully plans call for creating 5 lanes instead of just 4 as a center lane for left turns will greatly help traffic flow.

I sincerely hope that money can also be found soon to fund the Alii Parkway from that point to at least La'aloa St. Yesterday there was a traffic accident on Alii Drive at La'aloa Park. Had the Alii Parkway been in place, traffic could have been diverted northbound on that road rather than being turned around and sent 2 miles south to Kamehameha III Rd.

Hopefully your plans will include space for bicycle, moped and pedestrian traffic as alternate sources of getting around in the congested Kailua Kona area.

Mahalo for considering my comments.

Mary Ellen Smith

-----Original Message-----
From: MERRY ANNE STONE [mailto:buykona2004@hawaii.rr.com]
Sent: Tuesday, November 29, 2005 5:13 PM
To: Emler, Kiran
Subject: Kuakini Highway Improvements Project Public Comment Sheet

November 29, 2005

Public Comment Sheet
Kuakini Highway Improvements Project, Phase 2
Hualalai Road to Alii Highway

Mr. Kiran Emler

I went to the meeting at Kahakai school for the information regarding the Kuakini Highway Improvement Project.

You are spending more money on another environmental study. Too many studies and no results! There are so many needed projects that the county should be concentrating on which would bring some relief to our traffic situation. This one will not bring relief!

I am sure that this is developer driven since there were so many contractors present for this meeting.

The projects that have been started and stalled: Lako extension, LaAloa connection, a process to aleve the congestion from the elementary school to the highschool, more and more....the county then says that they are working on a plan. Years before any results and the costs have tripled! Or no results just more meetings!

The Plan never gets developed and by the time it should funded the study is outdated and the county has spent too much money to complete anything. Or better yet the Planning Director decides that the study is INaccurate and the project is scrapped, ie: Original LaAloa Connection.

Oh sure there is another meeting to discuss with the community their views, but had the developer put through the LaAloa Connection the county would not be in the situation they are now in with residents who were not notified by the developer about LaAloa connection to highway when they purchased their homes. The biggest issue is that the cost of completing these projects is higher than projected....so again it is stalled or better yet a new study is requested.

This is not a priority highway project that will do anything except cost the county money.

Stop now and spend those funds on completing the needed projects that have been discussed and will provide relief.

The costs have rose so high that again the county cannot pay to have any plans completed, GOOD at hiring studies!

Merry Anne Stone
808-960-2082
808-324-7006
77-159 Kai Poi Pl
Kailua-Kona, Hi.96740

-----Original Message-----
From: Tom Walton [mailto:twalton@povn.com]
Sent: Sunday, November 20, 2005 9:12 AM
To: Emler, Kiran
Subject: KUAKINI HIGHWAY IMPROVEMENTS PHASE 2
Concerning the KUAKINI HIGHWAY IMPROVEMENTS PHASE 2:

Dear Sirs,

My name is Tom Walton and my wife and I live at Kona Sea Villas, 75-6060 Kuakini Hwy, where I am a member of the association board. My Phone number is 329-5220 and my cell phone is 509 447-2535.

We are generally in favor of this project with these reservations and concerns:

We would like to see the project extend past the Kona Sea Villas Property. We believe that southbound traffic on Kuakini will increase past our property and bottleneck right at our gate, making access and egress difficult and dangerous.

We believe that the lighting is inadequate on Kuakini south of Kona Mansions and if it is not improved leading up to and past the bottleneck that we will see an increase in night time vehicular accidents with the possibility of pedestrian fatalities as this stretch of Kuakini has a heavy incidence of foot traffic.

Having said that, we applaud your efforts and hope that you will keep our concerns in mind as you continue developing a final plan.

Maholo,
Tom and Brenda Walton

-----Original Message-----
From: Bob Ward [mailto:rgward007@hawaii.rr.com]
Sent: Wednesday, November 30, 2005 10:18 PM
To: McClure, Bruce; Emler, Kiran
Subject: Kuakini - Phase II
Aloha,

Please consider the attached comments in favor of the proposed improvements to Kuakini Highway.

Bob

-----Attachment-----

November 30, 2005

Bruce McClure, P.E.
Director Public Works
County of Hawaii
Aupuni Center
Hilo, Hawaii 96720

RE: Environmental Assessment – Kuakini Highway – Phase II

I would like to offer the following comments in support of proposed improvements on Kuakini Highway between Hualalai Road and the proposed connection with the Ali'I Highway. The changes enhance the surface transportation network in West Hawaii and benefit all modes of transportation.

1. We are currently exposed to a significant deficit in the North-South capacity of our road system. This creates several problems that have an adverse impact on:
   - Traffic flow
   - Emergency services
   - Evacuation routes
   - Pedestrian corridors
   - Bikeways

2. Completing the proposed improvements will provide a crucial segment that will be part of a vital North-South corridor. This corridor will connect several segments that represent some of the largest investments for roads in Kona.
   - The four largest road investments ever planned by the County of Hawai'i in Kona are: Kuakini Highway - Phase I; Kuakini Highway - Phase II; Ali'i Highway - Phase I; Ali'i Highway - Phase II.
   - The largest private road investment (Hokuli'a)
   - Connecting these components into a single corridor will increase the return on investment on each individual component.

3. The four lanes will be necessary to carry current and future traffic
   - Locally generated residential and commercial traffic.
   - Southbound traffic from Hualalai Road destined for the major commercial centers.
   - Traffic that will utilize the Pua'a connector as a bypass around the pedestrian area on Ali'i Drive.
   - Converging traffic from both the Ali'i Highway and all of the mauka communities that utilize the Kuakini Highway.

4. Extending the Kuakini corridor northward can further enhance the transportation network.
   - Phase III - Palani Road to Makala Blvd. This would probably need to be configured as a four-lane road with pedestrian and cycling facilities to handle projected traffic volumes and maintain an acceptable level of service.
   - Phase IV - Makala Blvd. to Kealakehe Pkwy. This might be a divided parkway configuration that focuses on accommodating mass transit and provides recreation facilities for pedestrians and cyclists.

SUGGESTED ENGINEERING IMPROVEMENTS

5. Consider connecting Kuakini Highway - Phase II directly into Ali'i Highway - Phase II. This would add several improvements.
   - A north-south route from Napoopoo Jct. directly to Kailua (and possibly Honokohau.
   - A more efficient mass transit route.
   - A recreation loop for jogging and cycling.
   - Improved Wailua Road intersection that would continue south directly onto southbound Kuakini Highway.
   - Safer ingress and egress to Oni Oni Street and Pottery Terrace.

6. Do not terminate Ali'i Highway - Phase II at the Queen Ka'ahumanu Extension.
   - This would dump northbound traffic south of the congestion at Henry Street and Palani Road.
   - The route would terminate with no routes to continue the traffic north.
   - The short connection between Kuakini Highway and the Queen Ka'ahumanu Extension would be redundant with the adjacent connector being built by Pua'a & Suffolk development.

7. Consider homogeneous bike lanes.
   - Asphalt overlay gutter section, or
   - Monolithic wide concrete gutter section (5-feet minimum).
   - Eliminate construction joint hazard to cyclists.
   - Provides a separate bike lane for a major bicycle route.

8. Consider raised pedestrian way on mauka side.
   - Lower land acquisition and grading costs.
   - Faster construction.
   - Safer for pedestrians.
   - Better scenic vistas.
   - Unique landscape alternatives

9. Consider Pre-cast Post-tensioned segment construction on the makai side for bike and pedestrian way
   - Lower land acquisition and grading costs.
   - Faster construction.
   - Accommodates drainage facilities.
   - Provides utility placement below grade at lower cost.

Thank you for your consideration,
Robert Ward
Kailua Kona

APPENDIX A-4
PRE-ASSESSMENT THANK-YOU FOLLOW-UP LETTER

January 30, 2006

SEE ATTACHED LIST

Subject: Proposed Kuakini Highway Improvements Project Phase 2
Kailua-Kona, Island of Hawaii, Hawaii; Pre-Assessment Consultation

Dear M_. _____:

On behalf of the County of Hawaii, Department of Public Works, I am writing to thank you for your letter of November __, 2005, commenting on the proposed project. Your comments are being considered as we prepare the Environmental Assessment (EA) for this project.

The Draft EA will be prepared to satisfy the requirements of Chapter 343 of the Hawaii Revised Statutes. Upon completion, the Draft EA will be distributed for public and agency review and comment. Public meetings on the Draft EA will be advertised and held at a location within the study area. The Final EA will also satisfy the requirements of the National Environmental Policy Act of 1969 (NEPA) and its implementing regulations.

We appreciate your continued involvement on this project.

Sincerely yours,
PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

Nami Ohtomo
Lead Environmental Planner

Mailing List for Pre-Assessment Comment
Thank-you Letters/Postcards

Letter recipients

U.S. Army Corps of Engineers
(U.S. Army Engineer District)
Mr. George P. Young, P.E.,
Chief, Regulatory Branch
Pacific Ocean Division, Building 230
Fort Shafter, HI 96858-5440

U.S. Department of Interior
U.S. Fish And Wildlife Service
Mr. Mr. Patrick Leonard, Field Supervisor
300 Ala Moana Blvd, Rm 3-122 Box 50088
Honolulu, HI 96850

Department of Health
Solid and Hazardous Waste Branch
Mr. Steven K. Chang, Chief
P.O. Box 3378
Honolulu, HI 96801

Department of Water Supply
County of Hawaii
Mr. Milton Pavao, Manager
345 Kekuanaoa St. Suite 620
Hilo, HI 96720

Hawaii Police Department
County of Hawaii
Mr. Harry S. Kubojiri,
Deputy Police Chief; Acting Police Chief
349 Kapiolani St.
Hilo, HI 96720

United States Senate
The Honorable Daniel Akaka, Senator
141 Hart Senate Office Building
Washington, DC 20510

Hawaii Cycling Club
Mr. Chris Huber
P.O. Box 3246
Kailua-Kona, HI 96745

Hawaii Electric Light Company
Mr. Kevin Whitener
74-5519 Kaiwi St.
Kailua-Kona, HI 96740

U.S. Department of Agriculture
Natural Resources Conservation Service
Mr. Lawrence T. Yamamoto,
State Conservationist
PO Box 50004
Honolulu, HI 96850

Department of Health
Clean Water Branch
Mr. Denis R. Lau, P.E., Chief
919 Ala Moana Blvd., Rm. 301
Honolulu, HI 96814

Department of Land and Natural Resources
Division of Forestry and Wildlife
Mr. Paul Conry, Administrator
Kalanimoku Bldg, 1151 Punchbowl St. Rm 325
Honolulu, HI 96813

Hawaii Fire Department
County of Hawaii
Mr. Darryl J. Oliveira, Fire Chief
25 Aupuni St. Room 103
Hilo, HI 96720

Department of Environmental Management
County of Hawaii
Ms. Barbara Bell, Director
25 Aupuni St. Room 210
Hilo, HI 96720

University of the Nations - Kona Campus
Mr. Ken Clewett,
75-5787 Kakalina St.
Kailua-Kona, HI 96740

Hawaii Speleological Survey
Mr. William R. Halliday
101 Aupuni Street, #911
Hilo, HI 96720

Mailing List for Pre-Assessment Comment
Thank-you Letters/Postcards

Postcard recipients

Mr. Paul Bleck
75-5885 Walua Rd
Kailua-Kona, HI 96740

Mr. George (Denny) Coffman
77-203 Maliko St.
Kailua-Kona, HI 96740

Mr. & Mrs. Adele and David Nelsen
75-5919 Alii Drive, H-3
Kailua-Kona, HI 96740

Mr. Dan Sabo
76-6306 Mahuahua Pl.
Kailua-Kona, HI 96740

Mr. Bob Smith
(via email)

Ms. Merry Anne Stone
77-159 Kai Poi Pl.
Kailua-Kona, HI 96740

Mr. Todd Ussery
75-5851 Kuakini Hwy, #301
Kailua-Kona, HI 96740

Mr. Bob Ward
77-6526 Hoolaupai St.
Kailua-Kona, HI 96740

General Construction Pacific
Mr. Roger Pammer
75-5944 Kuakini Hwy
Kailua-Kona, HI 96740

Ms. Nancy Burns
73-1487 Hao St.
Kailua-Kona, HI 96740

Ms. Josephine Keliipio
76-168 Royal Poinciana Dr
Kailua-Kona, HI 96740

Piper Designs
Mr. Peter Piper
75-5944 Kuakini Hwy, #2
Kailua-Kona, HI 96740

Mr. George Sandusky
77-6300 Alii Drive
Kailua-Kona, HI 96740

Ms. Mary Ellen Smith
(via email)

Tinguely Development
Mr. Phil Tinguely
P.O. Box 9013
Kailua-Kona, HI 96745

Kona Sea Villas
Mr. Tom and Brenda Walton
75-6060 Kuakini Hwy
Kailua-Kona, HI 96740

Mr. Doug Wilkerson
P.O. Box 1107
Kailua-Kona, HI 96745

APPENDIX A-5
HISTORIC PRESERVATION CORRESPONDENCE

Telephone Conversation Memorandum

Parsons Brinckerhoff Quade & Douglas, Inc
Pacific Tower, Suite 3000
1001 Bishop Street
Honolulu, HI 96813
808-531-7094
Fax: 808-528-2368

project: Kuakini Hwy-DPW ***job no.:*** **16431A** ***date:*** *10/11/2005*

talked to: Mary Anne Maigret ***from:*** SHPD

item discussed: Kuakini Hwy project – initiation of Section 106

information obtained:

I informed Mary Anne about the project and of County's intent to initiate Section106 consultation. I described the widening extents, ROW impacts and/or retaining walls under the two main alternatives under consideration, However, we are still early in the planning process, and the project footprint has not been clearly defined (e.g., whether the final widening action will/will not stay within ROW). She noted that the construction staging area should also be defined, if it will be in addition to the project footprint.

We then broadly discussed potential project impacts. Mary Anne noted the need to define the APE, but agreed that it may be too early to pin this down. We agreed that initial information about the potential APE could be stated in the consultation letter.

She described the two most likely scenarios of concern to SHPD:

1) lava tube punctures – these must be addressed, if encountered. Tubes will likely be filled or crossed over.

2) Inadvertent discovery of burials in construction areas. – look at previous areas of discovery, conduct consultation, if discovered.

Mary Anne also mentioned a historic property at "Keopuolani's House", located near the site of the existing Outback Steakhouse restaurant. In general, project planning should also take into consideration the potential indirect, as well as direct, effects of its actions, particularly within Auhaukeae Ahupuaa.

She stressed that both direct and indirect effects must be considered when assessing impacts on historic properties, in general. She cited visual impacts as an example of the indirect impact of the project on historic properties.

She also suggested that the archaeological consultant review if there are any preservation agreements on private property in the project area.

We also discussed which Native Hawaiian Organizations (NHOs) should be consulted under 106. We agreed that the following list is ok: Kona Hawaiian Civic Club, Hui Malama, Hawaii Island Burial Council, OHA. Historic Hawaii Foundation, although not an NHO, will also be kept on the list. I informed her that our archaeological/cultural subconsultant is starting work, including additional informant interviews for a Cultural Impact Assessment. The archaeological report and the CIA will be treated as companion documents.

action required:

-send letter to SHPD, attention Melanie Chinen. Will be routed to Mary Anne

-define construction staging area

distribution

file	*DPW*	*IARII*	*SHPD*		

by: Nami Ohtomo

Harry Kim
Mayor

Bruce C. McClure
Director

Jiro A. Sumada
Deputy Director

County of Hawai'i
DEPARTMENT OF PUBLIC WORKS
Aupuni Center
101 Pauahi Street, Suite 7 • Hilo, Hawai'i 96720-4224
(808) 961-8321 • Fax (808) 961-8630

October 27, 2005

Mr. Peter T. Young
Chairperson and State Historic Preservation Officer
State of Hawaii Department of Land and Natural Resources
601 Kamokila Boulevard,
Kakuhihewa Bldg., Room 555
Kapolei, Hawaii, 96707

Attention: Melanie Chinen, SHPD Administrator

Dear Mr. Young:

Subject: **Proposed Kuakini Highway Improvements Project Phase 2**
Kailua-Kona, Island of Hawaii, Hawaii
Job No. P-3718, FAP No. STP 1910(2)
National Historic Preservation Act, Section 106 and HRS Chapter 6E Coordination; Pre-Assessment Consultation for Environmental Assessment; and Notice of Public Information Meeting

The County of Hawaii Department of Public Works (DPW), in cooperation with the U.S. Federal Highway Administration (FHWA), proposes to widen Kuakini Highway, between Hualalai Road and the future intersection with the proposed Alii Highway (see enclosed map). DPW proposes the widening to increase roadway capacity in the Kailua to Keauhou corridor. The project area lies within Tax Map Key section 3-7-5.

Under the proposal, Kuakini Highway would be widened from its existing two-lane configuration to four lanes. Improvements may require construction of retaining walls, some cutting and filling of slopes, and/or the possibility of additional right-of way acquisition.

On behalf of FHWA, we are initiating environmental review of the subject project and consultation with SHPO in compliance with Section 106 of the National Historic Preservation Act (NHPA). We request your early review and comment on the "undertaking" description, anticipated Area of Potential Effect (APE) for the project, and planned consultation efforts with other parties, as described below. This letter also summarizes our consultation activities to date with your Historic Preservation Division staff.

County of Hawai'i is an Equal Opportunity Provider and Employer.

In addition, if you have knowledge of any other environmental or social issues associated with this project, or other concerns about the project, we would very much appreciate receiving such information from you within 30 days of the date of this letter.

Proposed Undertaking

Under the proposal, Kuakini Highway would be widened from a two-lane, undivided roadway to a four-lane roadway. Details of the proposed design are still under discussion, but improvements are likely to include raised medians, auxiliary lanes, bike lanes, concrete sidewalks, curb and gutter, utilities, drainage system, highway lighting, and intersection improvements. Due to the steep terrain in the project area, we anticipate that cutting and filling of slopes will be necessary throughout the project extents.

We anticipate that two alternatives would be considered: one proposing widening within the existing right-of-way (ROW); another proposing some cuts and fills beyond the existing ROW to minimize the need for retaining walls. These and other project details will be developed further during the conceptual design.

Please note that we are currently preparing an archaeological report of the area and a companion cultural impact assessment.

Consultation with Historic Preservation Division Staff

The project consultant, Parsons Brinckerhoff (PB), contacted your Historic Preservation Division staff regarding the undertaking. PB consulted with Ms. Mary Anne Maigret of your staff via telephone on October 11, 2005. PB received the following comments regarding the undertaking's potential impact on archaeological resources (i.e., pre-contact or native Hawaiian historic properties) and other historic properties.

In this project area, there is a potential for encountering lava tubes. In the case that such lava tubes are identified in the project area, the County would consult with SHPD and other potential stakeholders on appropriate design measures to minimize harm. Inadvertent discovery of burials within the project area would also warrant appropriate consultation. Your staff also noted the existence of historic properties along the project site. Such sites would be identified and addressed in the archaeological report currently under preparation. In general, your staff noted that project planning should consider the potential indirect and direct effects of its actions, particularly within Auhaukeae Ahupuaa. Such indirect impacts may include the visual impacts of project elements on historic properties.

Area of Potential Effect (APE) of Undertaking

Based on the initial description of the undertaking provided above, we anticipate that the APE pursuant to NHPA Section 106 would be the footprint of the proposed project, including the existing ROW as shown on the attached map. As project planning and conceptual engineering progresses, we will be better able to determine whether the footprint includes areas beyond the ROW.

If the archaeological research and consultation input indicate that historic properties beyond the project footprint may be indirectly affected, the County and FHWA will coordinate further with SPHD regarding potential modification of the APE definition.

Upon completion of the draft archaeological report, we will make a determination as to whether or not historic properties lie within the APE.

Consultation with Other Parties

We plan to invite the following organizations to participate in NHPA Section 106 consultation:

- Kona Hawaiian Civic Club
- Hui Malama I Na Kupuna O Hawai`i Nei
- Hawaii Island Burial Council
- Office of Hawaiian Affairs
- Historic Hawaii Foundation

We ask that SHPO review and provide any comments you may have regarding these matters within 30 days of receipt of this letter.

Notice of Public Information Meeting

This letter also serves as a notice of a public information meeting for the subject project on November 16, 2005, from 6:30 pm to 8:00 pm, at Kahakai Elementary School cafeteria, 76-147 Royal Poinciana Drive, Kailua-Kona. Representatives from DPW and PB will be present to share information, answer questions, and receive public comments pertaining to this project.

If you have any questions or require additional information, please do not hesitate to contact Mr. Kiran Emler in our Kailua-Kona office at 808-327-3530.

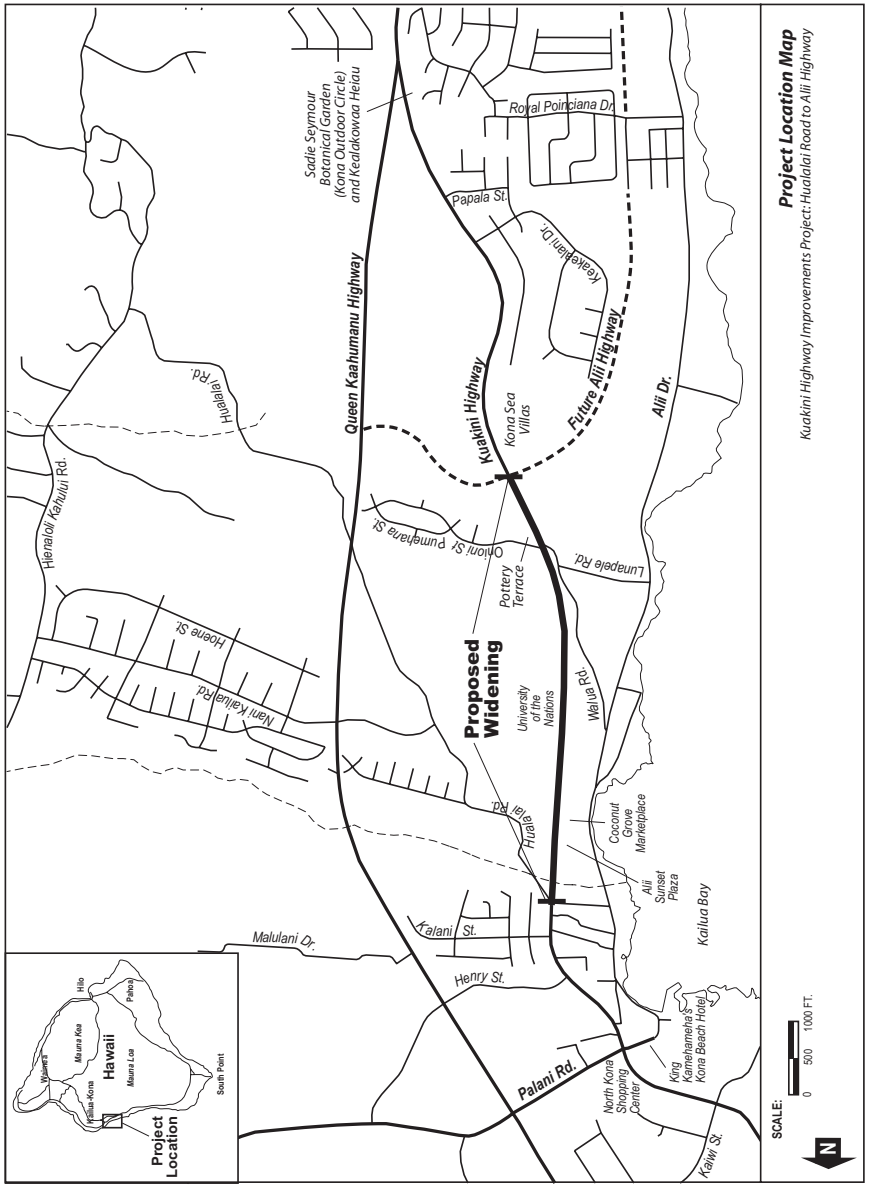
Sincerely yours,

Bruce C. McClure

Bruce C. McClure, P.E.
Director of Public Works

Attachment: Project location map

c. Ms. Richelle Takara, FHWA
Mr. David Atkin / Attn: Ms. Nami Ohtomo, Parsons Brinckerhoff



PB 100 YEARS ®

Memorandum

To: File; Meeting attendees

From: Nami Ohtomo

Date: November 23, 2005

Subject: Kuakini Highway Improvements Project, Phase 2
MEETING MINUTES - Meeting with State Historic Preservation Division – November 16, 2005, 10:00am; DLNR offices, Honokohau Harbor, Kailua-Kona

In Attendance: Mary Anne Maigret, SHPD, Hawaii Island Archaeologist
Kiran Emler, DPW
Coral Rasmussen, IARII
David Atkin, PB
Nami Ohtomo, PB

Handouts: Agenda
IARII Letter report with map to PB, dated November 4, 2005
Copy of unsigned Section 106 initiation letter from DPW to SHPD
PB Telephone Conversation Memo – with SHPD (October 11, 2005)

Other Materials: Map showing Sites/Features identified by IARII fieldwork, overlaid on existing roadway topography

Introductions, Project Description, and Background

PB verbally provided a project description, and noted that a Section 106 initiation letter had been sent from DPW to SHPD. (NOTE: Signed version was reportedly sent, but not available to PB.) That letter also contains project description language. PB reported that IARII completed fieldwork for the project in late October, and has provided a letter report to PB.

The study area was defined as a 200-foot corridor, including and extending beyond the existing ROW. Therefore, not all mapped sites will necessarily be affected by the project.

Summary of Fieldwork Findings

IARII presented the findings of their fieldwork within the 200-foot corridor, as summarized in the letter report, plus a map of prior study locations and known sites. IARII's team identified sites and mapped locations with a GPS (Trimble ProXR), which has submeter or better accuracy.

A full report is under preparation by IARII. IARII stated that the full report will meet inventory survey standards, which will be submitted to SHPD for review.

Coconut Grove Market Place - IARII noted in particular a very sensitive area near "Keopuolani's House," which used to exist at the current location of the Coconut Grove

Marketplace parking lot. Keopuolani was the sacred wife of Kamehameha (which Kamehameha not defined), indicating the level of significance of the area. There is a good chance that the sites mauka of the highway in this area are related to the house.

Site 5608 (Auhaukeae potential heiau) - Across the street (mauka) from Coconut Grove is Site 5608 (site number Temp-5 on summary table), which is a possible heiau, and probable burial. IARII feels this is the most obviously significant site. It is outside the existing ROW, but was within the study area. SHPD referred to this as the "Lanihau Parcels" for the "Kona Hale Alii" project, which includes this specific feature. IARII reported that this site needs additional research.

SHPD suggested we look at the re-zoning ordinance for Auhaukeae, which was passed for this area. A preservation agreement exists for a portion of the privately-owned Lanihau properties *(NOTE: later determined to be parcels 67 and 54, according to the County Ordinance 05 74)*, while allowing redevelopment of a 4-acre portion in the corner of one of the properties. Therefore, SHPD said there may already be something in ordinance preserving the cluster of historic sites mauka of the highway in perpetuity. SHPD reviewed the re-zoning. But the ordinance allows the subdivision of the 4-acre chunk for commercial development. The ordinance includes deed restrictions restricting development of the lower portion of the site. A preservation plan was to have been a condition of the commercial rezoning.

SHPD said a Rosendahl study covered both of the Lanihau parcels, but the study was never reviewed, or accepted as an inventory survey. SHPD verified that the Rosendahl study, completed in the 1980's, includes mapping, etc., but probably does not meet current standards for inventory survey.

SHPD wants a full inventory survey to be performed for the Lanihau parcels (but not necessarily as part of the Kuakini Highway project). The inventory survey would supercede the existing Rosendahl survey.

SHPD also noted a sewer line was also proposed in the area.

Laniakea Cave (lava tube)– The location/path of Laniakea cave is unknown, but is believed to cross under Kuakini Highway in the segment proposed for action. The cave runs between the Thurston Residence and Hale Halawai on the coast. Its depth is unknown. SHPD stated that burials are anticipated in the lava tube, and worshipping occurred in the cave.

SHPD stated it handles lava tube issues on a case-by-case basis. How SHPD has dealt with caves so far has been controversial. SHPD reviews impact of caves only within the boundaries of the project action. Therefore, if a cave passes under highway, then it needs to be addressed in that segment only. If we assert no impact on the cave, the basis of the no impact determination needs to be documented.

If a tube is punctured and there are no historic properties, such as burials, there would be no 106 nexus. However, the issue of collapsing the tube is to be discussed with SHPD.

IARII reported that Tom Woffard (sp?) has mapped the cave, and will try to obtain the documentation. A survey of the lava tube under this project may not be necessary. The amount of cave work necessary will be determined after IARII completes more research.

SHPD inquired whether the project will go onto private property. PB explained that at least one of the project alternatives will require work beyond the existing ROW. Right-of-entry has already been requested for on-going preliminary field work. Additional right of entry coordination may be needed if a survey of the lava tubes were needed.

Historic Walls: IARII reported that a variety of historic walls exist in the project area (garden walls, cattle walls, rock mounds, C shapes (temporary habitation), modified outcrops). They appear to be historic walls, but IARII is still assessing their significance, to determine if certain walls are eligible as historic properties. SHPD suggested considering questions such as how old they are, who built the wall, and whether they are ahupuaʻa boundary walls.

Burials: IARII stated there are a lot of previously identified burials, and suggested that the project will need an archeological monitor for inadvertent finds, given past history in the area.

PB suggested that "inadvertent finds" of burials be addressed in a Section 106 MOA. However, SHPD noted that an "Adverse Effect" determination needed to be made first, to trigger preparation of the MOA. Once an "Adverse Effect" determination is made and concurred, the corresponding MOA could address inadvertent finds.

SHPD also needs to clarify/verify the distinction between inadvertent finds and previously identified burials. SHPD believes that if a burial is found during the inventory survey phase, we will be asked to treat it as "previously identified". However, if a burial is found after the inventory survey is completed, then it is considered an "inadvertent find." SHPD will verify.

SHPD stated that the Chapter 6E mitigation should also be sufficient for Section 106 regulatory requirements. See Section 43.6 of Chapter 6E, which deals with SHPD's response to inadvertent finds and defines the process. Chapter 6E (8) applies to government projects.

NAGPRA would not be triggered because no federal properties are involved.

TCPs: Traditional Cultural Properties (TCPs) can also be a historic property under Section 106 and 6E. SHPD noted that TCPs must be geographically identified and bounded.

Other Sites: SHPD stated that the Ben Corp property is currently undergoing data recovery.

IARII asked SHPD if there is activity on a property north of the Ben Corp parcel (#028), which looked as if construction had been stopped near a potential site. SHPD did not have information on that property.

SHPD noted there are preservation sites also on the "Tinguely property" (appears to be Parcel #095), between Kuakini Hwy and Walua Rd, adjacent to the existing Kona Mansions.

Inventory survey: SHPD specified that the project follow State guidelines for inventory survey, to identify and categorize all archaeological features. SHPD noted that the guidelines were developed to be responsive to 106 requirements.

IARII reported it has already been treating this project as an inventory survey, following state guidelines. IARII is researching the significance criteria of previously identified sites, and will track the classification and mitigation for each site. It is expected that most of these sites may have already been mitigated (such as mapping), and require no further work, or that data recovery may be sufficient for many small resources, as long as they have been mapped.

Section 106 coordination letters will be issued. SHPD will "comment" on the inventory survey. The County will report the results of the Section 106 consultation to SHPD, prior to requesting SHPD concurrence with any effect determination.

Defining the Project's APE; Potential Impacts and Mitigation

PB discussed one possible APE definition: the project footprint, including the construction zone. If the project action stays within the ROW, it would be a continuation of the status quo, such that SHPD would likely concur that the APE is the ROW. In the case that the proposed action will be beyond the ROW, (such as for Alternative 2), SHPD stated that the construction zone plus a buffer for various potential impacts (dust, runoff, visual, and noise) would be adequate. SHPD noted that buffers for *heiau* have ranged in the past from 10 to 100 feet. SHPD stated that the APE for a cave would be limited to the construction zone (area of direct impact).

SHPD suggested that consultation with organizations may help us propose an appropriate APE. The appropriate buffer size will be up to the County to determine.

SHPD requests that the County map the limits of the APE, and propose mitigation for features within the APE that may be affected.

SHPD wants clear mitigation statements for affected resources. It must be clear which resources are being mitigated by the road project, and which resources would need to be mitigated by developers of abutting parcels in subsequent actions. Responsibility for mitigation of specific resources cannot be ambiguous between the DPW and abutting land owners.

SHPD clearly stated that no mitigation proposals by the County for affected properties should extend onto private property. SHPD has experienced problems with such mitigation actions affecting private properties. If the project has an adverse effect on features within a larger complex, only those features affected need to be mitigated, not impacts on the entire complex. The project (the County) need not assume mitigation responsibility for the entire complex, unless the entire complex is in the APE.

IARII clarified that the previously identified sites may appear numerous on the map, due to differences in industry standard on identifying sites and features. Some archaeologists tend to lump features into a site (IARII preferred method), whereas others disaggregate individual features (e.g. portion of wall of a larger complex) and treat them as individual sites.

Additional Inventory Survey possible

A SHPD goal is an inventory survey of the Lanihau properties (the Auhaukeae cluster). However, the road project is not responsible for the inventory survey of the entire Lanihau properties. Part of their property may be within our APE. In that case, the project's proposed mitigation measure would be to preserve these sites in place, as stated in the re-zoning ordinance. The current status of this area needs to be documented in our inventory survey. SHPD re-iterated that we need to check the County Rezoning Ordinance, which may also help define the project's APE.

However, SHPD explained that the problem with the Lanihau properties is that no preservation plan exists for those sites, because an inventory survey was never done. A preservation plan would have defined appropriate buffers to be preserved around these sites, including the probable heiau. It remains unclear whether the County could take action to complete an inventory survey and preservation plan for a private property, which may be affected by a County project. It is questionable if government funds could be expended to complete work that should have been completed by private parties.

SHPD emphasized and DPW concurred that both direct and indirect effects must be considered. Indirect effects can include visual impacts, which could affect the integrity of the site. Planting trees was suggested as potential noise mitigation.

It is unclear if mitigation will be needed for walls, until IARII completes their significance assessment.

All parties agreed that it is a little early to discuss impacts and mitigation, until the resources in the APE are identified.

Next Steps

PB asked SHPD for clarification on the next steps. SHPD suggested the following:

1. County consults with SHPD on APE
2. Concurrence on effect determination

PB inquired whether an additional interim step of review and concurrence on site identification by SHPD would be necessary (after stakeholder coordination comments). SHPD indicated that the additional step would not be necessary, but would verify.

Consulted Parties

PB noted that a proposed list of consulted parties is specified in the 106 consultation initiation letter. SHPD concurred with the list, and also suggested considering the following:

- "Friends Of Laniakea Cave" Group - nominated the Laniakea Cave. Ask Jocylen At SHPD for contact information.
- People Who Provided Testimony On The Lanihau Parcels Rezoning (check proceedings)

- Daughters Of Hawaii

PB asked with which organizations we should meet. SHPD suggested relying on the input from the consultation process.

PB will try to get on the January Burial Council agenda. IARII and SHPD agree that the draft inventory survey needs to be completed before going to the burial council. IARII indicated that this schedule should be possible.

ACTION ITEMS:

1) SHPD to research whether the project would have an adverse effect, based on the possibility of encountering inadvertent finds of burials.
2) SHPD needs to clarify/verify the distinction between inadvertent finds and previously identified burials.
3) PB/County to get on the January Burial Council agenda, assuming IARII will complete draft inventory survey beforehand.
4) IARII to complete draft inventory survey and submit to PB.
5) SHPD to verify to PB if an additional interim step of review and concurrence on site identification by SHPD would be necessary.

December 20, 2005

Name
Address
Address
City, State Zipcode

Dear Mr./Mrs. (name):

Subject: Proposed Kuakini Highway Improvements Project, Phase 2,
Hualalai Road to Alii Highway, Kailua-Kona, Island of Hawaii
Historic and Cultural Resources Consultation

We are assisting the County of Hawaii Department of Public Works (DPW) and the U.S. Federal Highway Administration (FHWA) with the preparation of an Environmental Assessment (EA) on their proposal to widen Kuakini Highway between Hualalai Road and the future intersection with the proposed Alii Highway (see enclosed map). Work is currently happening to widen Kuakini Highway between Palani Road and Hualalai Road. This project would continue the widening of Kuakini Highway roughly 1.2 miles further south, to its planned intersection with the future Alii Highway.

Purposes of the project include improving Kailua-Kona's roadway network by increasing roadway capacity along this stretch of the highway, enhancing pedestrian and bicycle facilities, and improving roadway safety, drainage, and emergency access. The need for these improvements is expected to increase as the area continues to develop.

We are writing to request your input on the project. Please note that as part of the EA process, we are currently conducting public outreach activities. For example, a community meeting for this project was held on November 16th at Kahakai Elementary School. Our intent with this letter is to focus specifically on historic properties that could be affected. Federal law requires consultation with interested parties regarding potential impacts to historic properties. Historic properties include archaeological resources, burials, historic structures and buildings, and traditional cultural properties. Your organization may be a potentially interested party.

The project may involve increasing the number of lanes on Kuakini Highway from two to four lanes. The roadway design concept is still being developed, but may be similar to the widening of Kuakini Highway now under construction between Palani Road and Hualalai Road. Due to the steep terrain in parts of the project area, we anticipate that the widening may require excavation into side slopes, construction of retaining walls, and filling of downslope areas. Land acquisition to create sufficient roadway right of way may also be necessary.

An archaeological report and a cultural impact assessment are being prepared for the project area. Early indications are that there are multiple historic properties in the vicinity of the project. We have also begun coordinating with the State Historic Preservation Division (SHPD) and have received some initial comments regarding the project's potential impact on archaeological resources and other historic properties.

To date, we have identified the following historic properties within the vicinity of the project:

Vicinity of Coconut Grove Market Place - This area within Auhaukeae Ahupuaa appears to be very sensitive. The historic "Keopuolani's House" formerly existed at the current location of the Coconut Grove Market Place parking lot. Keopuolani was the sacred wife of Kamehameha. Several archaeological sites that may be related to the house were identified on the mauka side of Kuakini Highway, across from Coconut Grove Market Place. In particular, a "platform" identified in this area may be eligible for the Hawaii and National Registers of Historic Places. Some of the property is protected by a preservation agreement between the County and the private developer for the "Kona Hale Alii" project.

Burials: A known burial monument is located in the sidewalk next to Coconut Grove Market Place. There may be other burials in the area.

Laniakea Cave (lava tube) – Laniakea Cave is believed to cross under the northern segment of Kuakini Highway. The cave may extend between the Thurston Residence and Hale Halawai on the coast. The cave has reportedly been used for cultural practices, and burials may occur in the lava tube.

Historic Walls: Several walls, which appear to be historic, exist in the project area, including a remnant of the Great Wall of Kuakini.

Other Sites: Undeveloped properties adjacent to the roadway may also contain archaeological features.

If you have additional information on these or other potential historic properties in the project vicinity, we would appreciate your assistance in identifying such sites and their significance. If you know other people we should contact to better understand the area's historic resources, please provide us with information on how to contact these people.

The County of Hawaii wants to avoid impacts to significant historic properties as much as possible. Avoidance of these resources starts with knowledge of their location and significance. Your *kokua* in helping us design an improved roadway that is sensitive to its surroundings is greatly appreciated.

We will send you a copy of the Draft EA when it is completed. The Draft EA will contain copies of the archaeological and cultural reports prepared for this project and letters showing the coordination activities we conducted.

If you have any comments, concerns, or information pertinent to this project, please send them in writing within 30 days of receipt of this letter. If you require additional time to respond to this request, have additional questions, wish to be removed from the project mailing list, or otherwise require further information, please contact me at (808) 531-7094, or via email at ohtomo@pbworld.com.

Very Truly Yours,

PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

Nami Ohtomo
Lead Environmental Planner

Enclosures: Project location map

cc. Ms. Richelle Takara, FHWA
Mr. Kiran Emler, Hawaii County DPW

Mr. Clyde Namuo
Administrator
Office of Hawaiian Affairs
711 Kapiolani Blvd Suite 500
Honolulu, HI 96813-5249

Ms. Ruby MacDonald
Big Island CAC
Office of Hawaiian Affairs
75-5706 Hanama Place Suite 107
Kailua-Kona, HI 96740

Mr. David Scott
Director
Historic Hawaii Foundation
PO Box 1658
Honolulu, HI 96806

Mr. Kunani Nihipali
Hui Malama I Na Kupuna O Hawaii Nei
PO Box 967
Kailua, HI 96734-0967

Ka Lahui Hawaii
P.O. Box 4964
Hilo, HI 96720

President
Kona Hawaiian Civic Club
P.O. Box 4098
Kailua-Kona, HI 96745

Ms. Fanny AuHoy
Daughters of Hawaii
Huihe'e Palace
75-5718 Alii Drive
Kailua-Kona, HI 96740

Mr. Charles Young
Chair
Hawaii Island Burial Council
State Historic Preservation Division
Department of Land and Natural Resources
c/o SHPD 601 Kamokila Blvd. #555
Kapolei, HI 96707

Ms. Jo-Anne Kahanamoku Sterling
Committtee Chair
Historic Kealakowa'a Heiau Preservation Council
c/o Kona Outdoor Circle Educational Center
76-6280 Kuakini Hwy.
Kailua-Kona, HI 96740

PHONE (808) 594-1888

FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

RECEIVED
JAN 13 2006
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

HRD05/2111B

January 10, 2006

Nami Ohtomo
Parsons, Brinkerhoff, Quade & Douglas
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, HI 96813

RE: Pre-Consultation for the Proposed Kuakini Highway Improvements Project, Phase 2 - Hualalai Road to Ali'i Highway, Kailua-Kona, Hawai'i Island.

Dear Nami Ohtomo,

The Office of Hawaiian Affairs (OHA) is in receipt of your December 20, 2005 request for comment on the above listed proposed project. OHA offers the following comments:

Please contact Ruby McDonald of OHA's Kailua–Kona office as she will likely be able to assist you in your pre-consultation effort. Thank you for your continued correspondence.

OHA further requests your assurances that if the project goes forward, should iwi or Native Hawaiian cultural or traditional deposits be found during ground disturbance, work will cease, and the appropriate agencies will be contacted pursuant to applicable law.

Thank you for the opportunity to comment. If you have further questions or concerns, please contact Jesse Yorck at (808) 594-0239 or jessey@oha.org.

'O wau iho nō,

Clyde W. Nāmu'o
Administrator

CC: Ruby McDonald
OHA Community Affairs Coordinator (Kailua-Kona)
75-5706 Hanama Pl., Suite 107
Kailua-Kona, HI 96740

Telephone Conversation Memorandum

Parsons Brinckerhoff Quade & Douglas, Inc
American Savings Bank Tower, Suite 2400
1001 Bishop Street
Honolulu, HI 96813
808-531-7094
Fax: 808-528-2368

project: Kuakini Hwy ***job no.:*** 16431A ***date:*** *January 23, 2006*

talked to: Mary Anne Maigret ***from:*** SHPD – Big Island

Hawaii Island Archaeologist

item discussed: discussion of potential APE; recap of 18Jan06 HIBC mtg

information obtained:

Determining the APE:

We greed that a logical APE may be something that follows the contours of the project limits of construction (project footprint), plus an additional buffer zone. Mary Anne suggested that the APE does not have to cover entire TMKs. It should encompass all sites near the road, which may be affected directly or indirectly. Using only the project footprint would not be sufficient for the APE, because of potential indirect impacts on sites.

She suggested that we consider the resources potentially affected to determine how much of a buffer would be appropriate. Such buffers may range from 10 to 100 feet, depending on varying factors. Consultation with the project archaeologists should help to determine an appropriate buffer.

Mary Anne suggested that issues to consider include the following: noise impacts (how far will the sound travel?); visual intrusion at sensitive sites (how will lights/headlights affect the site at nighttime, if there are nighttime worship activities? Will walls be placed in front of the resource? Is this desirable?); will project actions block access or open up too much access for vandals and trash-dumping?, will there be a pull-out that could facilitate access (for better or for worse)?;

Mary Anne's suggestions for future participation at burial council meetings:

- Determine APE first
- Indicate ahupuaa name in agenda item announcements – this will bring more people specifically knowledgeable about the area.
- Submit (draft) reports for archaeology and/or cultural impacts, in advance

action required:

Consult with IARII for appropriate APE size and shape.

distribution

file	*IARII*	*SRP*			

by: Nami Ohtomo

Parsons Brinckerhoff
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, HI 96813
808-531-7094
Fax: 808-528-2368

August 31, 2006

Laniakea Foundation
765 Kumukahi Place
Honolulu, Hawai'i 96825-1114

Subject: Proposed Kuakini Highway Improvements Project, Phase 2
Hualalai Road to Alii Highway
Kailua-Kona, Island of Hawai'i
Historic and Cultural Resources Consultation

Dear Sir or Madam:

We are assisting the County of Hawaii Department of Public Works (DPW) and the U.S. Federal Highway Administration (FHWA) with the preparation of an Environmental Assessment (EA) on their proposal to widen Kuakini Highway between Hualalai Road and the intersection with the proposed Alii Highway (project location illustrated in attachments). Kuakini Highway was recently widened from two to four lanes between Palani Road and Hualalai Road. This project would extend the widening of Kuakini Highway to four lanes roughly 1.2 miles further south, to its planned intersection with the future Alii Highway. Due to the steep terrain in parts of the project area, the widening may require excavation into side slopes, construction of retaining walls, and filling of down slope areas. Land acquisition to create sufficient roadway right of way may also be necessary.

Purposes of the project include improving Kailua-Kona's roadway network by increasing roadway capacity along this stretch of the highway, enhancing pedestrian and bicycle facilities, and improving roadway safety, drainage, and emergency access. The need for these improvements is expected to increase as the area continues to develop.

We are writing to request your input, particularly with respect to historic properties in the project area. Historic properties include archaeological resources, burials, historic structures and buildings, and traditional cultural properties. Knowledge that your organization has regarding historic properties in the area could help in the evaluation of project alternatives and mitigation measures. We think that your group may have particular expertise with respect to Laniakea Cave, which crosses the northern end of the project area.

An archaeological report and a cultural impact assessment have been prepared for the project area and are enclosed, for your review and comment.

Over a Century of Engineering Excellence

To date, we have identified the following historic properties within the vicinity of the project:

- Vicinity of Coconut Grove Market Place: This area within Auhaukeae Ahupuaa appears to be very sensitive. The historic "Keopuolani's House" formerly existed at the current location of the Coconut Grove Market Place parking lot. Keopuolani was the sacred wife of Kamehameha. Several archaeological sites that may be related to the house were identified on the mauka side of Kuakini Highway, across from Coconut Grove Market Place. In particular, a "platform" identified in this area may be eligible for the Hawaii and National Registers of Historic Places. Some of the property is protected by a preservation agreement between the County and the private developer for the "Kona Hale Alii" project.
- Burials: A burial monument is located in the sidewalk next to Coconut Grove Market Place. During a waterline construction project by the County's Department of Water Supply, additional burials were recently discovered under the existing roadway in the same area. There may be other burials in the area.
- Laniakea Cave (lava tube): Laniakea Cave crosses under the northern part of the proposed project. The cave may extend between the Thurston Residence and Hale Halawai on the coast. The cave has reportedly been used for cultural practices, and burials may occur in the lava tube.
- Historic Walls: Several walls which appear to be historic exist in the project area, including a remnant of the Great Wall of Kuakini.
- Other Sites: Undeveloped properties adjacent to the roadway may also contain archaeological features.

If you have additional information on these or other potential historic properties in the project vicinity, we would appreciate your assistance in identifying such sites and their significance. If you know other people we should contact to better understand the area's historic resources, please provide us with information on how to contact those people.

The County of Hawaii wants to avoid impacts to significant historic properties as much as possible. Avoidance of these resources starts with knowledge of their location and significance. Your *kokua* in helping us design an improved roadway that is sensitive to its surroundings is greatly appreciated.

We will send you a copy of the Draft EA when it is completed and you will have an additional opportunity to comment on the project at that time.

If you have any comments, concerns, or information pertinent to this project, please send them in writing within 30 days of receipt of this letter. If you require additional time to respond to this request, have additional questions, wish to be removed from the project mailing list, or otherwise require further information, please contact me at (808) 566-2239, or via email at hayesja@pbworld.com.

Very Truly Yours,

PARSONS BRINCKERHOFF, INC.

James Hayes
Lead Environmental Scientist

Enclosures:

1. Draft Archaeological Inventory Survey for the Kuakini Highway Improvements Project, Phase 2, Hualalai Road to Ali'i Highway, Kailua-Kona, Hawai'I, TMK: 7-5-8, 9, 10, 17, 18, 19, and 30 (POR.); by International Archaeological Research Institutes, Inc., April 2006
2. Draft Cultural Impact Assessment Study for the Kuakini Highway Improvements Project, Phase 2 Hualalai Road to Ali'i Highway, Kailua Kona, Island of Hawai'i; by Social Research Pacific, Inc., April 2006

cc. Ms. Richelle Takara, FHWA
Mr. Kiran Emler, Hawaii County DPW

From: Ohtomo, Nami
Sent: Tuesday, December 27, 2005 11:41 AM
To: 'konaoutdoorcircle@konacoast.com'
Subject: Message for Jo-Anne Kahanamoku-Sterling (Kealakowaa Heiau), re Kuakini Hwy project

Hi Jo-Anne,

Thank you for your voice mail. Sorry I missed your call. I tried you at your home number, and also at the Outdoor Circle office, but no luck.

I hope this email reaches you safely.

I appreciate your offer of assistance and involvement on the project, and we will keep you informed. You may be interested to know that we are planning on making a project presentation to the Hawaii Island Burial Council in January (location not yet determined, but SHPD staff says it will be on Weds, Jan 18 in Kailua-Kona somewhere). It'll probably be just some preliminary information and request for input, and I believe you have already been contacted by our cultural impact subconsultant (Usha Prasad), but you may find the presentation useful.

-Nami

Nami Ohtomo
Parsons Brinckerhoff - Honolulu
ASB Tower, Suite 2400 (new address as of 12/20/04)
1001 Bishop Street
Honolulu, HI 96813
tel (808) 566-2239
fax (808) 528-2368

Telephone Conversation Memorandum

Parsons Brinckerhoff Quade & Douglas, Inc
American Savings Bank Tower, Suite 2400
1001 Bishop Street
Honolulu, HI 96813
808-531-7094
Fax: 808-528-2368

project: Kuakini Hwy **job no.:** 16431A **date:** *January 25, 2006*

talked to: Keola Lindsey **from:** SHPD – Big Island

Hawaii Island Burials coordinator

item discussed: follow-up to Jan. 18, 2006, HIBC meeting

information obtained:

I contacted Keola to ask whether we should attend the Hawaii Island Burial Council, meeting in February, since some HIBC members indicated confusion about the Section 106 process, why we were making a presentation about the project, and frustration about not reviewing any of the relevant materials beforehand.

Keola said that unless there is a specific request from us, the item will not be placed on the agenda. If the project is not on the agenda, it will not be discussed. He said it is up to us, whether we choose to come back to the HIBC for recommendations or general thoughts. He felt there is no expectation by the HIBC that this issue be on the agenda next month. He noted that since we attended the meeting wanting feedback/general thoughts, and we did not get any at the meeting on Jan. 18, we may choose to come back to accomplish our goal. I clarified that we did accomplish one of our goals, which was to share information about the project with the HIBC, and to provide them an opportunity to give us their comments, as part of early consultation. Recommendations and feedback from the Council was requested, but optional, although this was a point of confusion among the Council members at the meeting.

I suggested that the next appropriate time for us to return to the HIBC would be when we have new information to share with the HIBC, such as the draft archaeological report and cultural impact assessment. Keola concurred, and also suggested that, depending on what adverse effects may later be identified under Section 106, that may be the best time at which to request HIBC's involvement.

I asked whether HIBC could instead respond to us in writing, replying to our December 20, 2005 consultation letter. He noted that HIBC does NOT respond to such letters, unless it is specifically "agendized" (put on the agenda) and discussed by the entire Council. Approval of the wording for a letter, or a decision to delegate the writing of a letter to an HIBC member, must first be decided at a Council meeting. Keola suggested that if such a discussion were held at a full HIBC meeting, we would probably want to attend anyway, since there are likely to be questions and discussion. We would also have to initiate the discussion by requesting the subject be properly "agendized".

action required:

None. Project team may choose to re-appear before HIBC at a later date, with additional information.

distribution

file	*IARII*	*SRP*	*DPW*		

by: Nami Ohtomo

Date: March 26, 2007

Submittal Sheet for Historic Preservation Review Filing Fees

State Historic Preservation Division
601 Kamokila Blvd., #555, Kapolei, Hawai‘i 96707

Agency/Firm (requesting review): Federal Highways Administration

Contact: Richelle Takara
Phone: 541-2700x311 Fax: 541-2704 E-mail: richelle.takara@fhwa.dot.gov
Address: Box 50206; Honolulu, Hawai‘i 96850

Title of Report/Plan: 1. Archaeological Inventory Survey for the Kuakini Highway Improvements Project, Phase 2, Hualālai Road to Ali‘i Highway, Kailua-Kona, Hawai‘i
2. A Cultural Impact Assessment Study for the Kuakini Highway Improvements Project, Phase 2 Hualālai Road to Ali‘i Highway, Kailua Kona, Island of Hawai‘i

Island: Hawai‘i District: North Kona Ahupua‘a: 9 (see attached)
TMK [(1) 1-1-001:001]: (3) 7-5-008, 009, 010, 017, 018, 019, and 030 (see attached)

Submitted Plan/Report Fee & Type: (All reports or plans submitted to SHPD for review shall be accompanied by the appropriate fee in accordance with HAR §13-275-4 and §284-4).

		Indicate here (X) if report is a re-submittal (no fee charged)
	$50	Archaeological Assessment
	$150	Archaeological Inventory Survey Plan
X	$450	Archaeological, Architectural or Ethnographic Survey Report
	$150	Preservation Plan
	$25	Monitoring Plan
	$150	Archaeological Data Recovery Plan
	$250	Burial Treatment Plan
	$100	Archaeological Monitoring Report, if resources reported
	$450	Archaeological Data Recovery Report
	$450	Ethnographic Documentation Report
	$25	Burial Disinterment Report
	$50	Osteological Analysis Report

Fee Total: $ Exempt

Make check payable to “Hawai‘i Historic Preservation Special Fund.” A service charge of $15 will be assessed on all dishonored checks pursuant to HRS §40-35.5. A copy of this form will be mailed or faxed back to you and will serve as your receipt.

For Office Use Only:

Date Received:	Receipt No.:
	Payment Method: Cash: _____ $ Check: _____ Check No.:
Log. No.:	Receipt Issued by: Treasury Deposit Receipt No.:

Ahupua‘a and Tax Map Key (TMK) Located within the Kuakini Highway Improvements Project

Ahupua‘a	Tax Map Key
Hienaloli 6th	7-5-009:023, 048, and 052
‘Auhaukea‘ē 2nd	7-5-009:025 and 055
‘Auhaukea‘ē 1st	7-5-009:029, 053, 054, and 059
Pua‘a 3rd	7-5-018:012 and 028
Pua‘a 2nd	7-5-010:003; 7-5-018:028; 7-5-009:003, 004, 010, 040, and 056
Pua‘a 1st	7-5-009:021, 023, 057
Wai‘aha 2nd	7-5-017:037; 7-5-018:041 and 043; 7-5-30:024 and 025
Wai‘aha 1st	7-5-017:037; 7-5-018:007, 089, 090, 091, 092, 094, 095; 7-5-010:085

U.S. Department
of Transportation
**Federal Highway
Administration**

Hawaii Division
Box 50206
300 Ala Moana Boulevard, Room 3-306
Honolulu, HI 96850

April 3, 2007

In Reply Refer To:
HEC-HI

Mr. Peter T. Young
Chairperson and State Historic Preservation Officer
State of Hawaii Department of Land and Natural Resources
601 Kamokila Boulevard
Kakuhihewa Bldg., Room 555
Kapolei, Hawai'i 96707

Attention: Melanie Chinen, SHPD Administrator

Dear Mr. Young:

The County of Hawai'i Department of Public Works (DPW), with the assistance of the Federal Highway Administration (FHWA), proposes to widen Kuakini Highway to four lanes between Hualalai Road and the future intersection with the proposed Ali'i Highway. In a letter dated October 27, 2005, DPW initiated Section 106 consultation with the SHPO under the National Historic Preservation Act (NHPA) for the proposed Kuakini Highway Improvements Project Phase 2, Kailua-Kona, Island of Hawaii, Hawaii Job No. P-3718, FAP No. STP-1910(2). An area of potential effect (APE) was also proposed in that letter.

The purpose of this letter is to provide the following items:

- refined description of the "undertaking",
- details of additional coordination with your staff,
- results of consultation with other parties,
- refined description of the APE and historic properties identified, and
- FHWA's effect determination for those historic properties within the project's APE.

We request that you review our draft archaeological inventory survey (enclosed) and concur with our effect determination pursuant to Section 106.

We consider that these activities, which we are conducting to comply with Section 106, are also sufficient to comply with Hawai'i Revised Statutes (HRS) Chapter 6E.

Refined Description of the Undertaking
Kuakini Highway would be widened from a two-lane, undivided roadway to a four-lane roadway. Improvements include auxiliary lanes, bike lanes, sidewalks, curbs and gutters,

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AMERICAN
ECONOMY

relocated utilities, drainage structures, highway lighting, intersection improvements, and driveway improvements. Due to the steep terrain in the project area, cutting and filling of slopes would be necessary and additional right-of way (ROW) may be needed depending on the design alternative selected.

The two design alternatives are as follows: one proposes widening within the existing ROW; another proposes widening beyond the existing ROW to minimize the need for and height of retaining walls. ROW impacts under the alternative with greater impacts are shown on the attached maps. Also shown are the limits of construction (LOC) where temporary ground disturbance may occur. The LOC is generally 10 feet beyond the edge of the existing and/or future ROW, plus anticipated driveway adjustments and construction staging areas. Because the construction staging area cannot be identified definitively at this time, we have indicated four possible sites for the staging area. Locations of potential historic properties discussed in the draft inventory survey (attached) are also shown. We assumed the worst-case design alternative (the alternative requiring additional ROW) as the basis of our effect determination below.

Additional Coordination and Consultation with SHPD Staff
In addition to communications with your Historic Preservation Division staff (Ms. Mary Anne Maigret) via telephone on October 11, 2005, DPW and its consultants also met with SHPD staff on November 16, 2005. In addition, consultant Parsons Brinckerhoff (PB) also followed up with Ms. Maigret via phone on January 26, 2006 for additional guidance on defining the APE. Mr. Keola Lindsey of the burials program was also consulted multiple times in the context of identifying or contacting cultural informants, and also coordinating an informational presentation to the Hawai'i Island Burial Council (HIBC) that occurred on January 18, 2006.

Consultation with Other Parties
Through correspondence sent on December 20, 2005, we invited the following organizations to participate in NHPA Section 106 consultation:

- Kona Hawaiian Civic Club
- Hui Malama I Na Kupuna O Hawai'i Nei
- Hawai'i Island Burial Council (HIBC)
- Office of Hawaiian Affairs (OHA)
- Daughters of Hawai'i
- Historic Kealakowa'a Heiau Preservation Council
- Ka Lahui Hawaii
- Historic Hawai'i Foundation

In addition, on August 31, 2006, correspondence was sent to the Laniakea Foundation inviting them to participate in the NHPA Section 106 consultation; however they have not responded.

Although not considered part of the Section 106 consultation, project consultants made an informational presentation at the January 2006 meeting of HIBC and requested its members provide additional relevant information.

We received one written reply from OHA requesting assurance that should a burial be discovered, work would cease and the appropriate agencies would be contacted. OHA also requested that we consult with their Kailua-Kona representative, Ms. Ruby McDonald. Members of our project team have been in touch with Ms. McDonald for information and guidance.

Ms. Jo-Anne Kahanamoku-Sterling of the Historic Kealakowa'a Heiau Preservation Council also contacted us to offer assistance. Input from both Ms. McDonald and Ms. Kahanamoku-Sterling are reflected in project reports.

Refined Description of the Area of Potential Effect (APE)

Because we are in the early project planning stage, the APE was conservatively defined as a 200-foot wide corridor 100 feet on either side of the existing Kuakini Highway centerline. A corridor that size was presumed to be more than sufficient to encompass the entire project footprint and document historic resources that could be effected by the project even if they were outside the actual limits of construction.

Subsequent conceptual engineering confirmed that the APE is wider than the limits of construction and captures all areas of potential effect. The only exception is the possibility that construction staging areas could extend beyond the 200-foot wide APE. Should the selected construction contractor choose to use a construction staging area beyond those areas already surveyed, it would be an obligation of the contractor to survey for historic properties any areas beyond those already addressed.

Historic Properties Identified and Effect Determination

Data gathered during archaeological research and consultation with cultural informants indicated that historic properties either lie within or close to the project footprint. Because these properties may be directly or indirectly affected, the project team has prepared an archaeological inventory survey and a companion cultural impact assessment (CIA). Both reports are attached for your information. We request that SHPD review the inventory survey; the CIA is provided for additional information.

IARII documented all sites found within the 200-foot wide APE in its inventory survey. A total of 21 sites, some with multiple features, were recorded. The sites and features identified by IARII have been separated into the following categories:

A. Historic sites on which the project will have no effect:
   - Rock clearing pile, Site 11059 feature 4
   - Ranching wall, Site 15514
   - Rock outcrop, Site 22045 (possible)
   - Rock wall, Site 22053 (possible)
   - Wall remnants, Site 22054 (possible)
   - Agricultural landscape, Site 23686 features 187, 188, 189, 190, 191, and 197
   - Rock mound, temporary Site 1
   - Burials encountered during 16-inch diameter water line installation (they have been relocated outside the APE)

B. Historic sites on which highway construction will have no effect but potential construction staging may cause an adverse effect, depending on where construction staging takes place:
   - Coral/boundary walls, Site 23662
   - Rock outcrop/quarry, temporary Site 3
   - Lava blister, temporary Site 4/Site 25032

C. Sites evaluated in the IARII report and found to be modern or not meeting any of the criteria for NHRA eligibility:
   - Modern rock wall on makai side of Kuakini Highway, Site 22057
   - Modern rock wall on mauka side o Kuakini Highway, Site 23666
   - Boundary wall, Site 23665 (rebuilt with modern materials)

D. Historic site on which the project will likely have no effect but further evaluation is necessary:
   1. Laniakea Cave, Site 7248

E. Historic sites on which the project will have no effect but avoidance, protection, and/or mitigation may be necessary:
   2. Temporary habitation site, temporary Site 2/Site 25030
   3. Kuakini's Wall, Site 6302
   4. Burial and memorial, Site 21189
   5. Platforms and occupation area, Site 5608 features BBB, CCC, DDD, and WWW

F. The proposed project would have an adverse effect on the historic sites in this group; however, no mitigation is required because they have been fully documented and preservation is not deemed necessary:
   6. Boundary wall, Site 6300
   7. Kamehameha V LCA boundary wall, Site 11059 feature 8
   8. Ranching boundary wall, Site 15508

All the sites listed above are discussed in detail in the IARII report (attached) and illustrated in the attached figures. Sites in category A are not discussed here because the project will not have any effect on them. Because the location of the construction staging area is not known at this time, sites in category B are not discussed here. Furthermore, because the APE did not cover the entire area of all conceivable construction staging areas, it will be the responsibility of the contractor to select a staging area and obtain Section 106 clearance of that area prior to starting work. The contractor will be provided the IARII report to assist in their selection of a construction staging area. Sites in category C are not discussed here because they are not historic sites.

The numbered sites and features listed in categories D, E, and F are discussed briefly below and in detail in the attached IARII report.

1. Laniakea Cave (Site 7248)
Laniakea Cave is a lava tube that lies directly beneath Kuakini Highway between Hualalai Road and the Keopu Stream drainage channel. The cave's exact location is unclear, but the cave is known to connect an entrance near the ruins of Thurston House (some 800 feet east of the APE) with Hale Halawai on the coast of Kailua-Kona. Furthermore, the cave is believed to be located between the intersection of Kuakini Highway and Hualālai Road and the box culvert that conveys Keopu Stream under Kuakini Highway. The cave is eligible for the NRHP under Criterion D, and the Hawaii Register under Criteria D and E.

The project will likely cause no adverse effect on the cave for the following reasons:

- The crossing of the cave under Kuakini Highway is believed to be deep.
- The cave was not encountered during the installation of a water line beneath the existing Kuakini Highway roadway.

For these reasons, the FHWA has rendered a "no effect" determination for Laniakea Cave. However, as an extra precaution, project engineers will inspect the cave and an opening near the roadway which could be connected to the cave to determine the cave's alignment and depth beneath the project area. In the unlikely event that the cave is found to be shallow enough to be affected by the project, the roof of the cave would be bridged. The cave would not be breached. If piles were required, they would be placed beyond the extent of the cave.

2. Temporary Habitation Site (Site 25030, Temp 2 in inventory survey)
This C-shaped structure is located in the vacant parcel adjacent to Pottery Terrace, and is at least 14 feet from the limits of construction. It may have served as temporary habitation. It is deemed eligible for the NRHP and the Hawaii Register under Criterion D. The inventory survey recommended avoidance of this site.

The FHWA has rendered a "no effect" determination for this site. It would not be directly affected by construction due to its distance from construction activities. However, construction fencing would be installed as a precautionary measure during construction to ensure it is avoided and protected.

3. Kuakini's Wall (Site 6302)
Two segments of Kuakini's Wall, also known as the Great Wall of Kuakini, were found on either side of Kuakini Highway near the OniOni Street/Walua Road intersection with Kuakini Highway. The existing Kuakini Highway appears to have breached this wall. The wall is eligible for the NRHP and the Hawaii Register under Criteria B, C, D, and E (Hawaii Register only).

The FHWA has rendered a "no effect" determination for this historic wall. The distance of this site from the limits of construction indicates that there would be no direct construction-period impacts on this wall. However, due to the importance of this wall, construction fencing will be installed around the closest approach of the wall segments to the construction zone, as a protective measure.

4. Burial and Memorial (Site 21189)
This burial lying within the Kuakini Highway ROW was an inadvertent discovery in 1998 during the construction of Coconut Grove Marketplace. The human remains were not directly associated with an individual or a specific family in the area. The remains were left in place and

a stone memorial was erected on the sidewalk, which now fronts the shopping center. The remains are a little more than 2 feet (about 70 centimeters) below the surface. This site is not eligible for the NRHP, but is eligible for the Hawaii Register under Criterion E.

The proposed project would not disturb this feature and the sidewalk on which the memorial is placed. Care will be taken during construction to avoid and preserve the burial by limiting the depth of disturbance in the area. Therefore, no effect is anticipated for this burial and monument.

5. Platforms and Occupation Area (Site 5608, Features BBB, CCC, DDD, and WWW)
This site with multiple features is located east (mauka) of the roadway, across from Coconut Grove Marketplace, and contains multiple features. The features BBB, CCC, DDD are described as platforms, are approximately 50 feet east of the LOC, are likely to be eligible for the NRHP under Criterion D, and eligible for the Hawaii Register under Criterion E. Feature WWW is described as an occupation area, is approximately 30 feet east of the LOC, and is likely to be eligible for NRHP and the Hawaii Register under Criterion D.

The FHWA has rendered a "no effect" determination for this site. It would not be directly affected by construction due to its distance from construction activities. To protect the features the following precautions will be taken:

- Install temporary construction fencing between the features and the LOC to protect the features during construction.
- Install rock walls along the highway ROW in the vicinity of the features, if no retaining wall 4 feet high or higher is required by the project, to preserve a buffer area of at least 30 feet between widened Kuakini Highway and the features. This would create a physical barrier between the highway and features to protect them, similar to the rock wall that now exists between the highway and the features.

6, 7, and 8. Rock Walls (Sites 6300; 11059, Feature 8; and 15508)
These walls are likely to be eligible for NRHP and the Hawaii Register under Criterion D. The rock walls are ranching or boundary walls and are relatively common in the area. Only the portion of the rock walls present in the ROW will be removed by the project. The archaeological survey indicates that the walls have been fully documented and preservation or mitigation is not recommended.

Because small portions of these walls within the highway right-of-way would be removed, the FHWA has rendered an "adverse effect" determination for these historic walls. However, no mitigation is proposed because the wall has been fully documented.

Additional Resources
Inadvertent discovery of subsurface cultural deposits is possible during construction. If a burial is encountered during construction, all work in that area would be temporarily halted, and the proper agencies and organizations would be notified, including SHPD. Archaeological monitoring will be conducted during construction, and a monitoring plan will be prepared and submitted to SHPD for approval.

Request for Review and Concurrence
We ask that SHPO review and concur with the effect determination provided herein within 30 days of receipt of this letter. We also request a review of our draft archaeological inventory survey.

Once we agree on the effect determination and the mitigation measures, a memorandum of agreement (MOA) will be drafted to record: (a) the protective plans outlined above for known nearby historical resources, and (b) our monitoring and contingency plan related to inadvertent discovery (Archaeological Recovery Plan) program.

If you have any questions or require additional information, please do not hesitate to contact me at 808-541-2700 ext. 311.

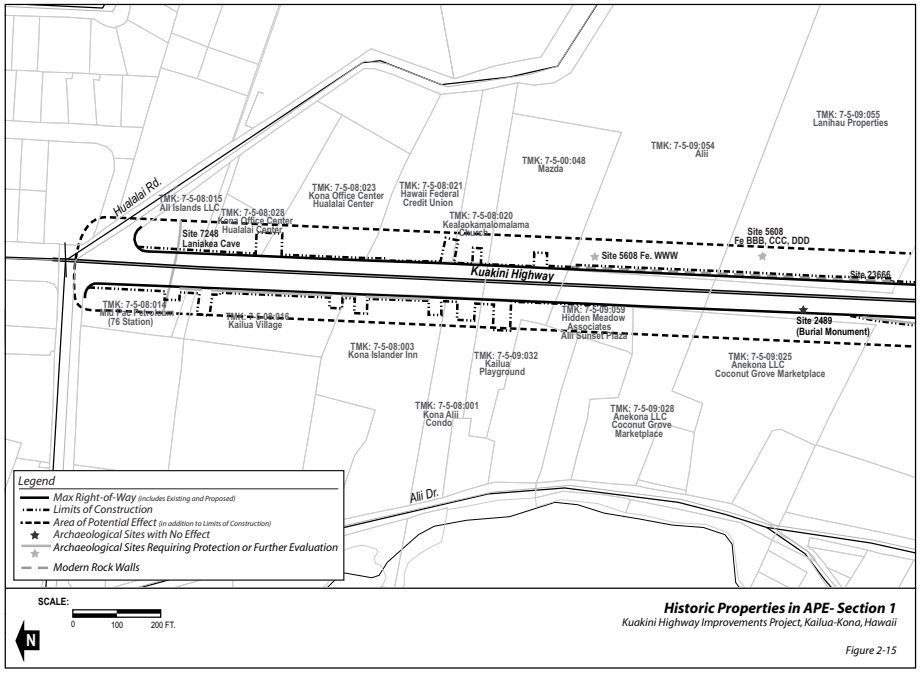
Sincerely yours,

Richelle M Takara

Richelle Takara, P.E.
Transportation Engineer

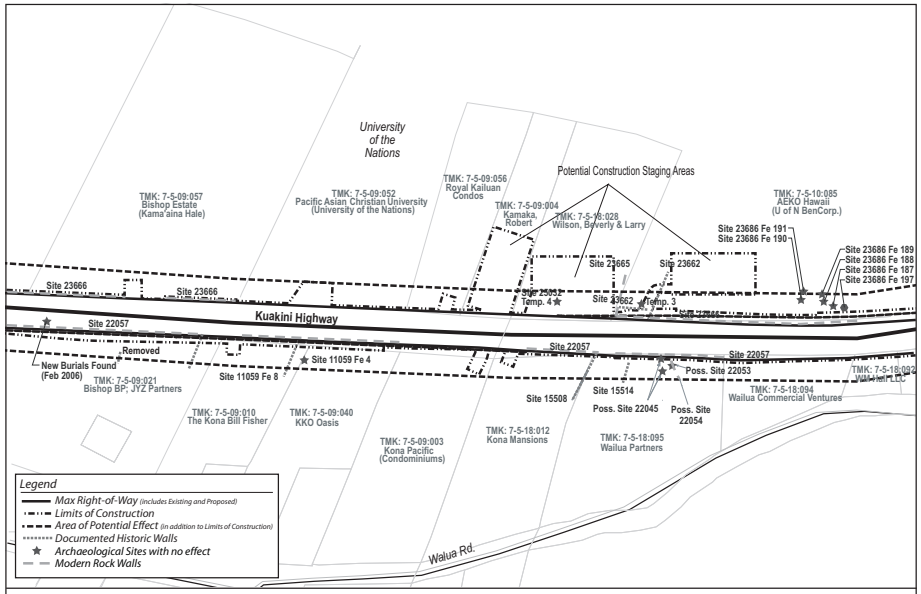
Attachments:
1) Area of Potential Effect (APE) maps (3)
2) Draft Archaeological Inventory Survey (April 2006)
3) Draft Cultural Impact Assessment (April 2006)

cc (without attachments):
Mr. Kiran Emler, DPW
Mr. James Hayes, PB
Ms. Coral Rasmussen, IARII



Historic Properties in APE- Section 1
Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

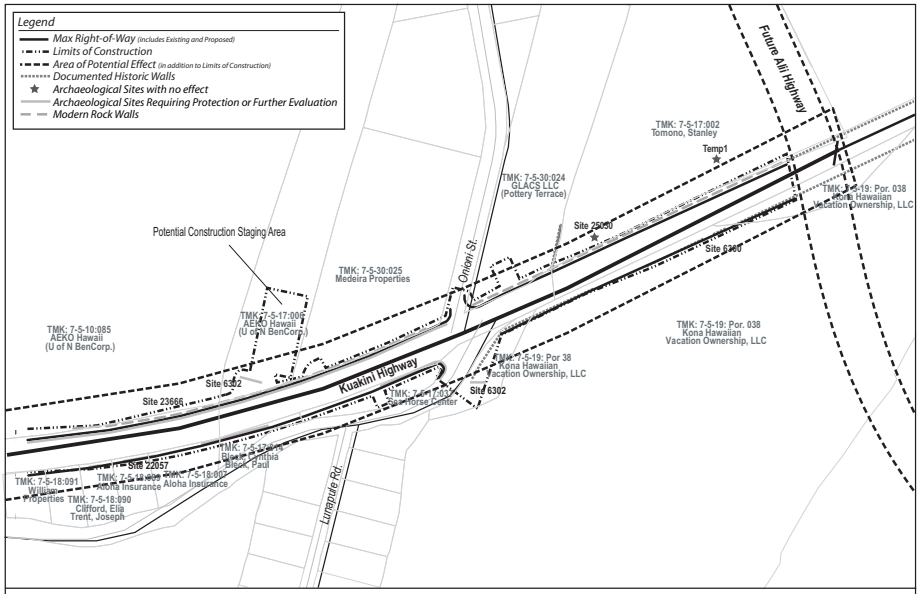
Figure 2-15



Historic Properties in APE - Section 2

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

Figure 2-16



Historic Properties in APE - Section 3

Kuakini Highway Improvements Project, Kailua-Kona, Hawaii

Figure 2-17

RT

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GOVERNOR OF HAWAII

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LAURA H. THIELEN
CHAIRPERSON
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COMMISSION ON WATER RESOURCE MANAGEMENT

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DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
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CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

October 9, 2007

Richelle Takara, P.E.
U.S. Department of Transportation
Federal Highway Administration, Hawai'i Division
Box 50206
300 Ala Moana Boulevard, Room 3-306
Honolulu, Hawai'i 96850

LOG NO: 2007.1203
DOC NO: 0709ED18
Archaeology

Dear Ms. Takara:

SUBJECT: National Historic Preservation Review (NHPA) Section 106 Review – Draft Archaeological Inventory Survey for the Kuakini Highway Improvements Project, Phase 2, Hualalai Road to Ali'i Highway Hienaloli 6th; 'Auhaukea'ē 1st and 2nd; Pua'a 1st, 2nd and 3rd; Wai'aha 1st and 2nd; and Kahului 1st Ahupua'a, North Kohala District, Island of Hawai'i TMK: (1) 7-5-008, 009, 010, 017, 018, 019, and 030: various parcels

Thank you for submitting the aforementioned report by Rasmussen (April 2006), which we received on April 12, 2007. We apologize for the delay in responding. The report documents the archaeological inventory survey (AIS) conducted by International Archaeological Research Institute, Inc of the Kuakini Highway Improvements project area between October 24 and October 28, 2005. Archaeologists surveyed a 200 foot wide corridor along 1.2 miles of Kuakini Highway. No subsurface testing was conducted during the AIS. Twenty-one archaeological sites were documented during the AIS, 17 of these sites have been previously identified during earlier archaeological surveys.

Sites -5608 (Features BBB, CCC, DDD, and WWW), -6302, -7248, and -21189 are recommended for preservation. Avoidance, or mitigation (where avoidance is not possible), is recommended for Temporary sites 2 and 4. We concur with your recommendations for the aforementioned sites. We also concur with your recommendation for archaeological monitoring during construction of the Kuakini Highway Improvements Project.

No further archaeological work is recommended for Sites -6300, -11059 (Features 4 and 8), -15514, -15508, -22045, -22053, -22057, -23662, -23665, -23666, -23686, Temporary Site 1, and Temporary Site 2.

Sites -22045, -22054, -22057, -23665, and -23666 lack integrity and are significant under only criterion d. We concur with your recommendations for Sites -22045, -22054, -22057, -23665, and -23666.

Sites -6300, -11059 (Feature 4 and 8), -15508, -15514, -22053, and -23662 all retain their integrity, are in excellent condition, and are significant under criterion d. We do not have sufficient information to assess a significance evaluation to these sites. Please provide justification as to why preservation, avoidance, or some form of mitigation is not warranted for these sites.

Temporary Site 1 and Temporary Site 3 are not located within the proposed APR. Please provide a significance evaluation for these sites and your justification for these evaluations.

Given that the disposition of the human remains that were inadvertently discovered during the Kuakini Highway 16-inch Waterline Project is was unknown at the time that this report was published, no recommendation was proposed for these remains. According to the document accompanying the submitted report, the human remains recovered during the Waterline Project were relocated outside of the APE.

Before we can accept this report as fulfilling the requirements of §13-276-5, Hawai'i Administrative Rules (HAR), we request that the following additional comments be addressed:

(1) Page 1, first paragraph; please replace "130.5 m" with "30.5 m."

(2) Page 37, Photo 1, we understand that the archaeologists are in the photo for scale; however, you may wish to consider replacing the photo given that this photo with the archaeologists on the platform may seem culturally inappropriate to some. The text states that the platform in the photo may possibly be one of the features identified by Rosendahl in a previous survey as a probable burial. If this platform is not one of the probable burials, the branch coral and the upright basalt may be indicative of a religious function of this feature.

(3) Page 49, NRHP criterion A, please change "hour" to "our."

(4) Page 50, there is no reference of Site CS4 throughout the text of the report. It is our understanding that Site CS4 is the burial mound that has been assigned SIHP number 21189. Please replace "CS4" with "21189."

(5) Please depict Site -22054 on the appropriate maps.

(6) As per §13-275-6, Hawai'i Administrative Rules (HAR), consultation shall be conducted with ethnic groups or members of the ethnic group for whom the historic properties have significance under criterion "e" to seek their views on the proposed form of treatment. The Office of Hawaiian Affairs shall also be consulted for historic properties significant under §13-275-6(b)(5). Please include a description of the consultation process, a list of individuals/groups contacted, and a summary of the views and concerns expressed by these individuals/groups and by OHA.

(7) Page 57 states that "Site 11514 is not located within the archaeological survey area." There is no mention throughout the report of Site -11514. We believe that "Site -11514" should be "Site -15514"

(8) Please replace Temporary Sites 1 through 4 with the following SIHP numbers:
Temp 1: -26099
Temp 2: -26100
Temp 3: -26101
Temp 4: -26102

We look forward to receiving a revised archaeological inventory survey report. We will provide our comments on the proposed widening of the Kuakini Highway upon approval of the revised archaeological inventory survey report.

Please contact Ms. Teresa Davan (O'ahu Archaeologist) at (808) 692-8015 if you have any questions or concerns regarding this letter.

Aloha,

for Melanie Chinen
Deputy State Historic Preservation Officer

ED:jen

U.S. Department of Transportation
Federal Highway Administration

Hawaii Division
Box 50206
300 Ala Moana Boulevard, Room 3-306
Honolulu, HI 96850

April 29, 2009

In Reply Refer To:
HEC-HI

Ms. Laura Thielen
Chairperson and State Historic Preservation Officer
State of Hawai'i Department of Land and Natural Resources
601 Kamokila Boulevard
Kakuhihewa Bldg., Room 555
Kapolei, Hawai'i 96707

Attention: Pua Aiu, SHPD Administrator

Dear Ms. Thielen:

The County of Hawai'i Department of Public Works (DPW), with the assistance of the Federal Highway Administration (FHWA), proposes to widen Kuakini Highway to four lanes between Hualālai Road and the future intersection with the proposed Ali'i Highway. In a letter dated October 27, 2005, DPW initiated Section 106 consultation with the SHPO under the National Historic Preservation Act (NHPA) for the proposed Kuakini Highway Improvements Project Phase 2, Kailua-Kona, Island of Hawai'i, Hawai'i Job No. P-3718, FAP No. STP-1910(2). An area of potential effect (APE) was also proposed in that letter.

In April 2007, we submitted our draft archeological inventory survey and Cultural Impact Assessment (CIA) and requested that SHPO review and concur with our effect determination pursuant to Section 106.

As requested in your response letter dated October 9, 2007, we have revised our draft archeological inventory survey to address specific issues. In addition to the revised archaeology survey, we have attached a table that provides responses to comments and an excerpt from the draft CIA regarding parties consulted.

We ask that SHPO review the attachments and concur with our effect determination pursuant to Section 106.

Once we agree on the effect determination and the mitigation measures, a memorandum of agreement (MOA) will be drafted to record: (a) the protective plans for the known nearby

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historical resources, and (b) our monitoring and contingency plan related to inadvertent discovery (Archaeological Recovery Plan) program.

If you have any questions or require additional information, please do not hesitate to contact me at 541-2700 ext. 302.

Sincerely yours,

Domingo Galicinao, P.E.
Division Bridge Engineer

Attachments:
1) Comment/Response Table
2) Revised Draft Archaeological Inventory Survey (July 2008)
3) Excerpt from Draft Cultural Impact Assessment (April 2006)

cc (without attachments):
Mr. Kiran Emler, DPW
Mr. James Hayes, PB
Ms. Gail M. Murakami, IARII
Rob Sun, HWY-DD

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Response to SHPD Review Comments of October 9, 2007 on Draft Report, Archaeological Inventory Survey for the Kuakini Highway Improvements Project, Phase 2, Hualalai Road to Ali'i Highway, Kailua-Kona, Hawaii. TMK: 7-5-8, 9, 10, 17, 18, 19, and 30 (Por.)

Comment #	Page/ Para.	Other	Comment	Response
			Sites –6300, -11059 (Feature 4 and 8), -15508, -15514, -22053, and -23662 all retain their integrity, are in excellent condition, and are significant under criterion d. Please provide justification as to why preservation, avoidance, or some form of mitigation is not warranted for these sites.	Done See page 56, paragraph 3 for Sites 6300, 11059, 15508, 23666; see page 57, paragraph 1 for Sites 15514, and 22053
			Temporary Site 1 and Temporary Site 3 are not located within the proposed APR. Please provide a significance evaluation for these sites and your justification for these evaluations.	Temporary Site 1 (Site 26099) is not in the APE because it is located over 50 feet away from the limits of construction and the maximum project ROW. It was therefore not evaluated (see Figure 7c on page 52). Temporary Site 3 (Site 26101) is in the APE; addressed on page 56, paragraph 5. Also see figure 7b on page 51.
1	1/1		Please replace "130.5 m" with "30.5 m"	Done
2	37	Photo 1	You may wish to consider replacing the photo given that this photo with the archaeologists on the platform may seem culturally inappropriate to some.	Done; see page 37.
3	49	Criteri on A	Please change "hour" to "our."	Done; see page 49.
4	50	Fig. 7a	Please replace "CS4" with "21189."	Done; see page 50.
5			Please depict Site -22054 on the appropriate maps	Done; see Figures 6 (page 34), 7b (page 51)

Comment #	Page/ Para.	Other	Comment	Response
6			As per §13-275-6, Hawaii Administrative Rules (HAR), consultation shall be conducted with ethnic groups or members of the ethnic group for whom the historic properties have significance under criterion "e" to seek their views on the proposed form of treatment. The Office of Hawaiian Affairs shall also be consulted for historic properties significant under §13-275-6(b)(5). Please include a description of the consultation process, a list of individuals/groups contacted, and a summary of the views and concerns expressed by these individuals/groups and by OHA.	Please see page 53 of inventory report. The cultural impact assessment (CIA) prepared for the Kuakini Highway Improvements project describes the consultation process and the organizations/groups consulted (Prasad 2006:13-23). A list of individuals consulted can be found on page 39 of the CIA. (Excerpts of this CIA are provided in Attachment 3 of this submittal.)
7	57		"Site 11514" should be "Site -15514"	Done; see page 57.
8		Throu gh-out	Please replace Temporary Sites 1 through 4 with the following SIHP numbers: Temp 1: -26099 Temp 2: -26100 Temp 3: -26101 Temp 4: -26102	Done

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LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

LAURA H. THIELEN
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FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
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CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

June 29, 2009

Mr. Domingo Galicinao, P. E.
Division Bridge Engineer
Federal Highways Administration
Box 50206
300 Ala Moana Boulevard, Room 3-306
Honolulu, Hawai`i 96850

LOG NO: 2009.1495
DOC NO: 0906TD15
Archaeology

Dear Mr. Galicinao:

SUBJECT: National Historic Preservation Act (NHPA) Section 106 Review – Kuakini Highway Improvements Project, Phase 2 (HEC-HI) (Job No. P-3718, FAP No. STP-1910(2) Nine Ahupua`a, North Kona District, Island of Hawai`i TMK: (3) 7-5-8, 9, 10, 17, 18, 19 and 30

Thank you for your letter dated April 29, 2009 requesting our concurrence with your effect determination regarding the proposed widening of Kuakini Highway between Hualalai Road and the future intersection with the proposed Ali`i Highway. We apologize for the delay in responding to your letter. At this time, it is apparent that the project is an undertaking and that it will have an effect on significant historic properties; mitigation measures will therefore need to be agreed upon prior to initiation of construction.

Site-specific effect determinations are presented for 14 historic properties that were identified within the area of potential effect (APE) during an inventory survey of the 200-foot wide project corridor (C.M. Rasmussen, July 2008: *Archaeological Inventory Survey for the Kuakini Highway Improvements Project, Phase 2, Hualalai Road to Ali`i Highway, Kailua-Kona, Hawai`i;* International Archaeological Research Institute, Inc.; No. 200529; hereafter referred to as IARII report). An earlier version of the IARII report was reviewed by our office in 2007 and revisions were requested at that time. The current revised report enclosed with your letter addresses the requested revisions, and we now accept this report as final, with one requested minor revision (see below).

Maps provided in the IARII report (Figures 7b & 7c) indicate that there are four potential construction staging areas along the corridor that extend well beyond the identified APE and scope of work for the completed inventory survey. The report recommends that an archaeological inventory survey be conducted of these areas (p. 57). We concur with this recommendation and believe that the APE should be revised to include these areas. It is likely that the additional survey work will result in additional historic properties identified within the APE. We believe this additional survey work should be completed prior to the initiation of a memorandum of agreement, so that appropriate treatments for sites potentially affected by land alteration in the staging areas can be addressed along with the other 14 sites identified and discussed in the IARII report.

We also note that the construction limits for one of the proposed intersections (7-5-17: 37) extends beyond the APE/survey corridor that was used for the IARII survey. We request that this area also be examined during the additional inventory survey, if it was not examined during the IARII survey.

At this time, we concur with the recommended treatments for the 14 sites discussed in the IARII report; however, we would like to wait until additional information is available for the entire APE before finalizing the agreed-upon mitigation measures. We also request that Table 8 in the report be revised to exclude the last row item entitled "undetermined". According to a footnote on 56, this inadvertent burial discovery was relocated and is no longer within the APE.

Please send one hardcopy of the final report with the above revision, clearly marked FINAL, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office, attention of "SHPD Library".

We also note that a Cultural Impact Assessment (CIA) was prepared for this undertaking, pursuant to HRS Chapter 343. We have no records indicating that our office reviewed this document. If you have records of such a review, please forward them; otherwise, we request that a complete copy of the CIA be sent to Phyllis Cayan, Chief, History and Culture Branch, State Historic Preservation Division as part of the consultation process (mailing address: 601 Kamokila Blvd., Room 555, Kapolei, Hawai`i 96707).

Please contact Theresa K. Donham at (808) 933-7653 if you have any questions or comments regarding this letter.

Aloha,

Nancy A. McMahon

Nancy McMahon, Deputy SHPO/State Archaeologist
and Historic Preservation Manager
Historic Preservation Division

cc: Phyllis Cayan, Chief, History and Culture Branch
Analu K. Josephides, History and Culture Branch, Hawai'i Island Section

APPENDIX A-6
THREATENED AND ENDANGERED SPECIES CORRESPONDENCE

Parsons Brinckerhoff Quade & Douglas, Inc.
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, HI 96813
808-531-7094
Fax: 808-528-2368

October 27, 2005

Mr. Patrick Leonard, Field Supervisor
Pacific Islands Office, U.S. Fish and Wildlife Service
300 Ala Moana Boulevard, Room 3-122
Box 50088
Honolulu, Hawaii 96850

Subject: Proposed Kuakini Highway Improvements Project, Kailua-Kona, Hawaii
Pre-Assessment Consultation; Request for Species List, Endangered Species Act;
and Notice of Public Information Meeting

Dear Mr. Leonard:

The County of Hawaii Department of Public Works (DPW), in cooperation with the U.S. Federal Highway Administration, proposes to widen the existing Kuakini Highway, between Hualalai Road and the future intersection with the proposed Alii Highway (see enclosed map). DPW proposes the widening to increase roadway capacity in the Kailua to Keauhou corridor. Parsons Brinckerhoff Quade & Douglas, Inc. (PB) has been contracted to assist in preparing an environmental assessment (EA) for this project and to assist with the Section 7 consultation process under the Endangered Species Act (ESA).

Under the proposal, Kuakini Highway would be widened from its existing two-lane configuration to four lanes. Improvements may require construction of retaining walls, some cutting and filling of slopes, and/or the possibility of additional right-of way acquisition.

If you have knowledge of any environmental or social issues associated with this project, or concerns about the project, we would very much appreciate receiving such information from you within 30 days of the date of this letter.

In addition, in order to facilitate project compliance with Section 7 requirements, we request that the U.S. Fish and Wildlife Service (Service) provide us with a species list for the area immediately surrounding the project limits, as well as any relevant critical habitat. The following is a summary of the information already available to us.

Protected Species

In regards to faunal species, we are aware from reviewing previously documented projects in the area, that waterbirds such as the Newell's Shearwater (*Puffinus auricularis newelli*) and the dark-rumped petrel (*Pterodroma phaeopygia sanwichensis*), both federally-listed species, may occur in this area. (May 21, 2004 letter from the Service to the Department of Water Supply, re Kuakini Highway 16-inch Waterline Improvements; Final EA/Finding of No Significant Impact for Hualalai Elderly Housing Project Phase II, September 2000). The EA will address appropriate mitigation measures to incorporate into project planning. For example, other projects specified measures such as limiting project construction to daylight hours during the shearwater nesting season (mid-April through November), in order to avoid use of bright lights which may disorient waterbirds.

In a 1996 communication with PB regarding a similar road widening project in an adjacent segment of Kuakini Highway (between Palani and Hualalai Roads), the Service noted that the Hawaiian hoary bat (*Lasiurus cinereus semotus*) occurs near the project site. However, for that project, the Service indicated that it is unlikely that the Hawaiian hoary bat would be affected because the area is highly developed. (See attached July 1996 letter.) Please confirm if this assessment would also apply to our current proposed project.

Although the State's Department of Land and Natural Resources (Division of Forestry and Wildlife) commented during the planning phase of the previous Kuakini Highway widening project (between Palani and Hualalai Roads) that two potentially rare and endangered plant species may occur in that area, they were not found on that project alignment. The two species were (*Capparis sandwichiana*, pua pilo or maiapilo, and *Pritchardia affinis*, Loulu Palm). Please note that a botanical survey is being conducted for this new project, and the results of this survey will be included in the EA. Preliminary fieldwork has been completed, and neither *Capparis* nor *Pritchardia* were located in the study area between Hualalai Road and the future Alii Highway intersection.

Please send any comments in writing within 30-days of the date of this letter. If you have any questions regarding this project, please call or email me at 808-566-2239 or ohtomo@pbworld.com.

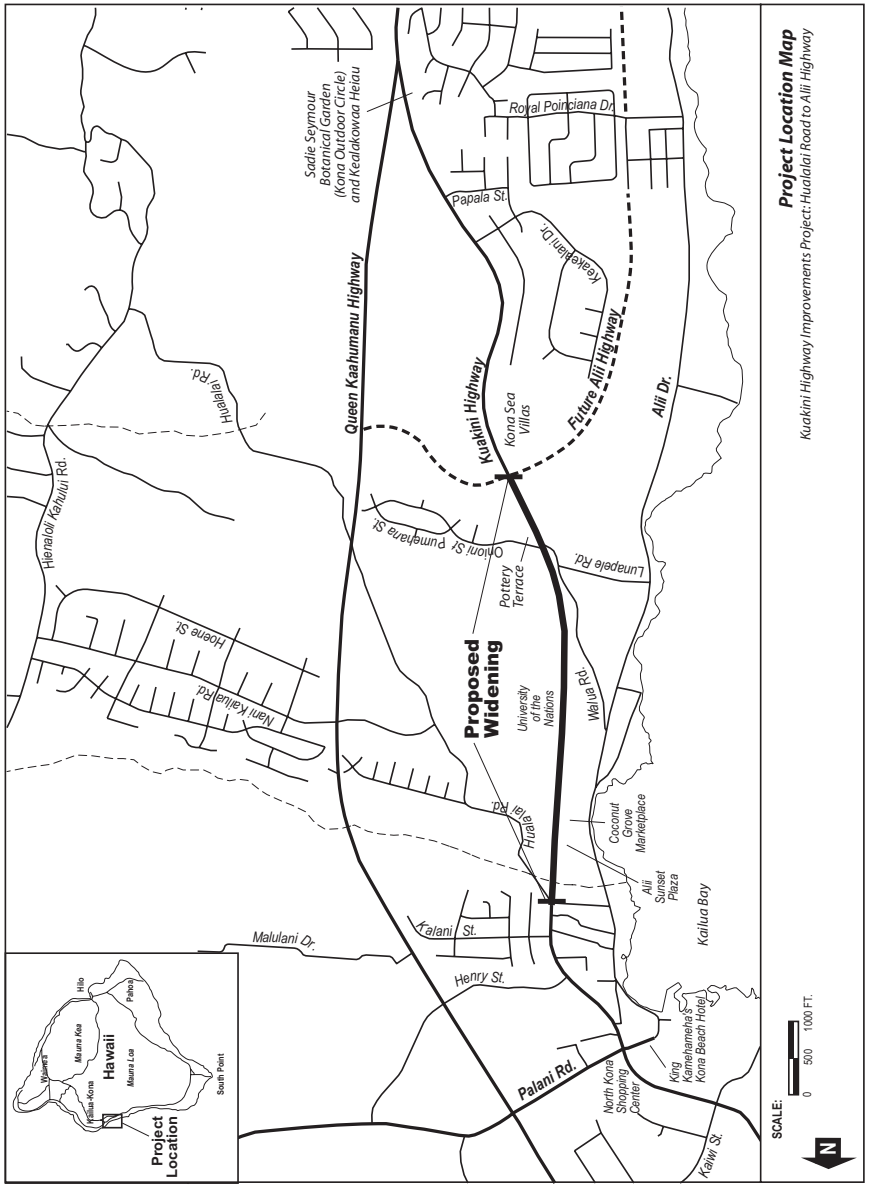
This letter also serves as a notice of a public information meeting for the subject project on November 16, 2005, from 6:30 pm to 8:00 pm, at Kahakai Elementary School cafeteria, 76-147 Royal Poinciana Drive, Kailua-Kona. Representatives from DPW and PB will be present to share information, answer questions, and receive public comments pertaining to this project.

Sincerely yours,
PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

Nami Ohtomo
Environmental Planner

Attachments: Project location map
U.S. Fish and Wildlife Service letter to PB, July 6, 1996

c. Mr. Paul Conry, State Department of Land and Natural Resources, Division of Forestry and Wildlife (w/o attachments)
Mr. Galen Kuba, County of Hawaii, Department of Public Works (w/o attachment)
Mr. Kiran Emler, County of Hawaii, Department of Public Works (w/o attachment)
Ms. Richelle Takara, Federal Highway Administration



United States Department of the Interior

FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS ECOREGION
300 ALA MOANA BOULEVARD, ROOM 3108
BOX 50088
HONOLULU, HAWAII 96850
PHONE: (808) 541-3441 FAX: (808) 541-3470

RECEIVED
JUL - 9 1996
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

In Reply Refer To: TR

JUL - 2 1996

Jan Reichelderfer, Environmental Planner
Parsons Brinckerhoff Quade & Douglas, Inc.
Pacific Tower, Suite 3000
1001 Bishop St.
Honolulu, HI 96813

Dear Ms. Reichelderfer:

On June 24, 1996, the U.S. Fish and Wildlife Service (Service) received your June 20, 1996 letter requesting identification of the proposed and listed threatened and endangered species in the vicinity of the proposed corridor for the Kuakini Highway improvements between Palani and Hualalai Roads. It is our understanding that you are requesting this information on behalf of the Federal Highway Administration.

The Service has reviewed the map provided with your request and pertinent information in our files, including maps prepared by the Hawaii Heritage Program of the Nature Conservancy. Our records indicate that the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus)* may occur within the vicinity of the project site or traverse the area. However, it is unlikely that the Hawaiian hoary bat will be impacted by the proposed project because this area is already highly developed.

We appreciate your concern for endangered species and would like the opportunity to review the Draft Environmental Assessment for this project. If you have any questions, please contact our Program Leader for Interagency Cooperation, Ms. Margo Stahl, or Fish and Wildlife Biologist Tanya Rubenstein at 808/541-3441 (fax: 808/541-3470)

Sincerely,

Brooks Harper

Brooks Harper
Field Supervisor
Ecological Services

Parsons Brinckerhoff Quade & Douglas, Inc.
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, HI 96813
808-531-7094
Fax: 808-528-2368

October 27, 2005

Mr. Paul Conry
Administrator
Division of Forestry and Wildlife
State Department of Land and Natural Resources
1151 Punchbowl Street, Room 325
Honolulu, Hawaii 96813

Subject: Proposed Kuakini Highway Improvements Project, Kailua-Kona, Hawaii
Pre-Assessment Consultation; Protected species coordination per HRS Chapter 195D; and Notice of Public Information Meeting

Dear Mr. Conry:

The County of Hawaii Department of Public Works (DPW), in cooperation with the U.S. Federal Highway Administration, proposes to widen the existing Kuakini Highway, between Hualalai Road and the future intersection with the proposed Alii Highway (see enclosed map). DPW proposes the widening to increase roadway capacity in the Kailua to Keauhou corridor. Parsons Brinckerhoff Quade & Douglas, Inc. (PB) has been contracted to assist in preparing an environmental assessment (EA) for this project, including regulatory coordination on protected species.

Under the proposal, Kuakini Highway would be widened from its existing two-lane configuration to four lanes. Improvements may require construction of retaining walls, some cutting and filling of slopes, and/or the possibility of additional right-of way acquisition.

If you have knowledge of any environmental or social issues associated with this project, or concerns about the project, we would very much appreciate receiving such information from you. The following is a summary of the information already available to us, concerning protected species.

Protected Species

In regards to faunal species, we are aware from reviewing previously documented projects in the area, that waterbirds such as the Newell's Shearwater (*Puffinus auricularis newelli*) and the dark-rumped petrel (*Pterodroma phaeopygia sanwichensis*), both federally-listed species, may occur in this area. (Final EA for Kuakini Highway 16-inch Waterline Improvements, October 2004; Final EA/Finding of No Significant Impact for Hualalai Elderly Housing Project Phase II, September 2000). Our EA will address appropriate mitigation measures to incorporate into project planning. For example, other projects specified measures such as limiting project construction to daylight hours during the shearwater nesting season (mid-April through November), in order to avoid use of bright lights which may disorient waterbirds.

In a 1996 communication with PB regarding a similar road widening project in an adjacent segment of Kuakini Highway (between Palani and Hualalai Roads), the U.S. Fish and Wildlife Service (Service) noted that the Hawaiian hoary bat (*Lasiurus cinereus semotus*) occurs near

the project site. However, for that project, the Service indicated that it is unlikely that the Hawaiian hoary bat would be affected because the area is highly developed. (See attached July 1996 letter.) We are confirming with the Service if this assessment would also apply to our current proposed project.

Although the DOFAW commented during the planning phase of the previous Kuakini Highway widening project (between Palani and Hualalai Roads) that two potentially rare and endangered plant species may occur in that area, they were not found on that project alignment. The two species were (*Capparis sandwichiana*, pua pilo or maiapilo, and *Pritchardia affinis*, Loulu Palm). Please note that a botanical survey is being conducted for this new project, and the results of this survey will be included in the EA. Preliminary fieldwork has been completed, and neither *Capparis* nor *Pritchardia* were located in the study area between Hualalai Road and the future Alii Highway intersection.

Please send any comments in writing within 30-days of the date of this letter. If you have any questions regarding this project, please call or email me at 808-566-2239 or ohtomo@pbworld.com.

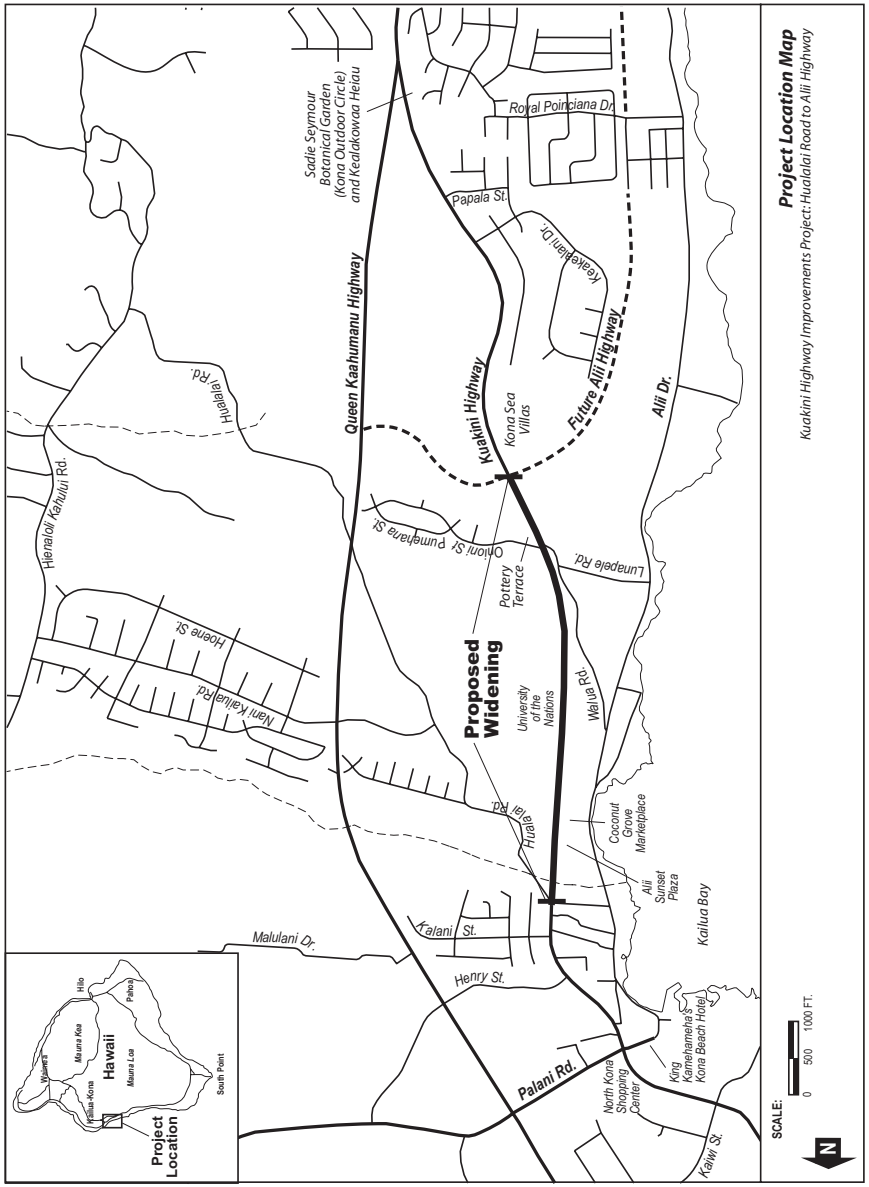
This letter also serves as a notice of a public information meeting for the subject project on November 16, 2005, from 6:30 pm to 8:00 pm, at Kahakai Elementary School cafeteria, 76-147 Royal Poinciana Drive, Kailua-Kona. Representatives from DPW and PB will be present to share information, answer questions, and receive public comments pertaining to this project.

Sincerely yours,
PARSONS BRINCKERHOFF QUADE & DOUGLAS, INC.

Nami Ohtomo
Environmental Planner

Attachment: Project location map

c. Mr. Patrick Leonard, U.S. Fish and Wildlife Service (w/o attachment)
Mr. Galen Kuba, County of Hawaii, Department of Public Works (w/o attachment)
Mr. Kiran Emler, County of Hawaii, Department of Public Works (w/o attachment)
Ms. Richelle Takara, Federal Highway Administration



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawai'i 96850

In Reply Refer To:
1-2-2006-SP-027

NOV 4 2005

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NOV - 7 2005
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

Nami Ohtomo
Parsons Brinckerhoff Quade & Douglas, Inc.
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, Hawai'i 96813

Dear Mr. Ohtomo:

Thank you for your letter dated October 27, 2005, requesting a list of threatened and endangered species that may occur in the vicinity of the proposed widening of Kuakini Highway between Hualālai Road and the future intersection with the proposed Ali'i Highway in Kailua-Kona on the island of Hawai'i. We received your letter on October 31, 2005. The proposed project is to widen a portion of Kuakini Highway from two lanes to four lanes, including construction of retaining walls, cut and fill of slopes, and additional right-of way acquisition, if needed. Your letter stated that the project is being undertaken by the County of Hawai'i, Department of Public Works, in cooperation with the Federal Highway Administration.

We reviewed the information you provided and pertinent information in our files, including data compiled by the Hawai'i Natural Heritage Program. There are no designated critical habitats within 1/3 mile (536 meters) of the project area. However, there are records of the Hawaiian hoary bat ('ope'ape'a, *Lasiurus cinereus semotus*) and a native Hawaiian palm (lolu, *Pritchardia affinis*) within 1/3 mile of the project area. We have no records of Newell's Shearwater ('a'o, *Puffinus auricularis newelli*) or dark-rumped petrel ('ua'u, *Pterodroma phaeopygia sanwichensis*) in the vicinity (1/3 mile) of the project, although your letter states that previous project documents indicated these federally listed species may occur in the area. All of these species may need special consideration before, during and after the execution of your project. We appreciate your efforts to conserve endangered species. If you have questions, please contact Assistant Field Supervisor Gina Shultz (phone: 808/792-9400; fax: 808/792-9581).

Sincerely,

Patrick Leonard
Field Supervisor

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LINDA LINGLE
GOVERNOR OF HAWII

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

Robert K. Masuda
DEPUTY DIRECTOR FOR LAND

Dean Nakano
DEPUTY DIRECTOR FOR
THE COMMISSION ON
WATER RESOURCE MANAGEMENT

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

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

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

November 3, 2005

Nami Ohtomo
Environmental Planner
Parsons Brinckerhoff Quade
and Douglas, Inc.
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, Hawaii 96813

RECEIVED
NOV 11 2005
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

Dear Nami Ohtomo:

Subject: Proposed Kuakini Highway Improvements Project, Kailua-Kona, Hawaii. Pre-Assessment Consultation: Protected species coordination per HRS Chapter 195D; and Notice of Public Information Meeting.

DOFAW has reviewed your information dated October 27, 2005 regarding the potential impacts your project may have on our management programs and endangered species in particular. Kuakini Highway is a major highway in the Kona area. We are doubtful that you will find endangered species during the planning phase of the project. However, since you will be completing a botanical survey that will be included in a draft Environmental Assessment (EA), we will defer comments until the EA is completed and reviewed by DLNR-DOFAW for endangered species. Thank you for the opportunity to comment on your project.

Sincerely yours,

Paul J. Conry
Administrator

APPENDIX A-7
U.S. DOT SEC. 771.135 SECTION 4(F) (49 U.S.C. 303) CORRESPONDENCE

Parsons Brinckerhoff
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, HI 96813
808-531-7094
Fax: 808-528-2368

October 16, 2006

James Komata
County of Hawai'i, Department of Parks and Recreation
Aupuni Center
101 Pauahi Street, Suite 6
Hilo, Hawai'i 96720
By Electronic Mail: jkomata@co.hawaii.hi.us

Subject: Potential Impacts to Kailua Playground from Kuakini Highway Improvements, Phase II

Dear Mr. Komata:

On behalf of the County of Hawai'i Department of Public Works, Parsons Brinckerhoff (PB) is contacting you to obtain the County of Hawai'i Department of Parks and Recreation's assessment of the possible impact on Kailua Playground as a result of the above-referenced proposed project. Because the proposed project is partially funded by the Federal Highways Administration (FHWA), the project must comply with all federal Department of Transportation (DOT) regulations. One DOT regulation, referred to as Section 4(F), requires that impacts to public parks be avoided to the maximum extent practicable.

Access to the 0.7-acre Kailua Playground is from Kuakini Highway via a steep driveway because the playground is roughly 11 feet below the roadway. The proposed road widening would bring the edge of Kuakini Highway closer to Kailua Playground, requiring the playground driveway be modified. However, the proposed project does not require any additional right-of-way (ROW). Currently, a portion of the playground driveway, the playground sign, and playground retaining wall are within the existing highway ROW.

PB has prepared the two attached figures to illustrate the proposed project in the vicinity of the playground. Figure 1 shows a plan view of the playground and illustrates the limits of the proposed construction activities. Figure 2 shows a section of the driveway, illustrating both current conditions (dashed line) and post-construction conditions (solid line).

The proposed project would reconfigure the playground driveway so that it extends further into the playground, and the driveway grade would change from its current 17% grade to an 18% grade. At the new grade of 18%, the park access road would still meet federal driveway criteria. Currently the base of the driveway matches the overall playground grade approximately 42 feet west (makai) of the Kuakini Highway ROW; after widening, the driveway will match park grade approximately 74 feet west (makai) of the ROW. This driveway modification would result in a loss of 1,280 square feet of level ground within the parking area of the playground (an area 32 feet long by 40 feet wide).

Construction of the driveway modification would temporarily be staged from the playground. The east-west portion of the rock wall along the playground driveway that is within the Kuakini Highway ROW would be removed. The rock retaining wall trending north-south between the playground and highway may also need to be removed and replaced depending on (a) the structural integrity of the wall after the east-west portion is removed; (b) the structural ability of the wall to withstand highway construction; and (c) the County of Hawai'i Department of Parks and Recreation's level of interest in preserving or replacing the wall.

Aside from limiting access during construction, playground amenities would not be affected by the proposed project. After construction is complete, use of the park would return to its current condition.

Because the proposed project does not require any new ROW and does not affect playground amenities, we believe the impact on the playground qualifies as a *de minimus* impact. A *de minimus* impact is defined as an impact that does not "adversely affect the activities, features, and attributes" of the Section 4(F) resource, in this case the playground. The DOT generally considers any parking lot encroachment or similar type of land use to be a *de minimus* impact, and requests your concurrence with this finding. The DOT requests that the Department of Parks and Recreation indicate in writing that the foreseeable project impacts are *de minimus,* in their view.

In summary, on behalf of the Department of Public Works, we request that the Department of Parks and Recreation review this information and make its own determination as to whether the impacts outlined above are *de minimus* impacts to the playground. If the Department of Parks and Recreation concurs with this *de minimus* assessment, we request that the Department of Parks and Recreation indicate its concurrence in writing. Please submit you findings to:

James T. Hayes
Parsons Brincherhoff
1001 Bishop Street, Suite 2400
Honolulu, Hawai'i 96813

PB and the Department of Public Works appreciate your attention to this matter. If you would like to discuss this matter further, please do not hesitate to contact me at 808-566-2239.

Sincerely,

PARSONS BRINCKERHOFF

James T. Hayes
Lead Environmental Scientist

Attachments:

Figure 1: Kailua Playground (plan view)
Figure 2: RT-DW-7 Kailua Playground Driveway (section)

cc: Kiran Emler, County of Hawai'i Department of Public Works; kemler@co.hawaii.hi.us
Richelle Takara, FHWA; richelle.takara@fhwa.dot.gov

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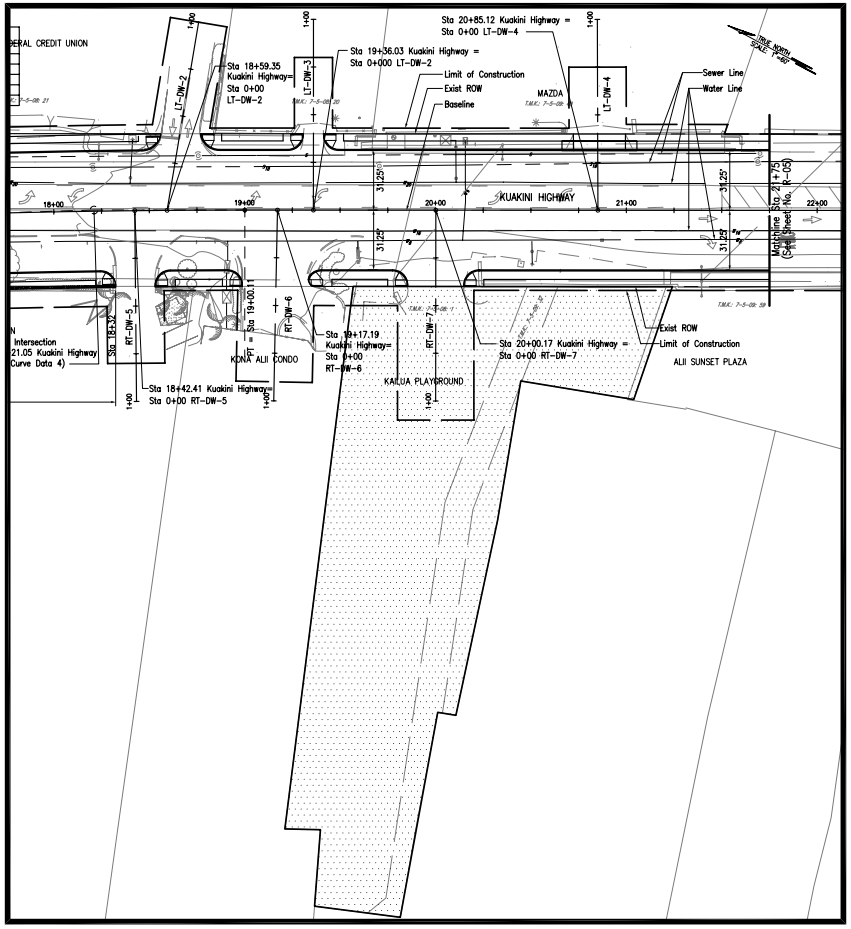

FIGURE 1 – KAILUA PLAYGROUND

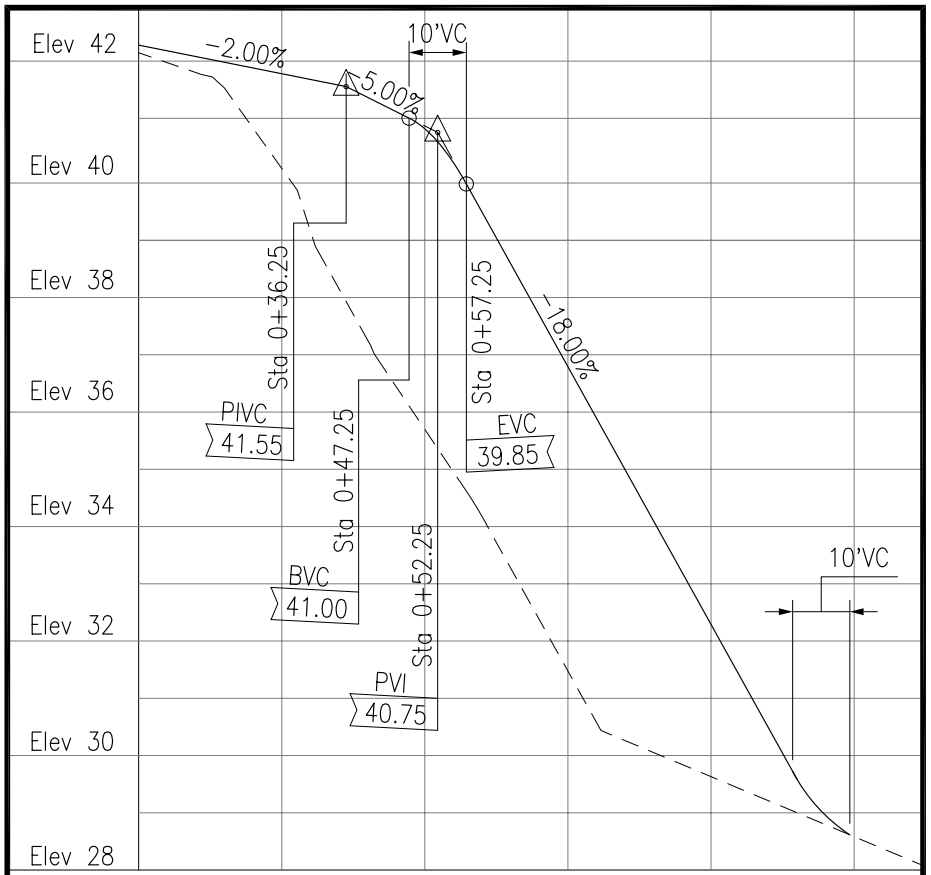

FIGURE 2 – RT-DW-7, KAILUA PLAYGROUND DRIVEWAY

APPENDIX B GEOTECHNICAL REPORT

GEOLABS, INC.
Geotechnical Engineering and Drilling Services

January 27, 2006
W.O. 5498-00

RECEIVED
FEB - 7
PAR

Mr. Dexter Eji
Parsons Brinckerhoff
American Savings Bank Tower, Suite 2400
1001 Bishop Street
Honolulu, HI 96813

PRELIMINARY GEOTECHNICAL ENGINEERING STUDY
KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

Dear **Mr. Eji:**

In accordance with our fee proposal dated February 9, 2005, we conducted a preliminary geotechnical engineering study for the proposed Kuakini Highway Widening (Hualalai Road to Alii Highway) project. This letter report summarizes our work on the project and presents our findings and preliminary geotechnical recommendations in support of developing retaining wall alternatives during the planning phase.

PROJECT CONSIDERATIONS

The project site is located along Kuakini Highway in the District of Kailua-Kona on the Island of Hawaii. The general location and vicinity of the project site are shown on the Project Location Map, Plate 1.

The project consists of widening Kuakini Highway from Hualalai Road to Alii Highway for a distance of about 6,000 linear feet. The widening will provide an 80-foot right-of-way with two 10.5-foot wide traffic lanes, a 5-foot wide bike lane, a 5-foot wide sidewalk, and a 3.75-foot distance between the sidewalk edge to the right-of-way on each side of the highway. In addition, a 10.5-foot wide turn/median will be provided. Currently, Kuakini Highway consists of one traffic lane in the northbound direction and one traffic lane in the southbound direction with a center turn/median area.

Two conceptual roadway alignment alternatives are being considered and are identified as Conceptual Alternative No. 1 and No. 2. For Conceptual Alternative No. 1, the new walls will be within the current right-of-way. A total of 18 wall structures approximately 4,820 linear feet in length are planned. The new wall structures vary in length from 26 to 1,650 linear feet with maximum wall height between about 2 to 16 feet. Twelve walls will be in fill condition and six walls will be in cut condition. The proposed wall locations for Conceptual Alternative No. 1 are shown on the Site Plan, Plates 2.1 through 2.10. A summary of the retaining walls for Conceptual Alternative No. 1 is shown on the Summary of Retaining Walls – Alternative No. 1, Plate 4.

Conceptual Alternative No. 2 consists of acquiring additional right-of-way and shifting the roadway downslope to minimize the wall heights along portions of the alignment. This alternative consists of 22 new wall structures approximately 4,170 linear feet in total length. The wall lengths and heights vary from about 20 to 515 linear feet and from about 2 to 16 feet, respectively. Fifteen of the twenty-two wall structures are in fill condition. The remaining seven wall structures are in cut condition. The proposed wall locations are shown on the Site Plans, Plates 3.1 through 3.10. A summary of the retaining walls for Conceptual Alternative No. 2 is presented on the Summary of Retaining Walls-Alternative No. 2, Plate 5.

For both alternatives, retaining walls will be required at the right-of-way line on both sides of the highway.

PURPOSE AND SCOPE

The purpose of our geotechnical engineering study was to develop retaining wall alternatives and recommendations for the project. The work was performed in general accordance with our fee proposal dated February 9, 2005. Our scope included the following tasks and work efforts.

1. Review of available in-house subsurface and geologic information near the project site.
2. Develop potential retaining wall alternatives for the roadway widening project and provide recommended wall alternative.
3. Preparation of this letter report summarizing our work on the project and presenting our findings and recommendations.
4. Coordination of the overall work on the project by our engineer.
5. Quality assurance of our work, and client/design team consultation by our principal engineer.
6. Miscellaneous work efforts, such as drafting, word processing, and clerical support.

REGIONAL GEOLOGY

The Island of Hawaii, the largest in the Hawaiian Archipelago, covers an area of approximately 4,000 square miles. The island was formed by the activity of five shield volcanoes. The five shield volcanoes include the following: Kohala, which is long extinct; Mauna Kea, which has had activity during recent geologic time; Hualalai, which last erupted in 1801; and Mauna Loa and Kilauea, both of which are still active.

The project site is situated on the western flank of Hualalai Mountain, which makes up the west central portion of the island. Most of the near-surface basaltic lava formation at the site appears to be composed of the pahoehoe type lava flow, which spread and ponded as it approached the ocean. Pahoehoe is characterized by a smooth, rope-like or billowy surface with an internal structure of vesicular (porous) rock. In addition to the pahoehoe type lava, some land area of the project site appears to be locally covered by a'a lava flows. The a'a lavas are typified by the appearance of loose, rubbly clinker layers interspersed with seams of very dense, massive basalt rock. The dense basalt rock layers represent the hard interior core of the individual lava flow.

ANTICIPATED SUBSURFACE CONDITIONS

The anticipated subsurface conditions described herein were determined from a review of geological maps and from observations of the surface soil conditions to obtain an indication of the subsurface conditions at the project site.

Based on geologic maps, the project site is characterized by basalt rock formation of the Hualalai Volcanic Series. This basalt formation generally consists of pahoehoe type flows with clinker layers. We anticipate that the site is generally underlain by a medium hard to hard basalt rock formation. Clinker material is anticipated at the ground surface and clinker layers are anticipated within the basalt rock formation. Encountering groundwater is not anticipated at shallow depths.

DISCUSSIONS AND RECOMMENDATIONS

A desk-top study was performed and included a review of available geologic information at the site. Based on the preliminary drawings, a significant amount of retaining walls will be required. These retaining walls will be constructed in both cut and fill conditions. Different retaining wall systems were evaluated and included conventional concrete wall, Cement Rubble Masonry (CRM) wall, segmental wall, soldier pile wall, and soil-nailed wall. These different wall systems are discussed below.

Based on our evaluation of the different wall alternatives, we recommend that conventional concrete retaining walls be used for cut conditions and segmental retaining walls be utilized for fill conditions. The preliminary recommendations and considerations are based on the results of the desk-top study and are intended for planning and preliminary design purposes only.

Conventional Concrete Wall

This type of wall is composed of concrete and reinforcing steel. The reinforced concrete and the backfill weight on the wall footing are used to resist the lateral forces acting on the wall. As previously discussed, the new walls are located at the right-of-way boundary. Therefore, we envision that an L-shaped wall will be used in the cut condition. Since the backfill weight on the wall footing adds to the lateral resistance of the wall, using

a small heel for the footing may be considered to reduce the footing size. Special construction equipment is not required for wall construction. This wall system is less costly compared to a soldier pile wall system. Noise and vibration will be generated from the wall excavation into the basalt rock formation.

For fill conditions, a larger heel can be used for the wall footing. Forming work will be required for wall construction. The concrete wall system is most costly compared to the CRM and segmental wall systems. For cut and fill conditions, a concrete wall can be constructed within the right-of-way.

Cement Rubble Masonry (CRM) Wall

The CRM wall is a gravity wall system with no footing and composed of rock cobbles and boulders with cement mortar. This wall system resists lateral loading by the weight of the wall. One of the advantages of this wall system is that rock cobbles and boulders are readily available from wall excavations at the site. A major disadvantage of this wall system is the significant wall size needed for seismic considerations using the Load Resistance Factor Design (LRFD) method. A very large horizontal seismic coefficient needs to be used in the design for the Island of Hawaii. Because of the large wall base required, it will be difficult to construct this type of wall within the current right-of-way.

Segmental Retaining Wall

Segmental retaining walls consist of modular block face units with reinforced fill consisting of geogrids and granular fill. This type of wall is typically used for fill conditions only. The segmental retaining wall system is less costly compared to the other wall alternatives for fill conditions. These walls are more tolerable to ground movement compared to other wall systems and can be constructed within the current roadway right-of-way. Since modular block face units are manufactured on the islands of Oahu and Maui, these units would need to be shipped to the island of Hawaii.

Soldier Pile Wall

The soldier pile wall alternative is feasible in cut conditions. This wall system consists of soldier pile usually set at 6 to 10 foot spacing, lagging between the soldier piles, and a shotcrete wall facing. We envision that the soldier piles will be composed of drilled shafts. In addition, we anticipate that concrete lagging will be used. The lateral loads are carried by the drilled shafts with the lagging resisting minor earth loading. This wall system can be constructed within the current right-of-way. The soldier pile wall system is costly compared to the other wall alternatives in cut conditions and special drilling equipment will be required.

Soil-Nailed Wall

Soil-nailed walls are typically used in cut conditions and consist of installing a shotcrete facing and soil nails. This wall alternative uses a top-to-down construction procedure with incremental excavation for wall construction. Soil-nailed walls are less costly compared to the other wall alternatives in cut condition. A major disadvantage of this wall system is the need to acquire permanent easement for the soil nails. Mobilization of special drilling equipment will be required.

Recommended Retaining Wall in Cut Conditions

Wall alternatives evaluated in cut conditions included conventional concrete wall, CRM wall, soldier pile wall, and soil-nailed wall. Major disadvantages were encountered for the CRM and soil-nailed wall alternatives. Due to seismic design considerations, the CRM walls are anticipated to be significant in size. Therefore, it would be difficult to construct this wall alternative within the current right-of-way. Since the new walls are located at the right-of-way boundary, the soil-nailed wall alternative would require acquiring permanent easements for the soil nails. The soldier pile wall alternative is very costly compared to the other wall alternatives in cut conditions. The wall alternatives are summarized in the Summary of Wall Alternatives in Cut Conditions, Plate 6.

Based on the above, we recommend that conventional concrete retaining wall system be used for walls in cut conditions for the project. Due to the limited space available for wall construction, we envision that an L-shaped wall will be utilized.

Recommended Retaining Wall in Fill Conditions

Conventional concrete wall, CRM wall, and segmental wall alternatives were evaluated for fill conditions. The major disadvantage for the CRM wall alternative described above applies for CRM wall in fill conditions. In comparing the conventional concrete wall and segmental wall alternatives, the segmental wall is less costly and can tolerate more ground movements. Therefore, we recommend that a segmental wall system be used for wall in fill conditions at the project site. The wall alternatives in fill condition are summarized in the Summary of Wall Alternatives in Fill Conditions, Plate 7.

Additional Services

This preliminary geotechnical engineering report is prepared for planning and preliminary engineering purposes only. It is not intended for use in design and/or preparation of construction documents for the proposed project. A design-level geotechnical exploration should be conducted for detailed design of the project based on the requirements of the proposed development. Considering the nature of the subsurface conditions, we recommend that Geolabs be retained to provide follow-up geotechnical services for this project.

LIMITATIONS

The findings and preliminary recommendations submitted in this letter report are based upon visual observations made during our site visit and geologic maps. Variations of subsurface conditions may occur, and the nature and extent of these variations may not become evident until additional exploration is conducted and/or construction is underway. If variations then appear evident, Geolabs should be contacted to re-evaluate the recommendations presented in this report.

This letter report has been prepared for the exclusive use of Parsons Brinckerhoff and other project consultants for specific application to the Kuakini Highway Widening (Hualalai Road to Alii Highway) project in accordance with generally accepted geotechnical engineering principles and practices. No warranty is expressed or implied. This report has been prepared solely for the purpose of assisting the planners and design engineers in the planning and preliminary design of the roadway alignment and retaining wall structures for the proposed project.

CLOSURE

We appreciate the opportunity to be of service to you on this project. If you have questions or need additional information, please contact our office.

Respectfully submitted,

GEOLABS, INC.

By _____
Gerald Y. Seki, P.E.
Senior Project Engineer

By _____
Clayton S. Mimura, P.E.
President

CLAYTON S. MIMURA
LICENSED PROFESSIONAL ENGINEER
No. 4176-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SIGNATURE _____ EXPIRATION DATE OF THE LICENSE 4-30-06

CSM:GS:mj

Attachments: Project Location Map (Plate 1)
Site Plan – Conceptual Alternative 1 (Plates 2.1 to 2.10)
Site Plan – Conceptual Alternative 2 (Plates 3.1 to 3.10)
Summary of Retaining Walls – Conceptual Alternative 1 (Plate 4)
Summary of Retaining Walls – Conceptual Alternative 2 (Plate 5)
Summary of Wall Alternatives in Cut Condition (Plate 6)
Summary of Wall Alternatives in Fill Condition (Plate 7)

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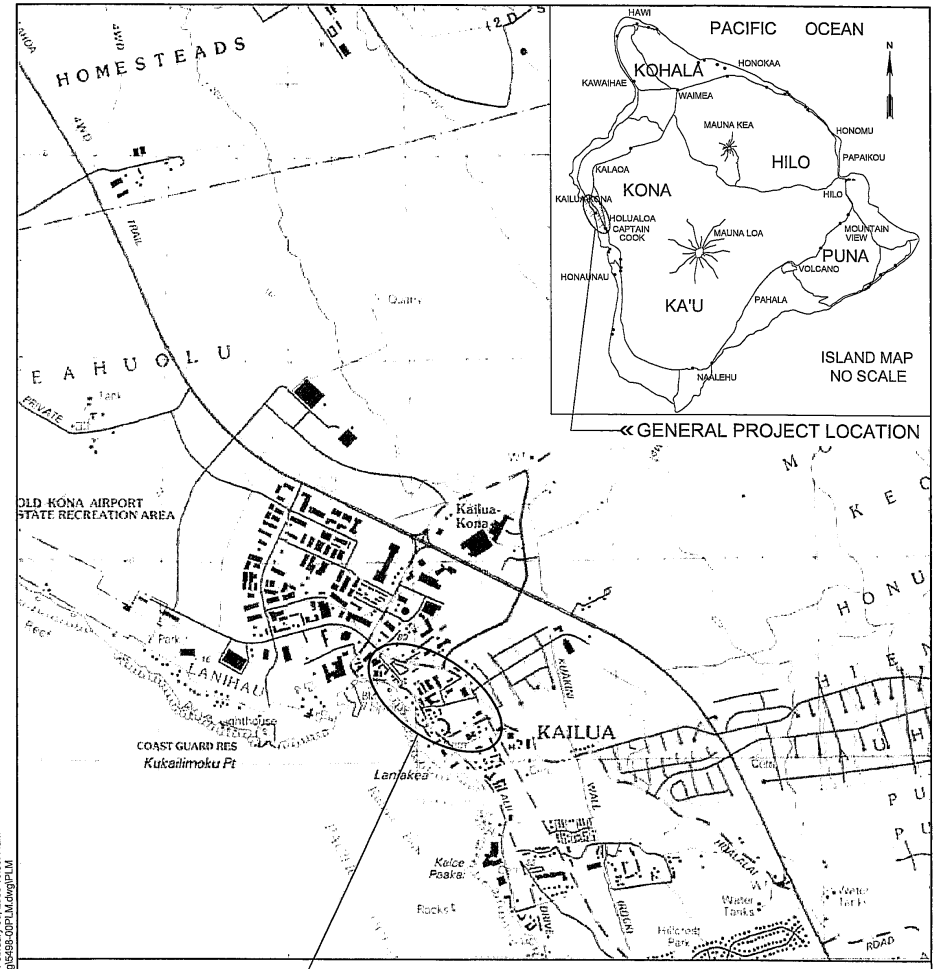

PROJECT LOCATION MAP

KUAKINI HIGHWAY WIDENING
(HUALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
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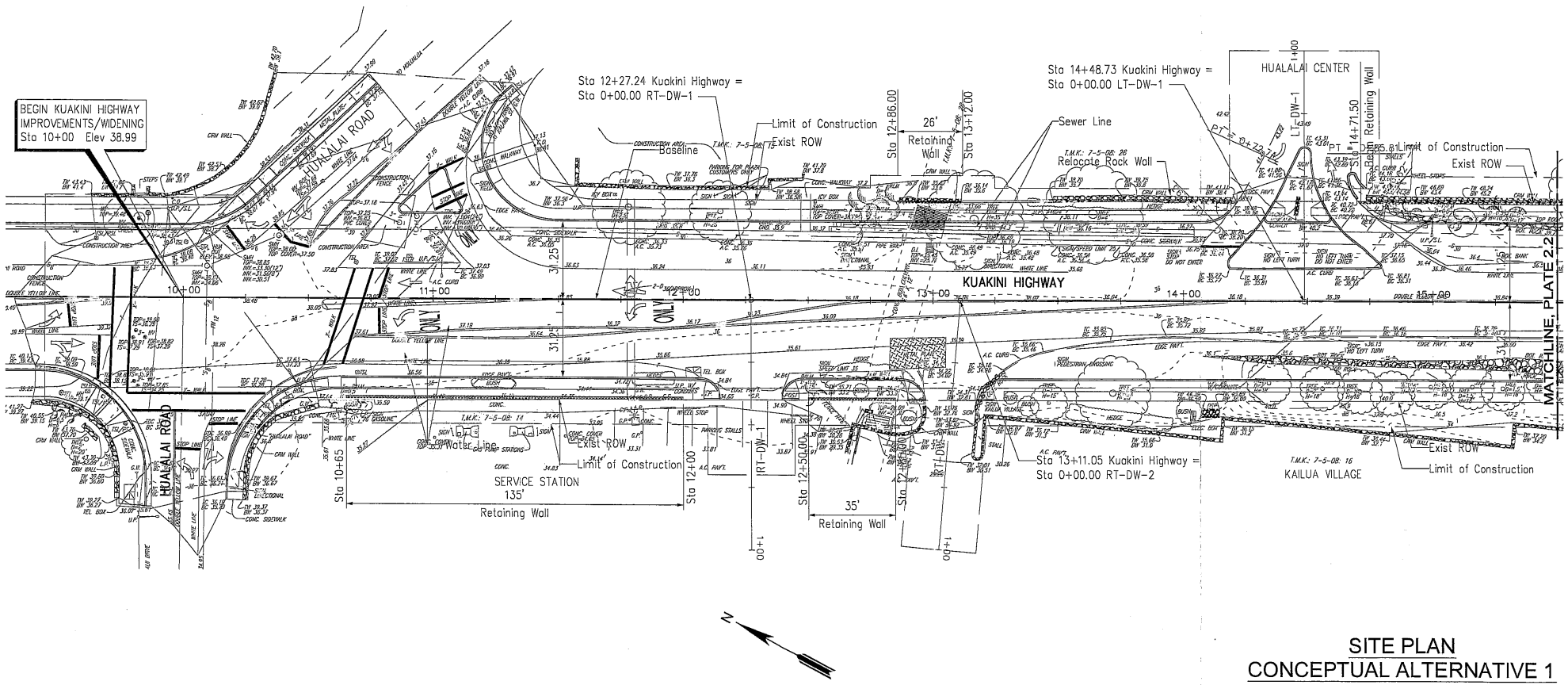

SITE PLAN
CONCEPTUAL ALTERNATIVE 1

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

0 20 40 80 120 FT.
GRAPHIC SCALE

REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
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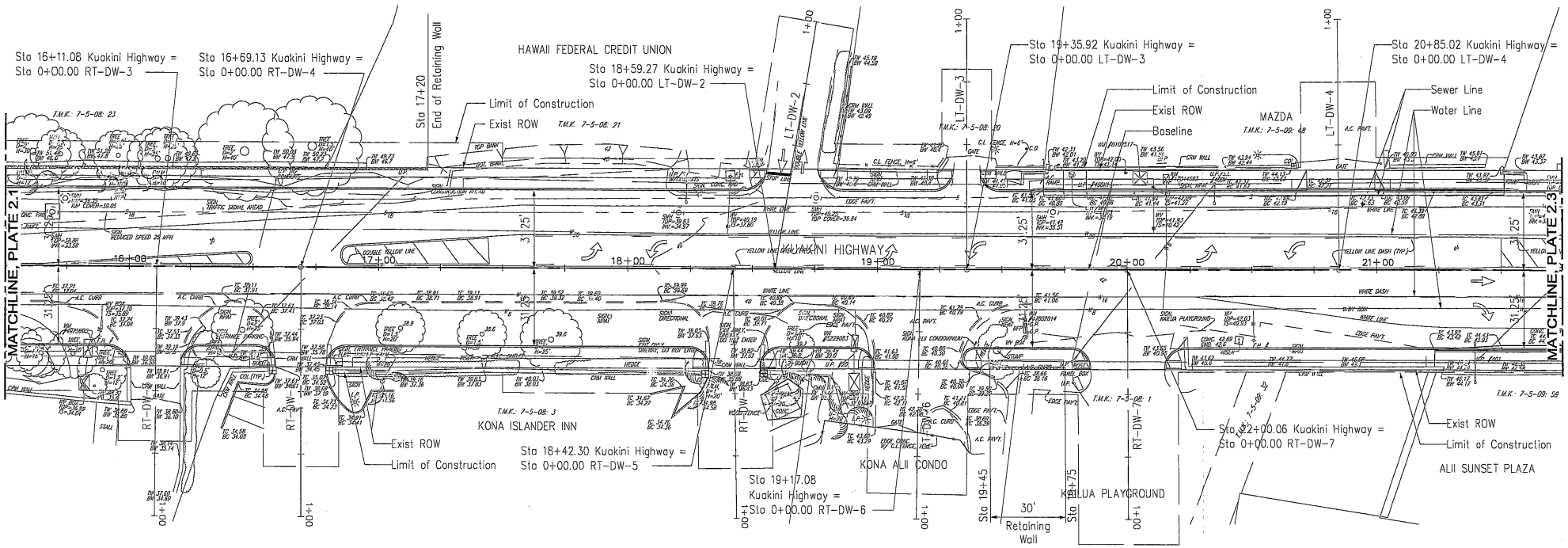

SITE PLAN
CONCEPTUAL ALTERNATIVE 1

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

0 20 40 80 120 FT.
GRAPHIC SCALE

REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
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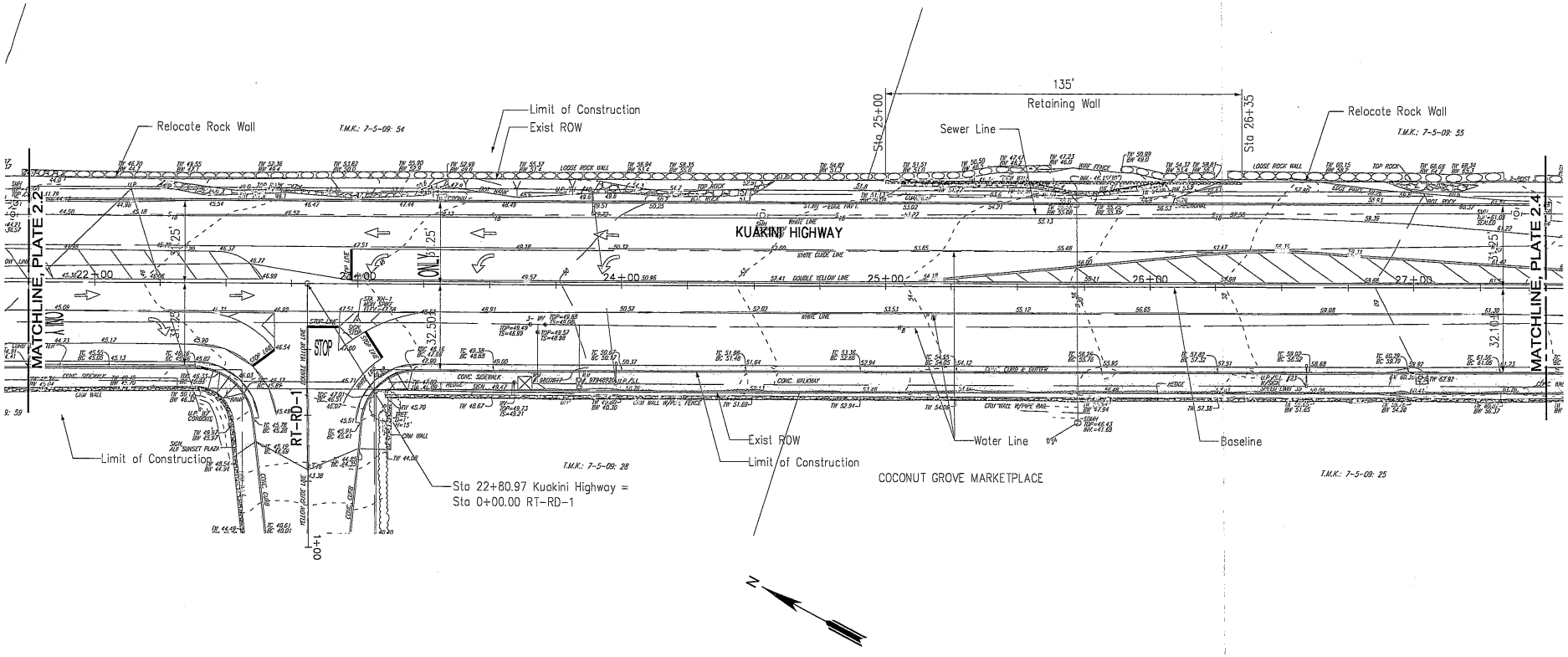

SITE PLAN
CONCEPTUAL ALTERNATIVE 1

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

0 20 40 80 120 FT.
GRAPHIC SCALE

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
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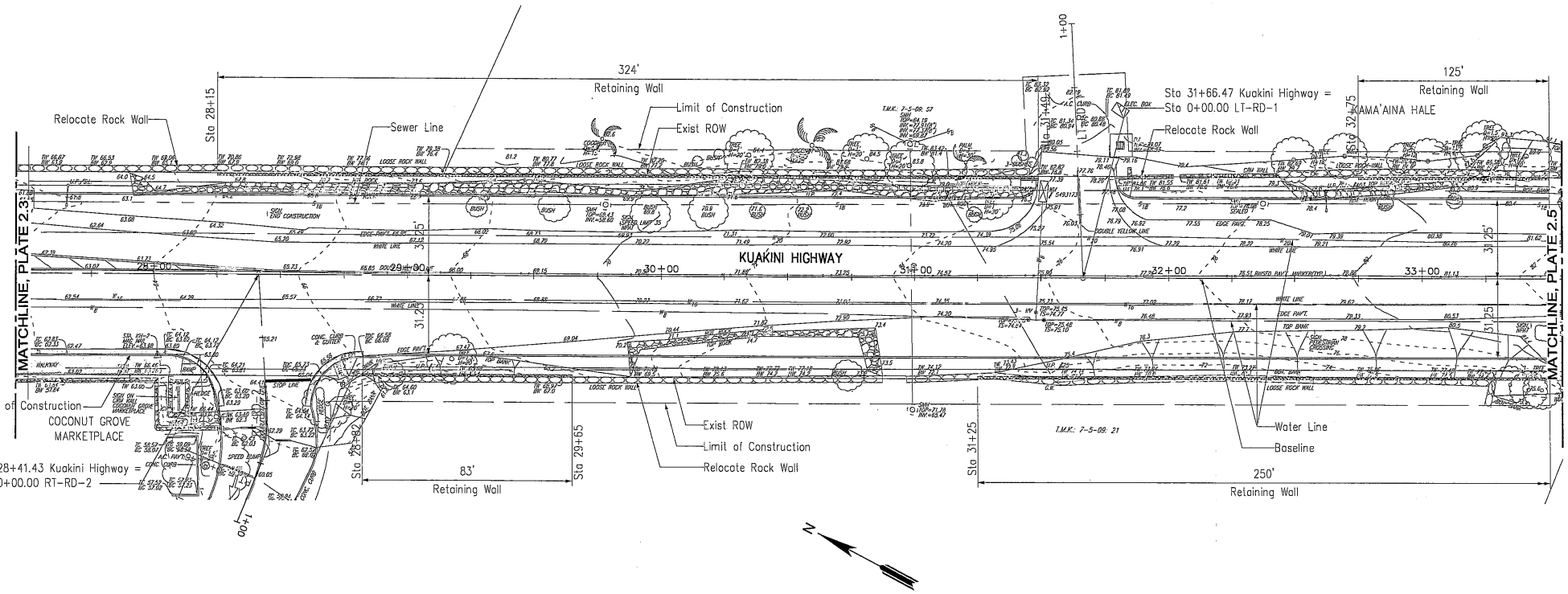

SITE PLAN
CONCEPTUAL ALTERNATIVE 1

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

0 20 40 80 120 FT.
GRAPHIC SCALE

REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

GEOLABS, INC.
Geotechnical Engineering

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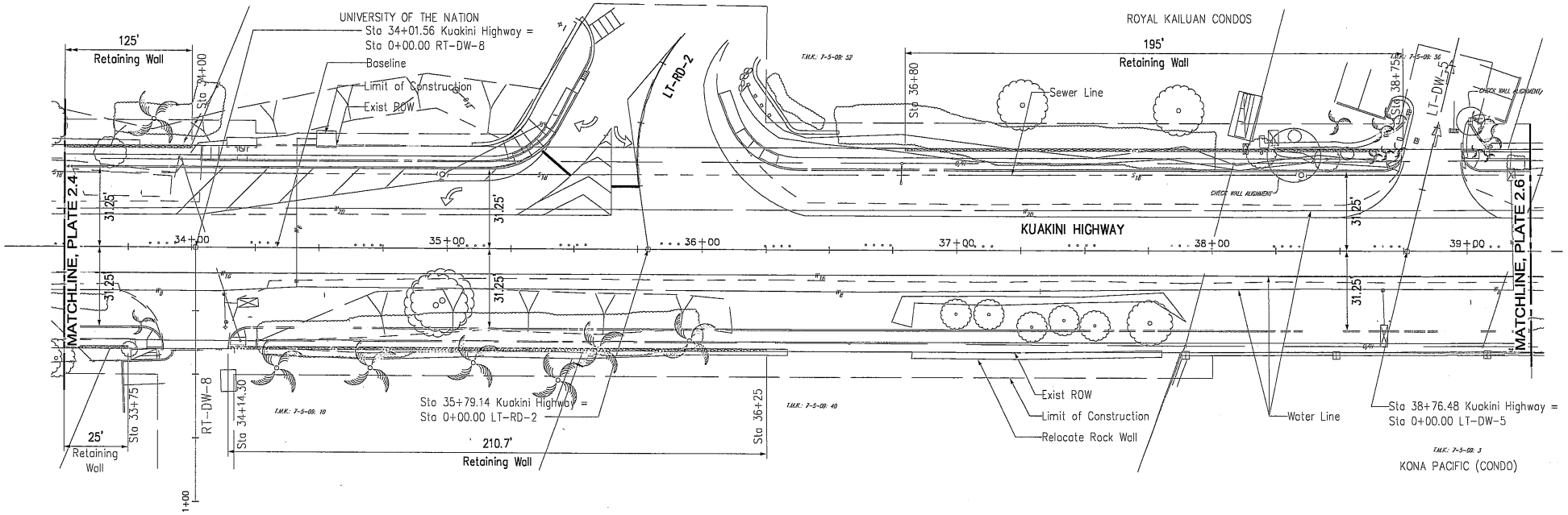

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SITE PLAN
CONCEPTUAL ALTERNATIVE 1

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

0 20 40 80 120 FT.
GRAPHIC SCALE

REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
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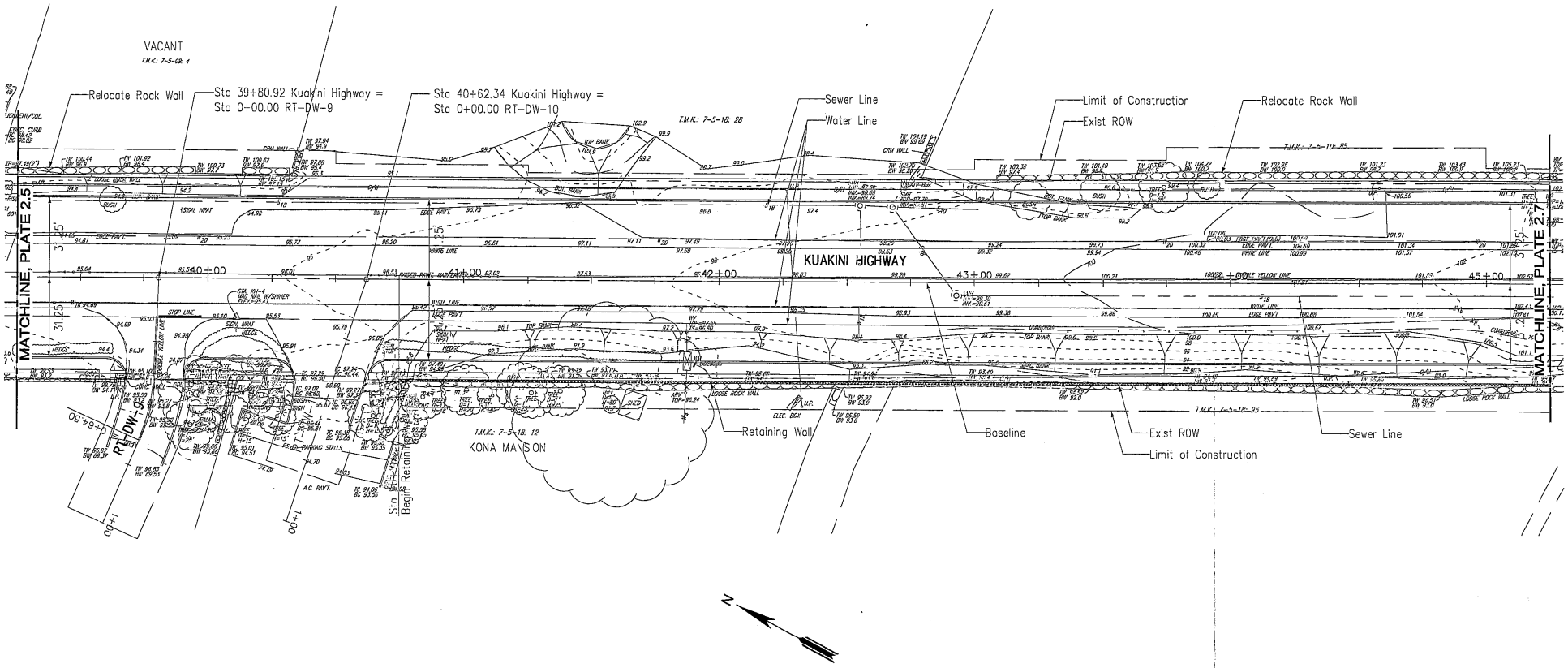

SITE PLAN
CONCEPTUAL ALTERNATIVE 1

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

0 20 40 80 120 FT.
GRAPHIC SCALE

REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

GEOLABS, INC.
Geotechnical Engineering

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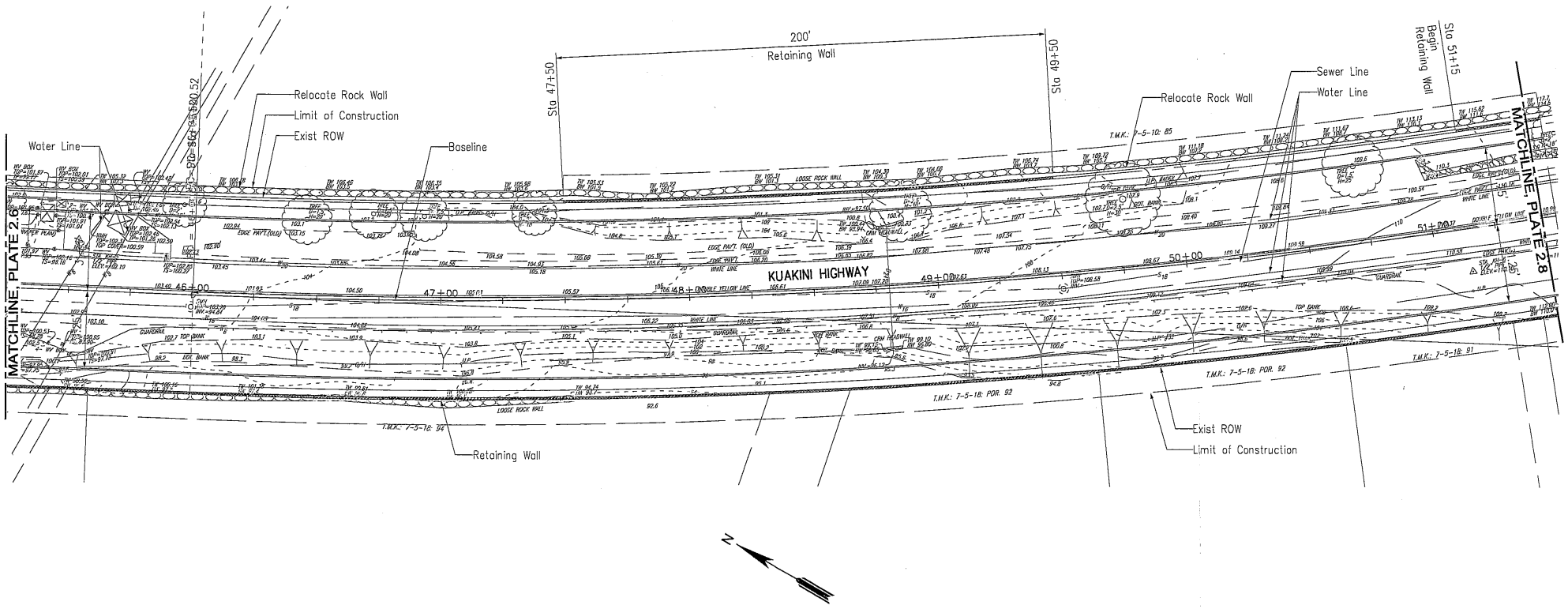

SITE PLAN
CONCEPTUAL ALTERNATIVE 1

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

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GRAPHIC SCALE

REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

GEOLABS, INC. Geotechnical Engineering		
DATE JANUARY 2006	DRAWN BY JRP	PLATE
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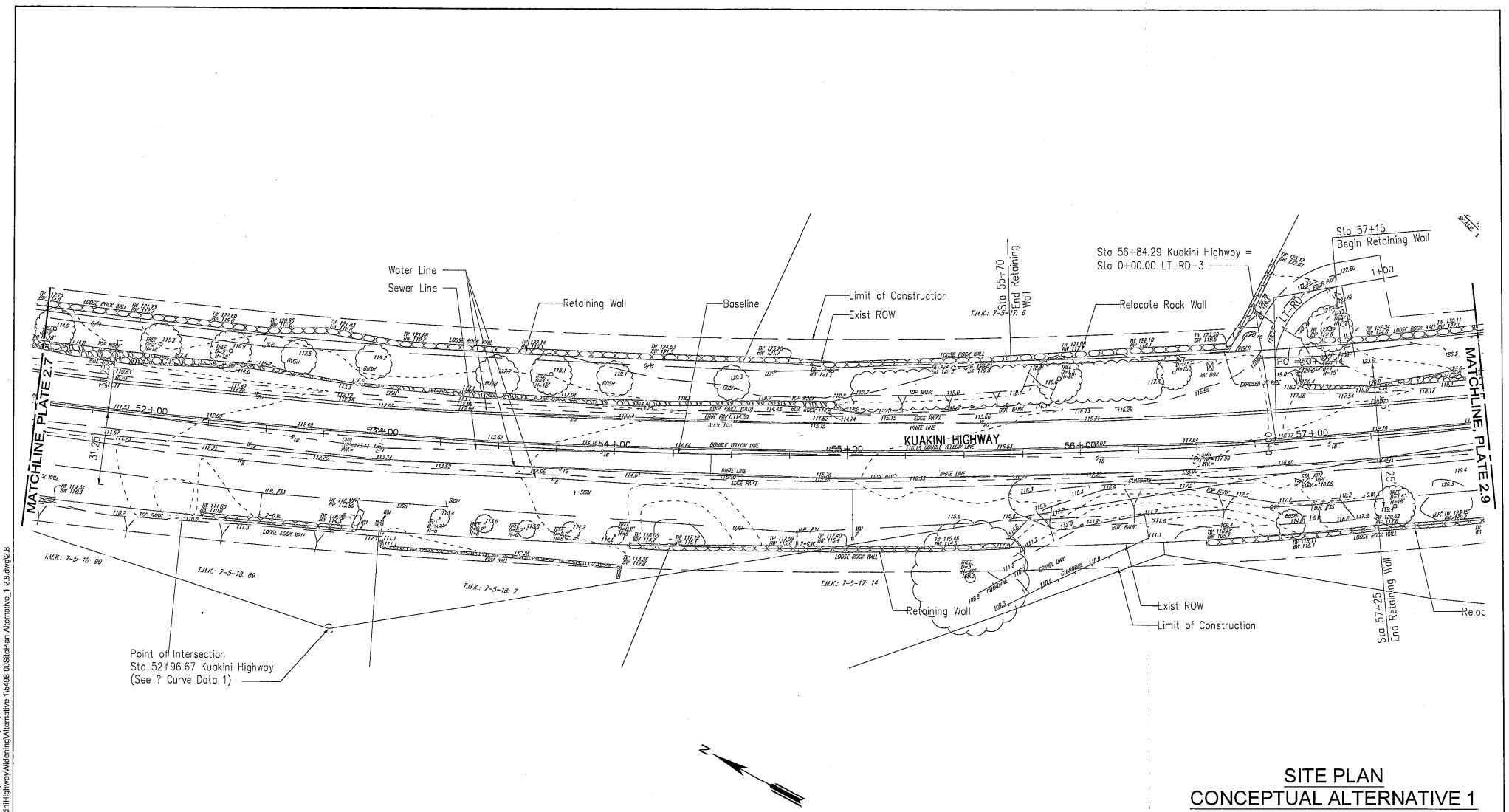

SITE PLAN
CONCEPTUAL ALTERNATIVE 1

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

0 20 40 80 120 FT.
GRAPHIC SCALE

GEOLABS, INC.
Geotechnical Engineering

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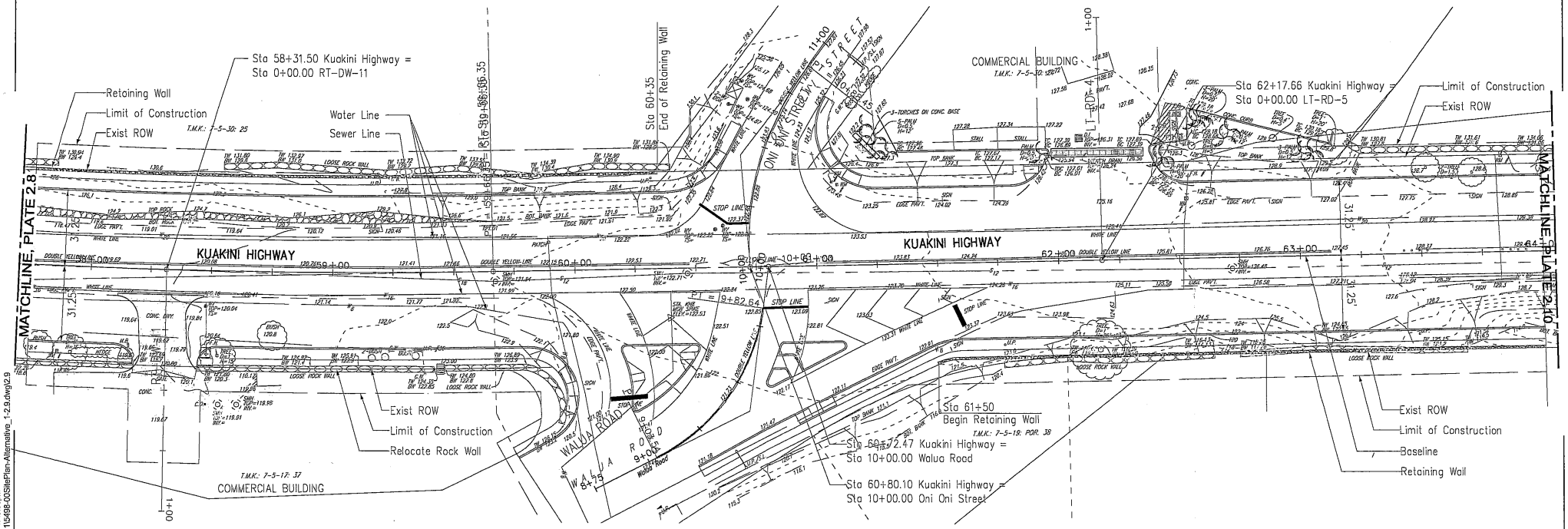

SITE PLAN
CONCEPTUAL ALTERNATIVE 1

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

0 20 40 80 120 FT.
GRAPHIC SCALE

REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

GEOLABS, INC.
Geotechnical Engineering

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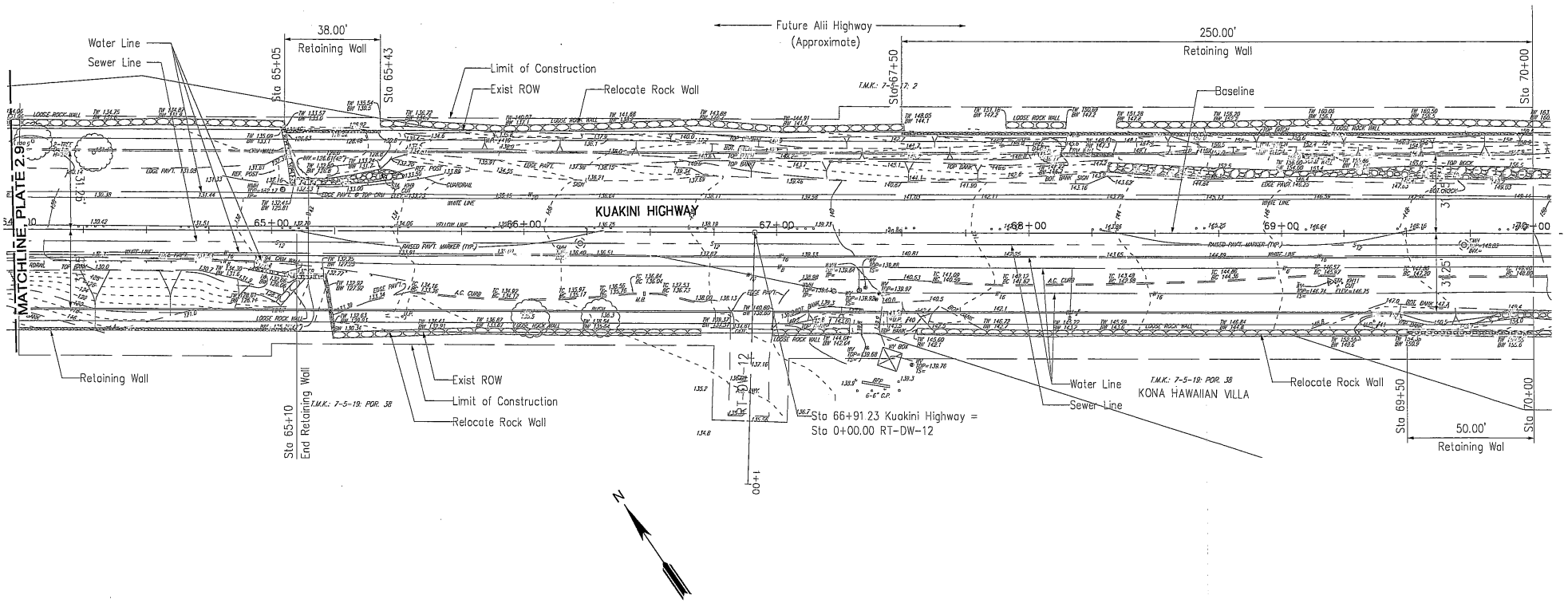

SITE PLAN
CONCEPTUAL ALTERNATIVE 1

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

0 20 40 80 120 FT.
GRAPHIC SCALE

GEOLABS, INC.
Geotechnical Engineering

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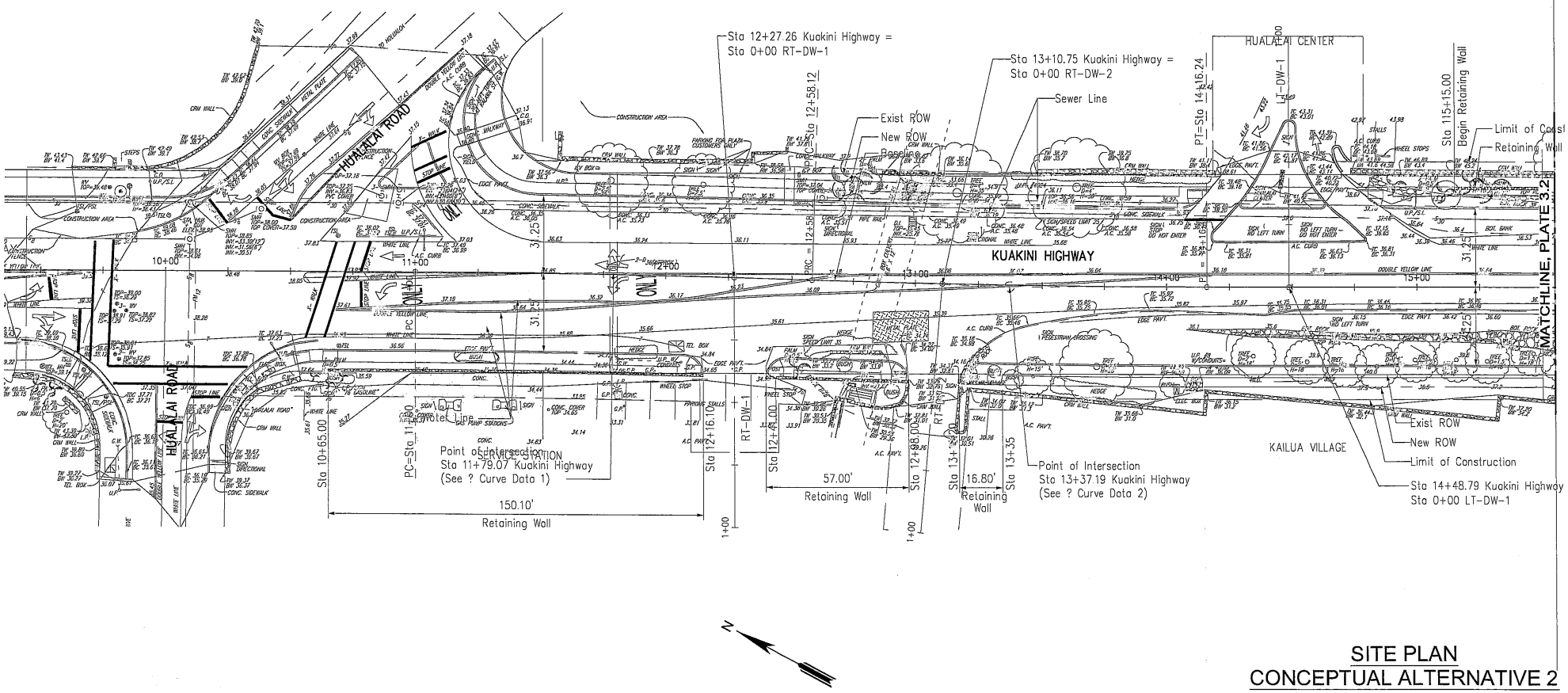

SITE PLAN
CONCEPTUAL ALTERNATIVE 2

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

0 20 40 80 120 FT.
GRAPHIC SCALE

REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
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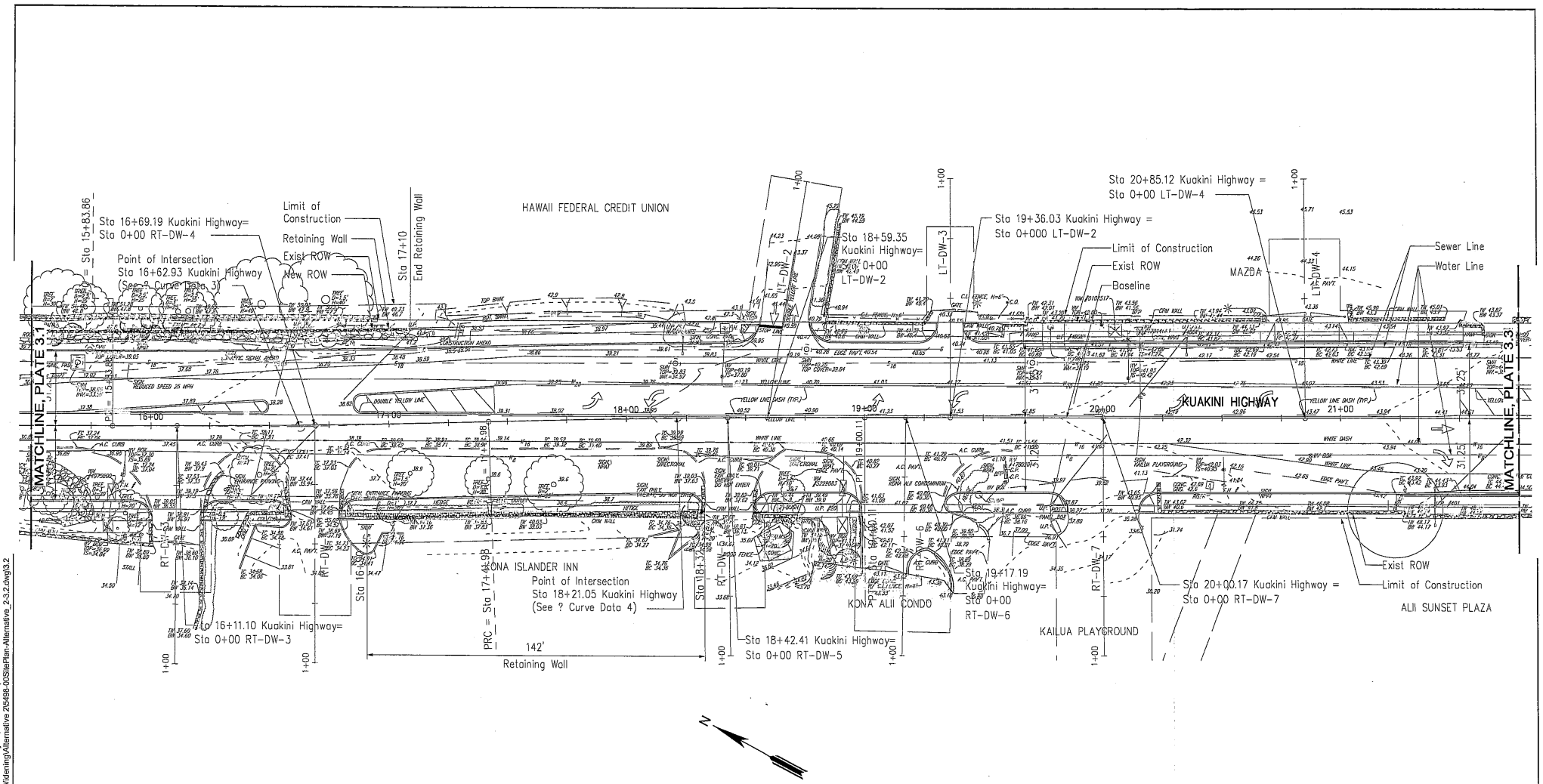

SITE PLAN
CONCEPTUAL ALTERNATIVE 2

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

0 20 40 80 120 FT.
GRAPHIC SCALE

REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
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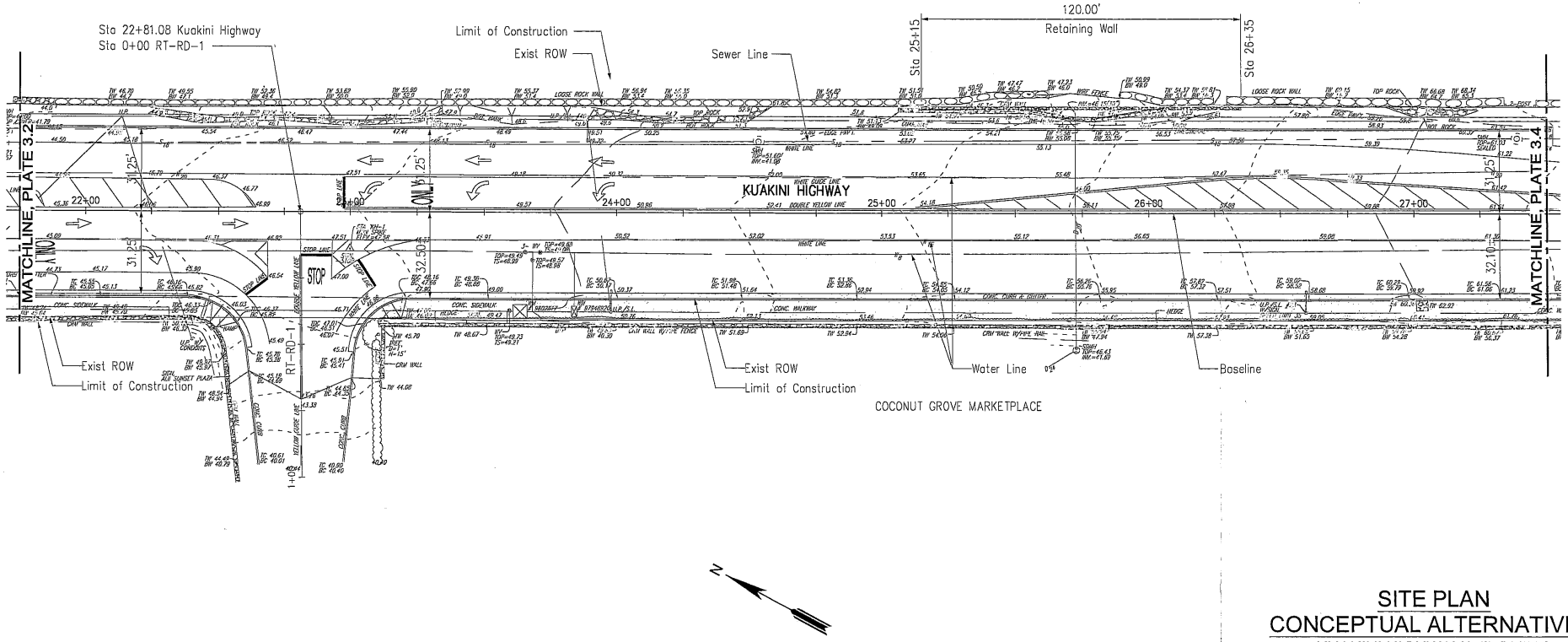

REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

0 20 40 80 120 FT.

GRAPHIC SCALE

SITE PLAN
CONCEPTUAL ALTERNATIVE 2

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
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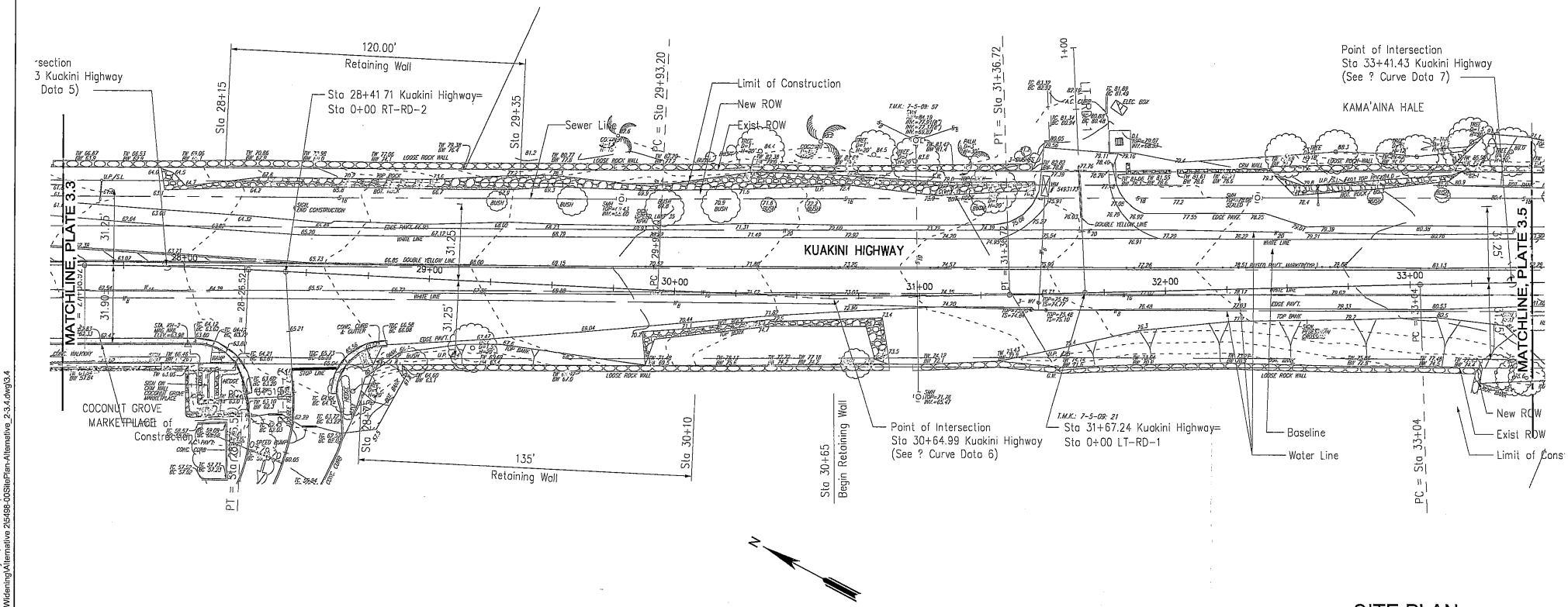

SITE PLAN
CONCEPTUAL ALTERNATIVE 2

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

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GRAPHIC SCALE

REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

GEOLABS, INC.
Geotechnical Engineering

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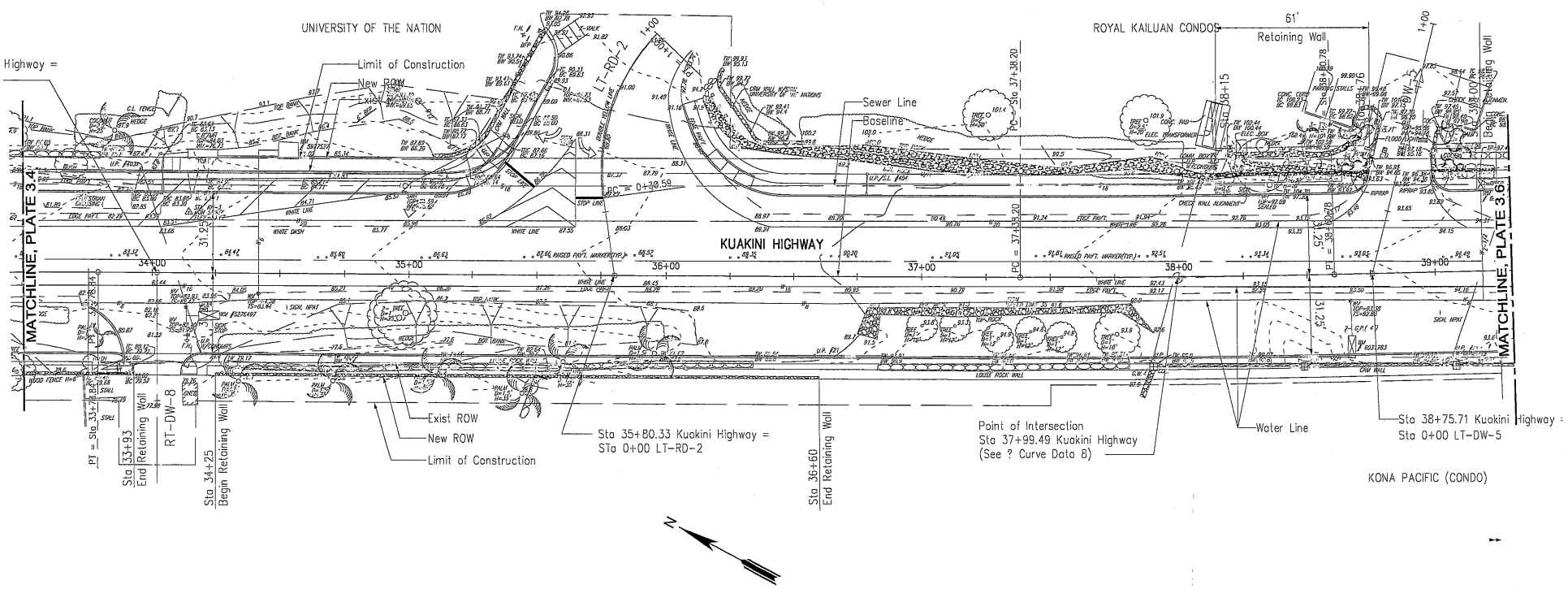

SITE PLAN
CONCEPTUAL ALTERNATIVE 2

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

0 20 40 80 120 FT.
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GEOLABS, INC.
Geotechnical Engineering

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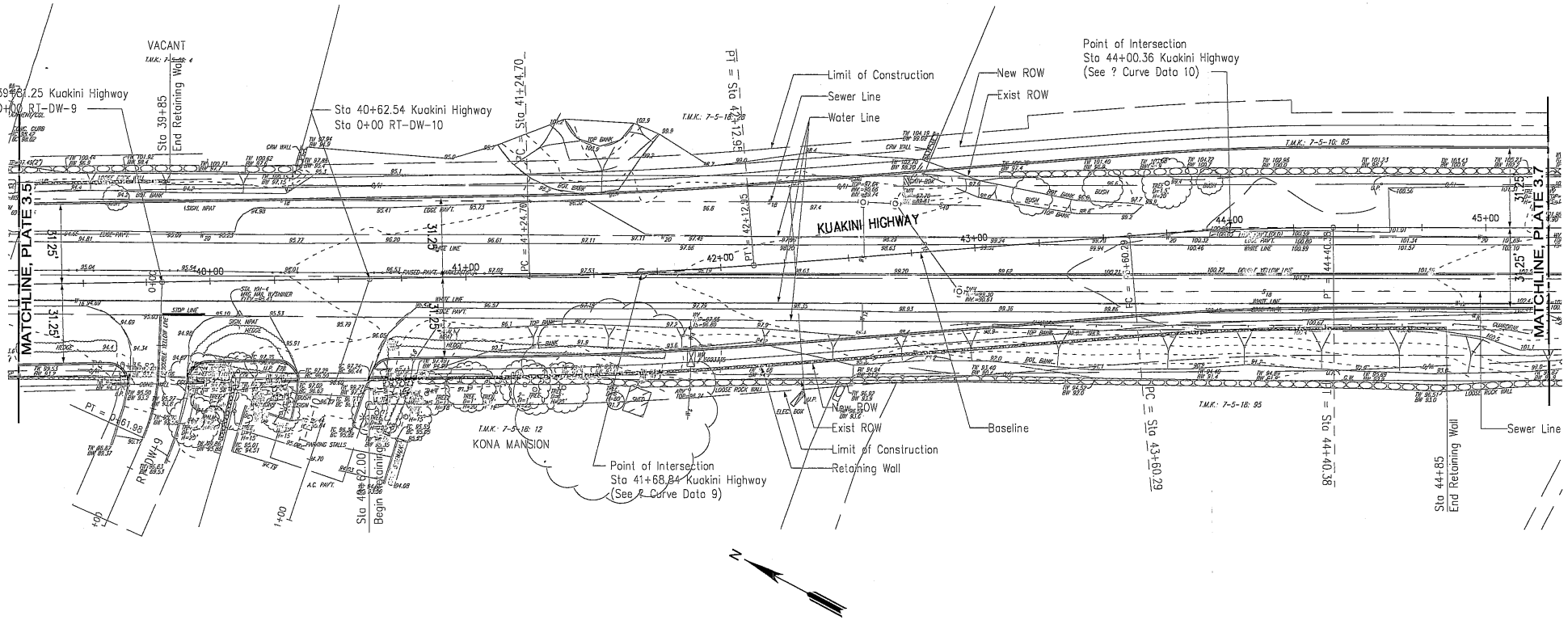

SITE PLAN
CONCEPTUAL ALTERNATIVE 2

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

0 20 40 80 120 FT.
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REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

GEOLABS, INC.
Geotechnical Engineering

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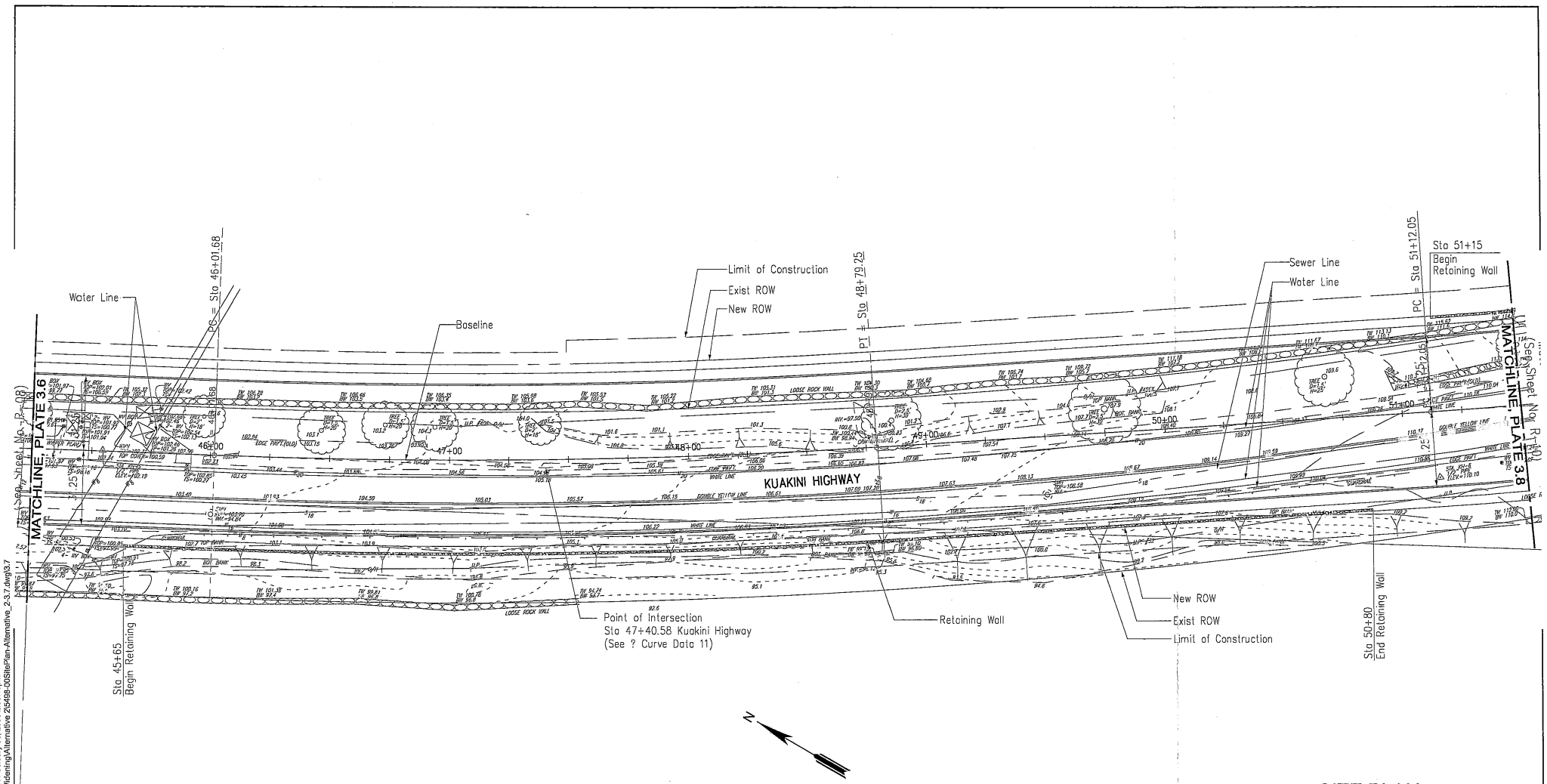

SITE PLAN
CONCEPTUAL ALTERNATIVE 2

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

0 20 40 80 120 FT.
GRAPHIC SCALE

REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
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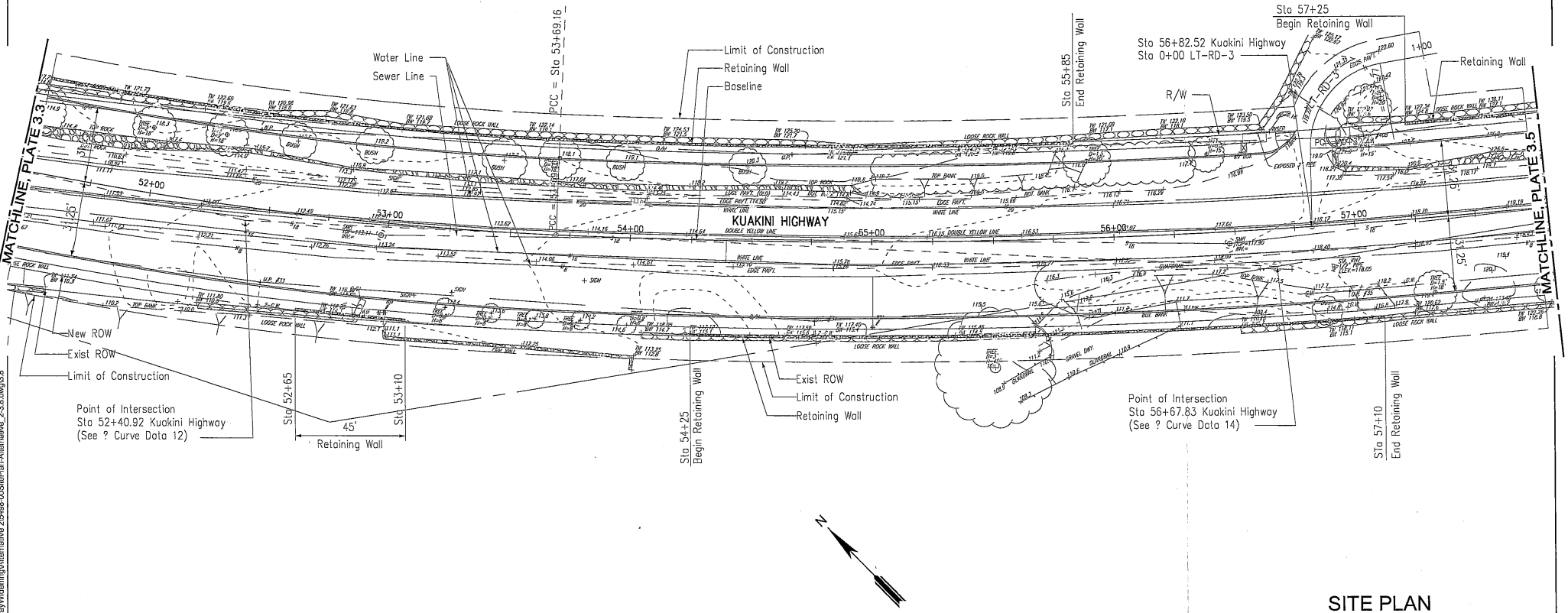

SITE PLAN
CONCEPTUAL ALTERNATIVE 2

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

0 20 40 80 120 FT.
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REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
JANUARY 2006	JRP	3.8
SCALE	W.O.	
1" = 40'	5498-00	

User: JJP File Created: April 29, 2003 File Last Updated: February 06, 2006 2:05:02pm
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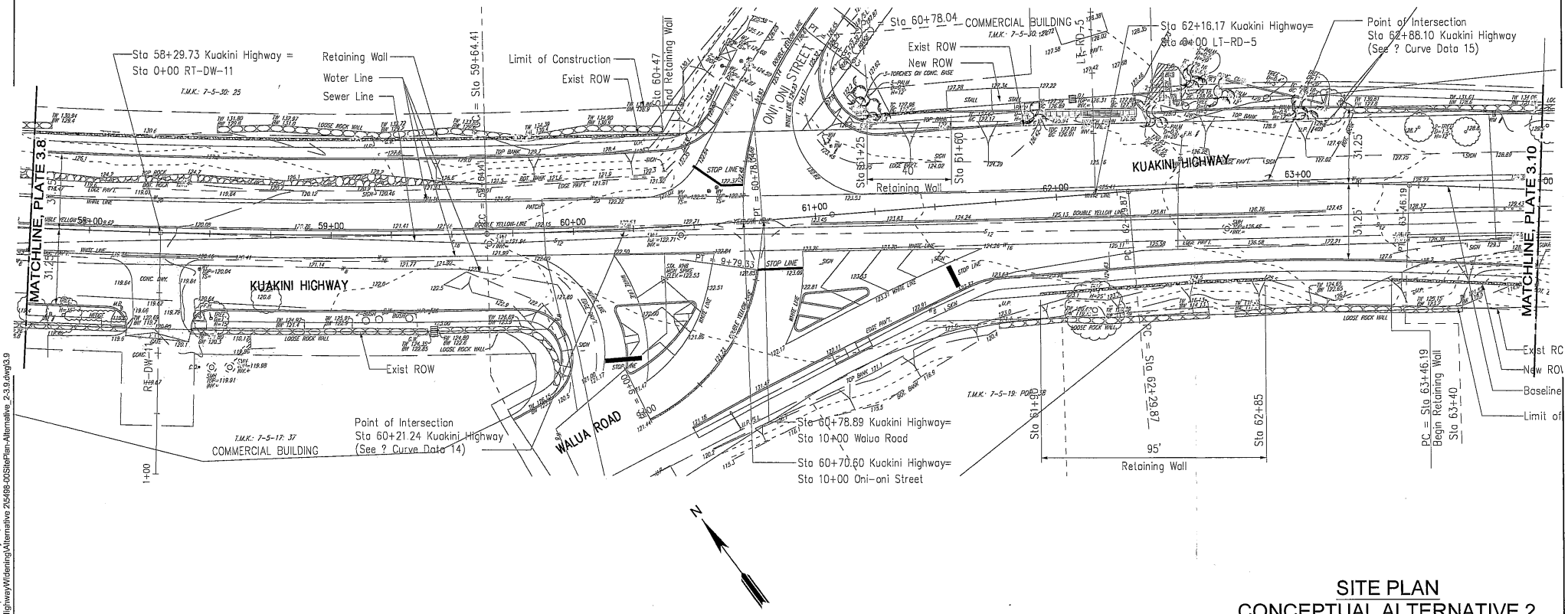

SITE PLAN
CONCEPTUAL ALTERNATIVE 2

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

0 20 40 80 120 FT.
GRAPHIC SCALE

REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
JANUARY 2006	JRP	3.9
SCALE 1" = 40'	W.O. 5498-00	

User: JJP File Created: April 29, 2003 File Last Updated: February 06, 2006 10:14:59am
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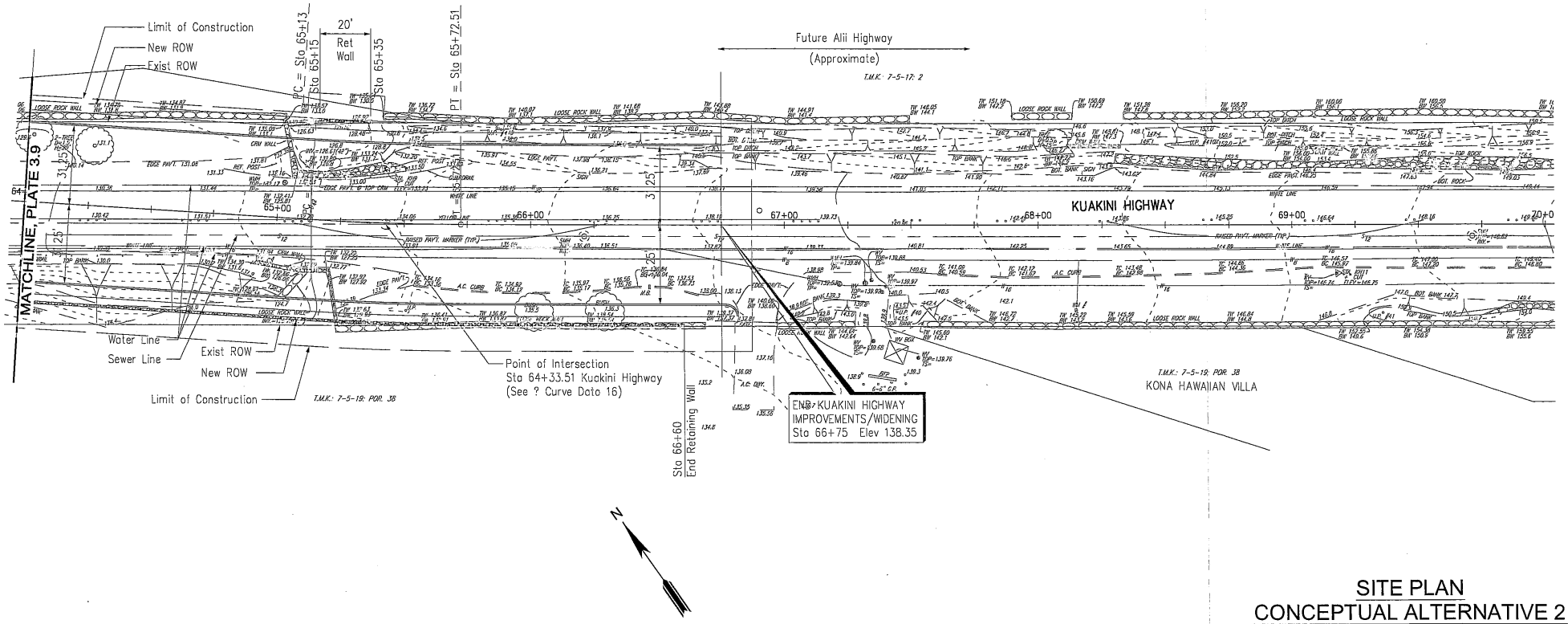

SITE PLAN
CONCEPTUAL ALTERNATIVE 2

KUAKINI HIGHWAY WIDENING
(HUALALAI ROAD TO ALII HIGHWAY)
KAILUA-KONA, ISLAND OF HAWAII

0 20 40 80 120 FT.
GRAPHIC SCALE

REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY PARSONS BRINCKERHOFF ON JANUARY 26, 2006.

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
JANUARY 2006	JRP	3.10
SCALE	W.O.	
1" = 40'	5498-00	

User: JJP File Created: April 29, 2003 File Last Updated: February 06, 2006 2:07:02pm
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SUMMARY OF RETAINING WALLS - CONCEPTUAL ALTERNATIVE 1
KUAKINI HIGHWAY IMPROVEMENTS
HULAILAI ROAD TO ALII HIGHWAY
W.O. 5498-00

Item No.	Side	Start Station No.	End Station No.	Wall Length (feet)	Max. Wall Height (feet)	Cut/Fill Condition
1	right	10+65	12+00	135	3	fill
2	right	12+50	12+85	35	5	fill
3	left	12+86	13+12	26	2	fill
4	left	14+71.5	17+20	248.5	13	cut
5	right	19+45	19+75	30	4	fill
6	left	25+00	26+35	135	10	fill
7	left	28+15	31+49	324	10	cut
8	right	28+82	29+65	83	4	fill
9	right	31+25	33+75	250	8	fill
10	left	32+75	34+00	125	5	cut
11	right	34+14.3	36+25	210.7	10	fill
12	left	36+80	38+75	195	11	cut
13	right	40+75	57+25	1650	16	fill
14	left	47+50	49+50	200	7	fill
15	left	51+15	55+70	455	7	cut
16	left	57+15	60+35	320	10	cut
17	right	61+50	65+10	360	16	fill
18	left	65+05	65+43	38	7	fill
			Total=	4820.2		

SUMMARY OF RETAINING WALLS - CONCEPTUAL ALTERNATIVE 2
KUAKINI HIGHWAY IMPROVEMENTS
HULAILAI ROAD TO ALII HIGHWAY
W.O. 5498-00

Item No.	Side	Start Station No.	End Station No.	Wall Length (feet)	Max. Wall Height (feet)	Cut/Fill Condition
1	right	10+65	12+16.1	150.1	3	fill
2	right	12+41	12+98	57	7	fill
3	right	13+18.2	13+35	16.8	4	fill
4	left	15+15	17+10	195	10	cut
5	right	16+90	18+32	142	4	fill
6	left	25+15	26+35	120	10	fill
7	left	28+15	29+35	120	5	cut
8	right	28+75	30+10	135	6	fill
9	right	30+65	33+93	328	8	fill
10	right	34+25	36+60	235	11	fill
11	left	38+15	38+76	61	4	cut
12	left	39+00	39+85	85	2	cut
13	right	40+62	44+85	423	11	fill
14	right	45+65	50+80	515	8	fill
15	left	51+15	55+85	470	8	cut
16	right	52+65	53+10	45	2	fill
17	right	54+25	57+10	285	10	fill
18	left	57+25	60+47	322	10	cut
19	left	61+25	61+60	35	3	cut
20	right	61+90	62+85	95	3	fill
21	right	63+46.19	66+60	313.81	16	fill
22	left	65+15	65+35	20	4	fill
			Total=	4168.71		

SUMMARY OF WALL ALTERNATIVES IN CUT CONDITION

Kuakini Highway Widening
(Hualalai Road to Alii Highway)
Kailua- Kona, Island of Hawaii

Wall Number	Wall Type	Description of Wall	Pros	Cons	Estimated Construction Cost Per Sq. Ft.
1	Conventional Concrete Retaining Wall	Reinforced concrete L-shaped wall.	1. Less costly compared to Wall 3. 2. Mobilizing special construction equipment not required.	1. Noise and vibration generated from wall excavation.	$175
2	Cement Rubble Masonry (CRM) Wall	Wall composed of rock cobbles and boulders with cement mortar.	1. Rock cobbles and boulders readily available from wall excavation. 2. Mobilizing special construction equipment not required.	1. Walls are significant in size due to seismic requirements. 2. Difficult to construct wall within existing right-of-way due to large wall base. 3. Noise and vibration generated from wall excavation.	$125
3	Soldier Pile Wall	Wall consisting of drilled shaft soldier piles, concrete lagging, and shotcrete facing.	1. Wall can be constructed within right-of-way.	1. Costly. 2. Need to mobilize special drilling equipment.	$300
4	Soil-Nailed Wall	Wall composed of shotcrete facing and soil nails. Top to down construction with incremental removal of cut face.	1. Least costly compared to other alternatives.	1. Need to acquire permanent easement for soil nails. 2. Noise and vibration generated from wall excavation. 3. Need to mobilize special drilling equipment.	$120

SUMMARY OF WALL ALTERNATIVES IN FILL CONDITION

Kuakini Highway Widening
(Hualalai Road to Alii Highway)
Kailua- Kona, Island of Hawaii

Wall Number	Wall Type	Description of Wall	Pros	Cons	Estimated Construction Cost Per Sq. Ft.
1	Conventional Concrete Retaining Wall	Reinforced concrete wall.	1. Wall can be constructed within right-of-way.	1. Most costly compared to other alternatives. 2. Forming work required for wall construction.	$175
2	Cement Rubble Masonry (CRM) Wall	Wall composed of rock cobbles and boulders with cement mortar.	1. Rock cobbles and boulders readily available. 2. Less costly compared to Wall 1.	1. Walls are significant in size due to seismic requirements. 2. May be difficult to construct wall within existing right-of-way due to large wall base.	$125
3	Segmental Retaining Wall	Wall composed of modular block face units with reinforced fill consisting of geogrids and granular fill.	1. Least costly compared to other alternatives. 2. Wall can be constructed within right-of-way. 3. More tolerable to ground movements compared to other wall alternaitves.	1. Modular block face units needs to be shipped to Big Island. 2.	$100

APPENDIX C ELECTRICAL ENGINEERING REPORT

KUAKINI HIGHWAY IMPROVEMENTS
HUALALAI ROAD TO ALII HIGHWAY

ELECTRICAL EVALUATION AND REPORT (DRAFT #1)
Prepared by MK Engineers, Ltd. for
PARSONS BRINCKERHOFF.
January 27, 2006

Existing Conditions

This project is a continuation of the County of Hawaii's Kuakini Highway Improvements. The initial phase provided sidewalk and road improvements along Kuakini Highway from Palani Road to Hualalai Road. The existing overhead utilities on both sides of the highway were replaced with a single steel pole overhead line on the mauka side of the highway with underground crossings to the makai side to maintain existing services. New street light poles and luminaires were installed on the makai side of the highway, and new street light luminaires mounted on bracket arms were installed on the new steel poles on the mauka side of the highway.

The second phase of the project from Hualalai Road to Alii Highway will continue with the same type of roadway and utility improvements. The existing conditions along this stretch of highway are as follows:

The Hawaii Electric Light Company (HELCO) has a transmission line (69 kV) and a distribution line (primary 12 kV and secondary) on wood poles along the mauka side of the highway. There are several primary and secondary overhead crossings to the makai side of the highway that provide electric service to customers on the makai side.

Telephone cables from Hawaiian Telecom (HTCOM) and CATV cables from Time Warner Oceanic Cable (OCEANIC) run overhead on wood poles on the makai side of the highway. There are several telephone and CATV overhead crossings to the mauka side of the highway that provide service to customers on the mauka side.

The County has several street lighting luminaires on bracket arms attached to the existing wood poles on both sides of the highway.

Proposed Improvements

The improved 80-foot wide highway right-of-way will contain five traffic lanes (two lanes in each direction with a middle left turn / median lane), a bike lane in each direction, sidewalks, and a 3'-9" buffer zone between the sidewalk and property line. New steel poles supporting HELCO, HTCOM, OCEANIC, and COUNTY street lights will be placed within this buffer zone along the mauka side of the highway, and new street light standards will be placed within this buffer zone along the makai side of the highway. To allow for conductor swing and not have the conductors encroach into private property, the overhead utility conductors will need to be placed on insulators mounted on bracket arms in a

vertical configuration, all facing toward the highway. To allow for a minimum 25 feet to the lowest conductor as desired by the community, provide for electrical clearance between each voltage class as required by the National Electrical Safety Code and State of Hawaii Public Utilities Commission, and provide for a shield wire (lightning protection) for the transmission circuit at the top of the pole, the resulting pole height above ground will be 80 feet (see Attachment 1 for a typical 80-foot steel pole). The steel pole foundation will extend approximately 10 feet below the ground.

As desired by the community, all primary, secondary, and communication lines to customers on the makai side of the highway will be installed underground. This will entail installation of ductlines, handholes in the sidewalk area, and cables to intercept the existing service points.

The following table summarizes the cost for the electric utility improvements:

TABLE 1: PROPOSED OVERHEAD COST (ELECTRICAL)

HELCO POWER SYSTEM	
OVERHEAD TRANSMISSION SYSTEM	$2,180,250
OVERHEAD DISTRIBUTION SYSTEM	$212,900
UNDERGROUND CROSSINGS / SERVICES	$157,500
REMOVE EXISTING SYSTEM	$180,000
HELCO SUBTOTAL	**$2,730,650**
HTCOM TELEPHONE SYSTEM	
OVERHEAD TELEPHONE SYSTEM	$1,141,600
UNDERGROUND CROSSINGS / SERVICES	$170,500
REMOVE EXISTING SYSTEM	$60,000
HTCOM SUBTOTAL	**$1,372,100**
OCEANIC CATV SYSTEM	
OVERHEAD CATV SYSTEM	$318,400
UNDERGROUND CROSSINGS / SERVICES	$80,200
REMOVE EXISTING SYSTEM	$15,000
OCEANIC SUBTOTAL	**$413,600**
COUNTY SYSTEM	
STREET LIGHTING SYSTEM	$821,600
UNDERGROUND UTILITY INFRASTRUCTURE	$590,000
REMOVE EXISTING SYSTEM	$6,000
COUNTY SUBTOTAL	**$1,417,600**
TOTAL ELECTRICAL PROJECT COST	**$5,933,950**

The costs are based on the following assumptions:

- All electric utilities are to be placed overhead on the mauka side of the highway on 80-foot steel poles located within the 3'-9" buffer zone adjacent to the property line.
- New utility poles are to be designed to withstand 100 mph winds and painted to blend with the environment.
- All crossings to provide service to customers on the makai side of the highway are to be placed underground.
- A minimum of 25 feet will be maintained to the lowest conductor on the new steel poles to accommodate any planting of trees within the sidewalk area.
- The County will provide the underground ductline infrastructure for the utilities.
- The cost estimate does not reflect any cost-sharing between utilities for joint pole agreements, between the utilities and the County for utility agreements, nor between the County and the State or Federal governments for funding of federal-aid highway improvements.
- The cost estimate is based solely on past project information within the MK Engineers database and does not reflect actual utility costs or estimates provided by the utilities.
- The cost estimate does not reflect future price increases that may occur from the time this estimate was prepared and the project is actually constructed.

See Attachment 2 for a detailed cost breakdown of the proposed overhead plan.

ALL UNDERGROUND OPTION

A rough cost estimate was prepared to determine the cost of constructing this project by placing all the utilities underground. For this option, the HELCO transmission line will be placed in the roadway area. The HELCO primary and secondary lines and HTCOM and Oceanic communication cables will be placed within the mauka sidewalk area with underground crossings to the makai side similar to the proposed overhead plan. All existing overhead services to buildings will need to be converted to underground. Typically, this is a customer cost, but for the purposes of this exercise, the service conversion costs were included as utility company costs. Also, padmount transformers and a padmount switchgear will require easements from property owners. Easement costs are not included in the all underground estimate.

The County street lighting system will be installed on both sides of the highway utilizing standard street lighting poles within the 3'-9" buffer zone adjacent to the property line. The County will be providing the ductlines, manholes, and handhole groups for the utilities. Also, it should be noted that unless there are specific State or County ordinances that mandate the undergrounding of utilities, a government or third-party entity will need to pay each respective utility the difference in cost between an overhead utility installation and an underground utility installation including the cost of service conversions.

The following table summarizes the cost for an all underground option:

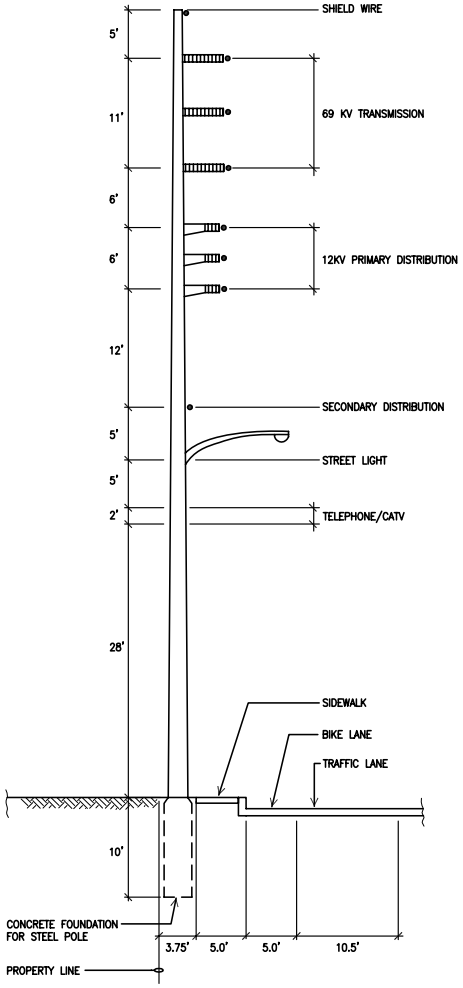
TABLE 2: ALL UNDERGROUND OPTION COST (ELECTRICAL)

HELCO POWER SYSTEM	
UNDERGROUND TRANSMISSION SYSTEM	$1,239,700
UNDERGROUND DISTRIBUTION SYSTEM	$1,408,200
UNDERGROUND CROSSINGS / SERVICES	$337,500
REMOVE EXISTING SYSTEM	$180,000
HELCO SUBTOTAL	**$3,165,400**
HTCOM TELEPHONE SYSTEM	
OVERHEAD TELEPHONE SYSTEM	$1,790,000
UNDERGROUND CROSSINGS / SERVICES	$260,500
REMOVE EXISTING SYSTEM	$60,000
HTCOM SUBTOTAL	**$2,110,500**
OCEANIC CATV SYSTEM	
OVERHEAD CATV SYSTEM	$375,400
UNDERGROUND CROSSINGS / SERVICES	$110,200
REMOVE EXISTING SYSTEM	$15,000
OCEANIC SUBTOTAL	**$500,600**
COUNTY SYSTEM	
STREET LIGHTING SYSTEM	$1,379,800
UNDERGROUND UTILITY INFRASTRUCTURE	$3,430,000
REMOVE EXISTING SYSTEM	$6,000
COUNTY SUBTOTAL	**$4,815,800**
TOTAL ELECTRICAL PROJECT COST	**$10,592,300**

See Attachment 3 for a detailed cost breakdown of the all underground option.

Attachment 1

Typical 80-foot Steel Pole



TYPICAL 80' STEEL POLE

NOT TO SCALE

Attachment 2

Proposed Overhead Cost Estimate

KUAKINI HIGHWAY IMPROVEMENTS
Hualalai Road to Alii Highway
PROJECT ELECTRICAL COSTS
OVERHEAD OPTION

HELCO POWER SYSTEM		
Overhead Transmission System	$	2,180,250
Overhead Distribution System		212,900
Underground Crossings / Services		157,500
Subtotal for Installation of New System	$	2,550,650
Removal of Existing System	$	180,000
Total HELCO Project Cost	**$**	**2,730,650**

HTCOM TELEPHONE SYSTEM		
Overhead Telephone System	$	1,141,600
Underground Crossings / Services	$	170,500
Subtotal for Installation of New System	$	1,312,100
Removal of Existing System	$	60,000
Total HTCOM Project Cost	**$**	**1,372,100**

OCEANIC CATV SYSTEM		
Overhead CATV System	$	318,400
Underground Crossings / Services	$	80,200
Subtotal for Installation of New System	$	398,600
Removal of Existing System	$	15,000
Total OCEANIC Project Cost	**$**	**413,600**

COUNTY SYSTEM		
Street Lighting System	$	821,600
UG Utility Infrastructure	$	590,000
Subtotal for Installation of New System	$	1,411,600
Removal of Existing System	$	6,000
Total COUNTY Project Cost	**$**	**1,417,600**

TOTAL CONSTRUCTION COST		
HELCO System	$	2,730,650
HTCOM System	$	1,372,100
OCEANIC System	$	413,600
COUNTY System	$	1,417,600
Total Project Construction Cost	**$**	**5,933,950**

KUAKINI HIGHWAY IMPROVEMENTS
HELCO ELECTRICAL COSTS

Estimate for 69KV Single-Circuit Overhead Transmission Line					
Item	Quantity	Units	Cost/Unit	Total Cost	Comments
Engineering	1	Lot	$ 100,000	$100,000	Both Consulting Engineering and HELCO internal engineering
Project Management	1	Lot	$ 25,000	$25,000	Both Consulting Engineering and HELCO internal engineering
PUC Approval	1	Lot	$ 30,000	$30,000	Preparation of application and follow-up
Permits	1	Lot	$ 20,000	$20,000	County, etc.
Public Outreach	1	Lot	$ 25,000	$25,000	Time and presentation materials
Foundation (Tangent Pole)	28	Ea.	$ 6,000	$168,000	10 feet deep, 3' diameter, concrete backfill
Foundation (Small Angle Pole)	8	Ea.	$ 20,000	$160,000	10 feet deep, 4' diameter, concrete w/ anchor bolts
Tangent Poles (Materials)	28	Ea.	$ 12,000	$336,000	90' with 10' embedded in ground
Small Angle Poles (Materials)	8	Ea.	$ 30,000	$240,000	80' with anchor bolt base plate
Poles (Labor)	36	Ea.	$ 15,000	$540,000	Prep, paint, erect
Wire (Materials)	17,000	Ft.	$ 1.20	$20,400	556 AAC
Shield Wire (Materials)	5,700	Ft.	$ 0.50	$2,850	#3/0 AAAC
Wire (Labor)	1,200	Hrs.	$ 100	$120,000	Crew of 10 @ 120 hours
Other Materials	1	Lot	$ 108,000	$108,000	Insulators, nuts, bolts, etc.
Construction Management	1	Lot	$ 50,000	$50,000	
Equipment Mobilization	1	Lot	$ 100,000	$100,000	
Equipment Rental	1	Lot	$ 50,000	$50,000	
Labor Mobilization	1	Lot	$ 10,000	$10,000	
Site Preparation	1	Lot	$ 50,000	$50,000	
Traffic Control	1	Lot	$ 25,000	$25,000	
Subtotal Transmission System				$2,180,250	

Estimate for 12KV Overhead Distribution Line (Underbuilt)					
Item	Quantity	Units	Cost/Unit	Extended	Comments
Engineering	1	Lot	$ 25,000	$25,000	Both Consulting Engineering and HELCO internal engineering
Wire (Materials)	17,000	Ft.	$ 0.80	$13,600	336 AAC plus neutral
Wire (Labor)	640	Hrs.	$ 100	$64,000	Crew of 4 @ 160 hours
Other Materials (Materials)	1	Lot	$ 36,000	$36,000	Insulators, nuts, bolts, fuses, etc.
Omnirupter Switch	1	Ea.	$ 3,500	$3,500	
1-Ph Transformers	10	Ea.	$ 1,500	$15,000	
3-Ph Transformer Bank	3	Ea.	$ 15,000	$45,000	
3-Ph Riser	9	Ea.	$ 1,200	$10,800	
Subtotal Distribution System				$212,900	

Estimate for 12KV Underground Crossings / Services					
Item	Quantity	Units	Cost/Unit	Extended	Comments
Engineering	1	Lot	$ 25,000	$25,000	Both Consulting Engineering and HELCO internal engineering
Cable (Materials)	1,300	Ft.	$ 40	$52,000	
Cable (Labor)	1,300	Ft.	$ 25	$32,500	
Cable Splices	16	Ea.	$ 3,000	$48,000	
Subtotal UG Distribution System				$157,500	

KUAKINI HIGHWAY IMPROVEMENTS
HAWAIIAN TELCOM ELECTRICAL COSTS

Estimate for Hawaiian TelCom Overhead Line					
Item	Quantity	Units	Cost/Unit	Total Cost	Comments
Engineering	1	Lot	$ 25,000	$25,000	HTCOM internal engineering
PUC Approval	1	Lot	$ 30,000	$30,000	Preparation of application and follow-up
Permits	1	Lot	$ 20,000	$20,000	County, Utility Agreement, etc.
Wire (Materials)	5,700	Ft.	$ 100.00	$570,000	Telephone cables
Wire (Labor)	4,000	Hrs.	$ 100	$400,000	Crew of 4 @ 1000 hours
Other Materials	1	Lot	$ 21,600	$21,600	Splices, terminal blocks
Equipment Rental	1	Lot	$ 20,000	$20,000	
Labor Mobilization	1	Lot	$ 10,000	$10,000	
Site Preparation	1	Lot	$ 20,000	$20,000	
Traffic Control	1	Lot	$ 25,000	$25,000	
Subtotal OH Telephone System				$1,141,600	

Estimate for Telephone Underground Crossings / Services					
Item	Quantity	Units	Cost/Unit	Extended	Comments
Engineering	1	Lot	$ 25,000	$25,000	HTCOM internal engineering
Cable (Materials)	1,300	Ft.	$ 25	$32,500	
Cable (Labor)	1,300	Ft.	$ 50	$65,000	
Cable Splices	16	Ea.	$ 3,000	$48,000	
Subtotal UG Telephone System				$170,500	

KUAKINI HIGHWAY IMPROVEMENTS
TIME WARNER OCEANIC ELECTRICAL COSTS

Estimate for Oceanic Cable Overhead Line					
Item	Quantity	Units	Cost/Unit	Total Cost	Comments
Engineering	1	Lot	$ 25,000	$25,000	Oceanic internal engineering
Permits	1	Lot	$ 10,000	$10,000	County, Utility Agreement, etc.
Wire (Materials)	5,700	Ft.	$ 20.00	$114,000	CATV cable
Wire (Labor)	1,000	Hrs.	$ 100	$100,000	Crew of 2 @ 500 hours
Other Materials	1	Lot	$ 14,400	$14,400	Splices, enclosures, etc.
Equipment Rental	1	Lot	$ 20,000	$20,000	
Labor Mobilization	1	Lot	$ 10,000	$10,000	
Traffic Control	1	Lot	$ 25,000	$25,000	
Subtotal OH CATV System				$318,400	

Estimate for CATV Underground Crossings / Services					
Item	Quantity	Units	Cost/Unit	Extended	Comments
Engineering	1	Lot	$ 25,000	$25,000	Oceanic internal engineering
Cable (Materials)	1,300	Ft.	$ 15	$19,500	
Cable (Labor)	1,300	Ft.	$ 25	$32,500	
Cable Splices	16	Ea.	$ 200	$3,200	
Subtotal UG CATV System				$80,200	

KUAKINI HIGHWAY IMPROVEMENTS
COUNTY OF HAWAII ELECTRICAL COSTS

Estimate for County Street Lighting System					
Item	Quantity	Units	Cost/Unit	Total Cost	Comments
Engineering	1	Lot	$ 50,000	$50,000	Both Consulting Engineering and County internal engineering
Foundation	36	Ea.	$ 1,500	$54,000	Concrete footing, anchor bolts, grounding
35' Lighting Standard	36	Ea.	$ 9,000	$324,000	Single bracket luminaire, 15' arm
Lighting Standard mtd on joint pole	36	Ea.	$ 2,000	$72,000	Single bracket luminaire, 15' arm
Conduit, 2" PVC80, direct buried	4,600	Ft.	$ 35.00	$161,000	PVC 80
Pullbox, 2'x4'	18	Ea.	$ 2,000	$36,000	
Conductors, street light	4,600	Ft.	$ 12.00	$55,200	
Other Materials	1	Lot	$ 14,400	$14,400	
Equipment Rental	1	Lot	$ 20,000	$20,000	
Labor Mobilization	1	Lot	$ 10,000	$10,000	
Traffic Control	1	Lot	$ 25,000	$25,000	
Subtotal Street Lighting System				$821,600	

Estimate for Underground Utility Infrastructure					
Item	Quantity	Units	Cost/Unit	Extended	Comments
Engineering	1	Lot	$ 50,000	$50,000	Both Consulting Engineering and County internal engineering
Ductline	1,300	Ft.	$ 150.00	$195,000	4-4", 2-3" concrete encased
Handhole Group	16	Ea.	$ 20,000	$320,000	HELCO, HTCOM, Oceanic
Traffic Control	1	Lot	$ 25,000	$25,000	
Subtotal UG Utility Infrastructure				$590,000	

Attachment 3

All Underground Cost Estimate

KUAKINI HIGHWAY IMPROVEMENTS
Hualalai Road to Alii Highway
PROJECT ELECTRICAL COSTS
ALL UNDERGROUND OPTION

HELCO POWER SYSTEM		
Underground Transmission System	$	1,239,700
Underground Distribution System		1,408,200
Underground Crossings / Services		337,500
Subtotal for Installation of New System	$	2,985,400
Removal of Existing System	$	180,000
Total HELCO Project Cost	**$**	**3,165,400**

HTCOM TELEPHONE SYSTEM		
Underground Telephone System	$	1,790,000
Underground Crossings / Services	$	260,500
Subtotal for Installation of New System	$	2,050,500
Removal of Existing System	$	60,000
Total HTCOM Project Cost	**$**	**2,110,500**

OCEANIC CATV SYSTEM		
Underground CATV System	$	375,400
Underground Crossings / Services	$	110,200
Subtotal for Installation of New System	$	485,600
Removal of Existing System	$	15,000
Total OCEANIC Project Cost	**$**	**500,600**

COUNTY SYSTEM		
Street Lighting System	$	1,379,800
UG Utility Infrastructure	$	3,430,000
Subtotal for Installation of New System	$	4,809,800
Removal of Existing System	$	6,000
Total COUNTY Project Cost	**$**	**4,815,800**

TOTAL CONSTRUCTION COST		
HELCO System	$	3,165,400
HTCOM System	$	2,110,500
OCEANIC System	$	500,600
COUNTY System	$	4,815,800
Total Project Construction Cost	**$**	**10,592,300**

KUAKINI HIGHWAY IMPROVEMENTS
HELCO ELECTRICAL COSTS

Estimate for 69KV Single-Circuit Underground Transmission Line					
Item	Quantity	Units	Cost/Unit	Total Cost	Comments
Engineering	1	Lot	$ 100,000	$100,000	Both Consulting Engineering and HELCO internal engineering
Project Management	1	Lot	$ 25,000	$25,000	Both Consulting Engineering and HELCO internal engineering
PUC Approval	1	Lot	$ 30,000	$30,000	Preparation of application and follow-up
Permits	1	Lot	$ 20,000	$20,000	County, etc.
Foundation (69KV Deadend Pole)	2	Ea.	$ 15,000	$30,000	10 feet deep, 4' diameter, concrete with anchor bolts
69KV Deadend Pole/Anchors	2	Ea.	$ 20,000	$40,000	80' guyed deadend
Poles (Labor)	2	Ea.	$ 15,000	$30,000	Prep, paint, erect
Wire (Materials)	1,000	Ft.	$ 1.20	$1,200	556 AAC
Shield Wire (Materials)	1,000	Ft.	$ 0.50	$500	#3/0 AAAC
Wire (Labor)	320	Hrs.	$ 100	$32,000	Crew of 8 @ 40 hours
Other Materials	1	Lot	$ 6,000	$6,000	Insulators, nuts, bolts, etc.
Cable (Materials)	17,000	Ft.	$ 30	$510,000	1500 kcmil AL, 69KV, XLPE
Pull Cable (Labor)	960	Hrs.	$ 100	$96,000	Crew of 8 @ 120 hours
3-Ph Cable Splices	6	Ea.	$ 10,000	$60,000	Modular
3-Ph Cable Terminations	2	Ea.	$ 12,000	$24,000	
Equipment Mobilization	1	Lot	$ 100,000	$100,000	
Equipment Rental	1	Lot	$ 50,000	$50,000	
Labor Mobilization	1	Lot	$ 10,000	$10,000	
Site Preparation	1	Lot	$ 50,000	$50,000	
Traffic Control	1	Lot	$ 25,000	$25,000	
Subtotal Transmission System				$1,239,700	

Estimate for 12KV Underground Main Distribution Line					
Item	Quantity	Units	Cost/Unit	Extended	Comments
Engineering	1	Lot	$ 25,000	$25,000	Both Consulting Engineering and HELCO internal engineering
Foundation (12KV Deadend Pole)	2	Ea.	$ 8,000	$16,000	6 feet deep, 3' diameter, concrete w/ anchor bolts
12KV Deadend Pole (Materials)	2	Ea.	$ 10,000	$20,000	80' with anchor bolt base plate
Poles (Labor)	2	Ea.	$ 15,000	$30,000	Prep, paint, erect
Wire (Materials)	1,000	Ft.	$ 0.80	$800	336 AAC plus neutral
Wire (Labor)	64	Hrs.	$ 100	$6,400	Crew of 4 @ 16 hours
Other Materials (Materials)	1	Lot	$ 2,000	$2,000	Insulators, nuts, bolts, fuses, etc.
Cable (Materials)	17,000	Ft.	$ 20	$340,000	1000 kcmil AL, 12KV, XLPE
Pull Cable (Labor)	960	Hrs.	$ 100	$96,000	Crew of 8 @ 120 hours
3-Ph Cable Splices	6	Ea.	$ 6,000	$36,000	Modular
3-Ph Cable Terminations	2	Ea.	$ 8,000	$16,000	
Equipment Mobilization	1	Lot	$ 100,000	$100,000	
Equipment Rental	1	Lot	$ 50,000	$50,000	
Labor Mobilization	1	Lot	$ 10,000	$10,000	
Padmounted Switchgear	1	Ea.	$ 150,000	$150,000	
1-Ph Padmtd Transformers	10	Ea.	$ 30,000	$300,000	
3-Ph Padmtd Transformer	3	Ea.	$ 50,000	$150,000	
3-Ph Riser	3	Ea.	$ 20,000	$60,000	
Subtotal Distribution System				$1,408,200	

KUAKINI HIGHWAY IMPROVEMENTS
HELCO ELECTRICAL COSTS

Estimate for 12KV Underground Crossings / Services					
Item	Quantity	Units	Cost/Unit	Extended	Comments
Engineering	1	Lot	$ 25,000	$25,000	Both Consulting Engineering and HELCO internal engineering
Cable (Materials)	1,300	Ft.	$ 40	$52,000	
Cable (Labor)	1,300	Ft.	$ 25	$32,500	
Cable Splices	16	Ea.	$ 3,000	$48,000	
Service conversions	30	Ea.	$ 6,000	$180,000	
Subtotal UG Distribution System				$337,500	

KUAKINI HIGHWAY IMPROVEMENTS
HAWAIIAN TELCOM ELECTRICAL COSTS

Estimate for Hawaiian TelCom Main Underground Line					
Item	Quantity	Units	Cost/Unit	Total Cost	Comments
Engineering	1	Lot	$ 25,000	$25,000	HTCOM internal engineering
PUC Approval	1	Lot	$ 30,000	$30,000	Preparation of application and follow-up
Permits	1	Lot	$ 20,000	$20,000	County, Utility Agreement, etc.
Cable (Materials)	5,700	Ft.	$ 200.00	$1,140,000	Telephone cables
Cable (Labor)	4,000	Hrs.	$ 100	$400,000	Crew of 4 @ 1000 hours
Other Materials	1	Lot	$ 100,000	$100,000	Splices, terminal blocks
Equipment Rental	1	Lot	$ 20,000	$20,000	
Labor Mobilization	1	Lot	$ 10,000	$10,000	
Site Preparation	1	Lot	$ 20,000	$20,000	
Traffic Control	1	Lot	$ 25,000	$25,000	
Subtotal OH Telephone System				$1,790,000	

Estimate for Telephone Underground Crossings / Services					
Item	Quantity	Units	Cost/Unit	Extended	Comments
Engineering	1	Lot	$ 25,000	$25,000	HTCOM internal engineering
Cable (Materials)	1,300	Ft.	$ 25	$32,500	
Cable (Labor)	1,300	Ft.	$ 50	$65,000	
Cable Splices	16	Ea.	$ 3,000	$48,000	
Service conversions	30	Ea.	$ 3,000	$90,000	
Subtotal UG Telephone System				$260,500	

KUAKINI HIGHWAY IMPROVEMENTS
TIME WARNER OCEANIC ELECTRICAL COSTS

Estimate for Oceanic Cable Main Underground Line					
Item	Quantity	Units	Cost/Unit	Total Cost	Comments
Engineering	1	Lot	$ 25,000	$25,000	Oceanic internal engineering
Permits	1	Lot	$ 10,000	$10,000	County, Utility Agreement, etc.
Cable (Materials)	5,700	Ft.	$ 30.00	$171,000	CATV cable
Cable (Labor)	1,000	Hrs.	$ 100	$100,000	Crew of 2 @ 500 hours
Other Materials	1	Lot	$ 14,400	$14,400	Splices, enclosures, etc.
Equipment Rental	1	Lot	$ 20,000	$20,000	
Labor Mobilization	1	Lot	$ 10,000	$10,000	
Traffic Control	1	Lot	$ 25,000	$25,000	
Subtotal OH CATV System				$375,400	

Estimate for CATV Underground Crossings / Services					
Item	Quantity	Units	Cost/Unit	Extended	Comments
Engineering	1	Lot	$ 25,000	$25,000	Oceanic internal engineering
Cable (Materials)	1,300	Ft.	$ 15	$19,500	
Cable (Labor)	1,300	Ft.	$ 25	$32,500	
Cable Splices	16	Ea.	$ 200	$3,200	
Service conversions	30	Ea.	$ 1,000	$30,000	
Subtotal UG CATV System				$110,200	

KUAKINI HIGHWAY IMPROVEMENTS
COUNTY OF HAWAII ELECTRICAL COSTS

Estimate for County Street Lighting System

Item	Quantity	Units	Cost/Unit	Total Cost	Comments
Engineering	1	Lot	$ 50,000	$50,000	Both Consulting Engineering and County internal engineering
Foundation	72	Ea.	$ 1,500	$108,000	Concrete footing, anchor bolts, grounding
35' Lighting Standard	72	Ea.	$ 9,000	$648,000	Single bracket luminaire, 15' arm
Conduit, 2" PVC80, direct buried	9,200	Ft.	$ 35.00	$322,000	PVC 80
Pullbox, 2'x4'	36	Ea.	$ 2,000	$72,000	
Conductors, street light	9,200	Ft.	$ 12.00	$110,400	
Other Materials	1	Lot	$ 14,400	$14,400	
Equipment Rental	1	Lot	$ 20,000	$20,000	
Labor Mobilization	1	Lot	$ 10,000	$10,000	
Traffic Control	1	Lot	$ 25,000	$25,000	
Subtotal Street Lighting System				$1,379,800	

Estimate for Underground Utility Infrastructure

Item	Quantity	Units	Cost/Unit	Extended	Comments
Engineering	1	Lot	$ 100,000	$100,000	Both Consulting Engineering and County internal engineering
Ductline, 69KV	5,600	Ft.	$ 150.00	$840,000	4-5", concrete encased, thermal backfill
Ductline, distribution main	5,600	Ft.	$ 250.00	$1,400,000	2-6", 4-4", 2-3" concrete encased
Ductline, crossings	1,300	Ft.	$ 150.00	$195,000	4-4", 2-3" concrete encased
Ductline, service conversions	3,000	Ft.	$ 100.00	$300,000	30 customers
Manhole, 6'x14'	5	Ea.	$ 25,000	$125,000	69KV
Handhole Group	21	Ea.	$ 20,000	$420,000	HELCO, HTCOM, Oceanic
Traffic Control	1	Lot	$ 50,000	$50,000	
Subtotal UG Utility Infrastructure				$3,430,000	

APPENDIX D CORRIDOR TRANSPORTATION STUDY

CORRIDOR TRANSPORTATION STUDY

KUAKINI HIGHWAY WIDENING – HUALALAI ROAD TO ALII HIGHWAY

KONA, HAWAII

January 2007

PARSONS BRINCKERHOFF

Over a Century of Engineering Excellence

CORRIDOR TRANSPORTATION STUDY

KUAKINI HIGHWAY WIDENING – HUALALAI ROAD TO ALII HIGHWAY

Kona, Hawaii

January 2007

Prepared For:

Hawaii County Department of Public Works
101 Pauahi Street, #7
Hilo, Hawaii 96720-4224

Prepared By:

Parsons Brinckerhoff Quade & Douglas, Inc.
American Savings Bank Tower - Suite 2400
1001 Bishop Street
Honolulu, HI 96813
(808) 531-7094

PBQD Reference Number:
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I. INTRODUCTION

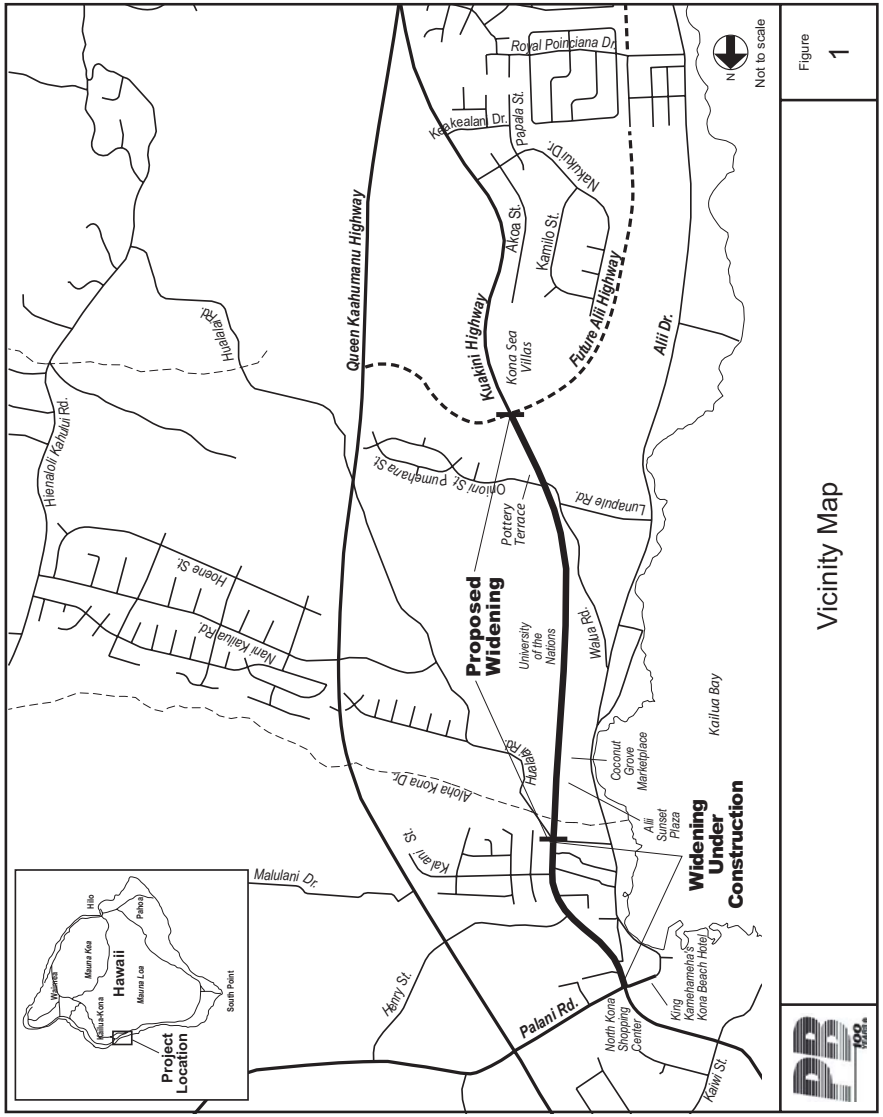
Recently, the Hawaii County Department of Public Works (DPW) completed its widening of Kuakini Highway between Palani Road and Hualalai Road. Hawaii County DPW is proposing to continue widening Kuakini Highway from Hualalai Road to the future Alii Highway as shown in figure 1. The future Alii Highway is planned to intersect Kuakini Highway near the Waiaha Stream gulch about 1.5 miles south of Hualalai Road. Proposed improvements would transform Kuakini Highway south of Hualalai Road from a 2-lane roadway to a 4-lane roadway.

This report documents the assumptions and methodology used and summarizes the findings and recommendations of a corridor transportation study for the proposed Kuakini Highway widening. Existing and projected Year 2020 traffic conditions along Kuakini Highway were evaluated. The transportation study area along Kuakini Highway is defined by Hualalai Road on the northern terminus and Queen Kaahumanu Highway Extension at the southern terminus.

A. Background

Proposed roadway improvements will widen Kuakini Highway from a 2-lane rural roadway to a four-lane roadway with curb and gutter, roadside drainage features, pedestrian and bicycle facilities, and turning lanes where warranted. Projections of future travel demand will be consistent with the Hawaii Long Range Land Transportation Plan, May 1998.

In addition to widening Kuakini Highway, Hawaii County has expressed interest in widening Queen Kaahumanu Highway from two to four lanes from Henry Street to Alii Highway, thereafter remaining a two-lane facility. The four-lane Queen Kaahumanu Highway would split into the proposed two-lane Alii Highway and the remainder of the two-lane Queen Kaahumanu Highway Extension. The proposed four-lane Kuakini Highway would split at Waiaha Gulch into the two-lane Alii Highway and existing Kuakini Highway. The future Alii Highway is planned to connect with Alii Drive in Keauhou. This potential network will help to increase north-south mobility in this region.



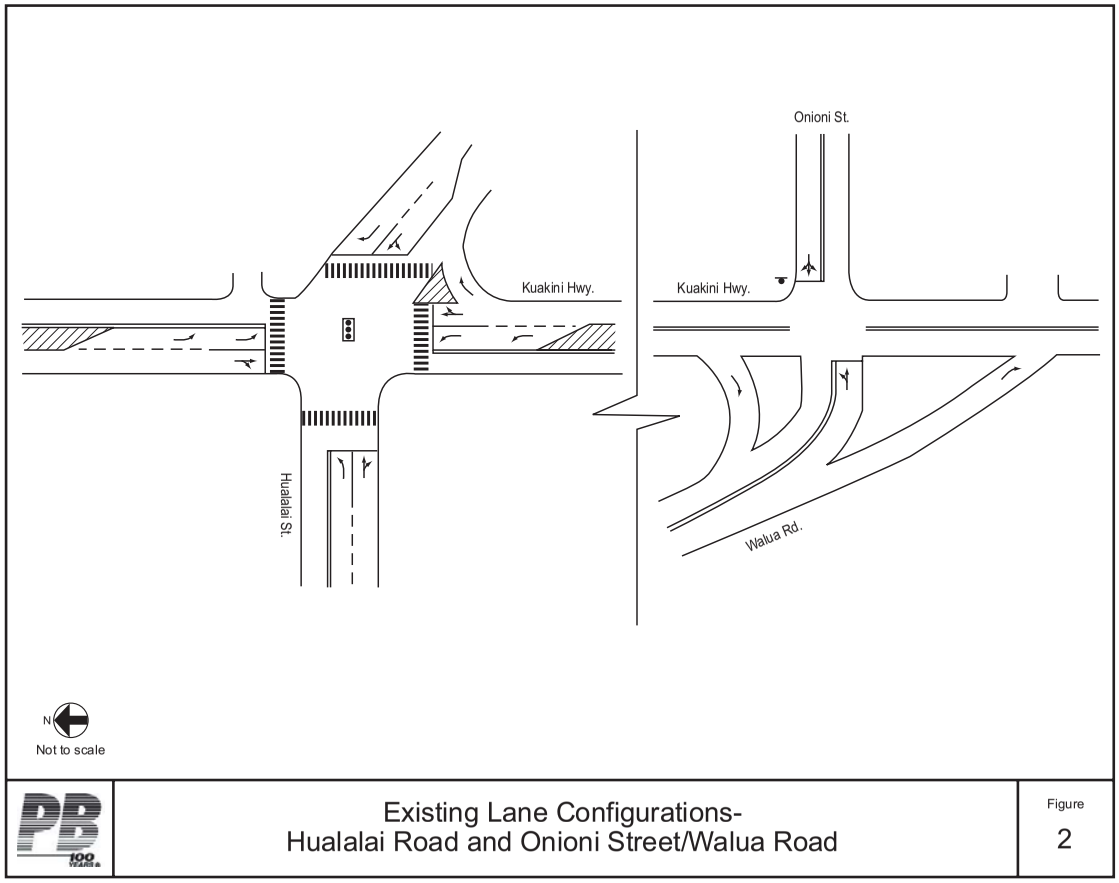
II. EXISTING CONDITIONS

A. Existing Land Use

Uses in the Kailua-Kona area south of Hualalai Road include a mix of business, hotel, and residential uses. In addition to commercial properties with individual businesses, there are several shopping centers within the study corridor. Examples are the Coconut Grove Marketplace and Alii Sunset Plaza. University of Nations is located about half a mile south of Hualalai Road. Multi-family residential and hotel development occur primarily along the segment of Kuakini Highway between Hualalai Road and Walua Road. Further south, land use is primarily small-scale commercial with single-family residential uses.

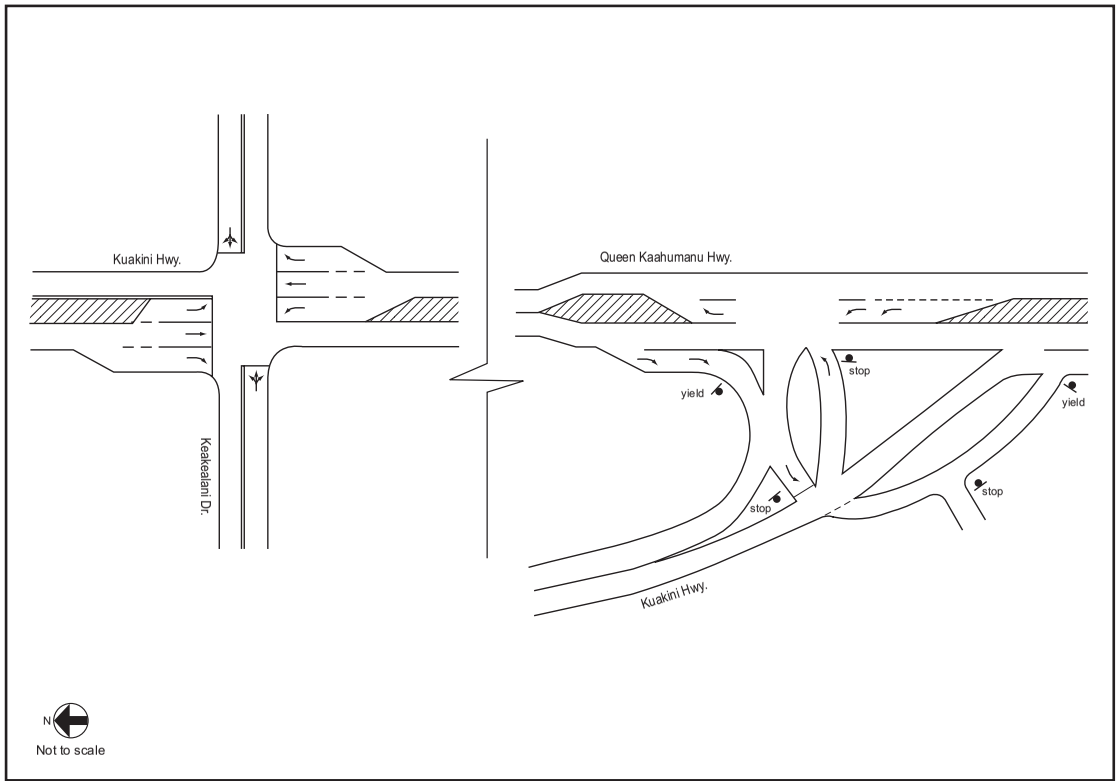
B. Existing Roadway Network

Within the study area, Queen Kaahumanu Highway/Kuakini Highway and Alii Drive provide regional north-south mobility. Walua Road and Hualalai Road provide mauka-makai circulation. Intersections along Kuakini Highway within the study area occur at Hualalai Road, Oni Oni Street/Walua Road, Keakealani Drive, and Queen Kaahumanu Highway Extension. Figures 2 and 3 show the existing lane configurations at these cross streets. Intersections within the study area operate with Two-Way-Stop-Control (TWSC) except for Hualalai Road/Kuakini Highway which is a signalized intersection.



Existing Lane Configurations-
Hualalai Road and Onioni Street/Walua Road

Figure
2



Existing Lane Configurations-
Keakealani Drive and Queen Kaahumanu Highway

Figure
3

1. Kuakini Highway

Kuakini Highway is an undivided two-lane arterial roadway which extends from Kailua-Kona to Honalo. The segment from Makala Street to Queen Kaahumanu Highway Extension is under County of Hawaii jurisdiction. The segment from Queen Kaahumanu Highway Extension to Honalo is under State of Hawaii jurisdiction. The proposed widening segment is completely contained within the County of Hawaii jurisdiction. Within the study area Kuakini Highway has limited pedestrian or bicycle facilities and curb and gutter. Cross streets within the study area occur at Hualalai Road, Walua Road/Oni Oni Street, Nakukui Drive, Keakealani Drive, and Queen Kaahumanu Highway Extension. Currently, the Hualalai Road/Kuakini Highway intersection is the only signalized intersection. Speed limits along Kuakini Highway start at 25 miles per hour (MPH) in Kailua town, transitions to 35 MPH at the Kona Islander Inn south of Hualalai Road and finally to 45 MPH immediately south of the Oni Oni Street/Walua Road intersection.

2. Queen Kaahumanu Highway

Queen Kaahumanu Highway is an undivided two-lane arterial roadway which extends from Kawaihae to immediately south of Kailua-Kona where it transitions into Kuakini Highway. State DOT plans to widen a 7.5-mile stretch of Queen Kaahumanu Highway from Kailua-Kona town to Kona Airport. The project will create two traffic lanes in each direction and a median. Currently, DOT is in the first phase of this project, widening a 2.5-mile section of the highway from Henry Street to Kealakehe Parkway. This phase is scheduled for completion in Spring 2007.

3. Alii Highway

The future Alii Highway would provide north-south mobility between Kailua-Kona and South Kona. Alii Highway is planned to begin at Queen Kaahumanu Highway, cross Kuakini Highway near Waiaha Stream, about 1.5 miles south of Kailua-Kona, connect to Alii Drive in Keauhou, and eventually continue south to Captain Cook via the Mamalahoa Bypass through the Hokulia development.

4. Alii Drive

Alii Drive is a two-lane collector roadway that begins at Kuakini Highway in Kailua-Kona and continues south to Keauhou traveling along the coastline. Alii Drive provides north-south circulation as well as access to many resort businesses and lodging. Major cross streets include Hualalai Road, Kahakai Road, Walua Road, Lunapule Road, and Royal Poinciana Drive.

5. Hualalai Road

Hualalai Road is an undivided two-lane roadway which provides mauka-makai circulation between Mamalahoa Highway and Alii Drive, intersecting Alii Drive at an unsignalized T-intersection. The signalized intersection of Hualalai Road and Kuakini Highway is the northern terminus of the Kuakini widening project.

6. Oni Oni Street/ Walua Road

Oni Oni Street provides access to residential areas located mauka of Kuakini Highway. Walua Road is located makai of Kuakini Highway opposite Oni Oni Street. It provides mauka-makai circulation between Kuakini Highway and Alii Drive. Both of these facilities have 20-foot pavement width with paved shoulders.

7. Keakealani Drive

Keakealani Drive provides access to a residential community makai of Kuakini Highway and a commercial center mauka of Kuakini Highway. The residential portion of Keakealani Drive ends at Papala Street and has sidewalks, curbs and gutters.

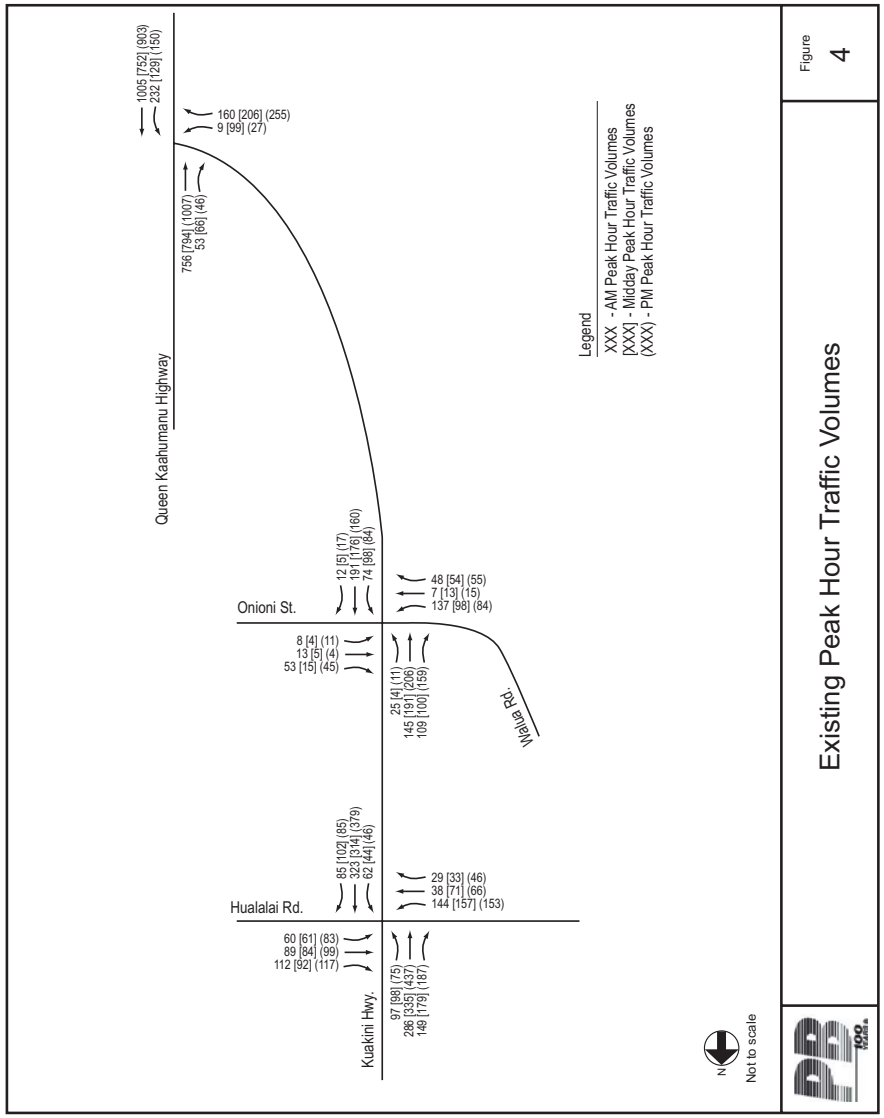
C. Existing Traffic Volumes

Manual traffic counts during the AM, midday, and PM peak periods were conducted by PB employees at the following intersections on Tuesday, August 9, 2005 and Wednesday August 10, 2005 respectively:

- Hualalai Road and Kuakini Highway
- Oni Oni Street/Walua Drive and Kuakini Highway
- Keakealani Drive and Kuakini Highway
- Queen Kaahumanu Highway Extension and Kuakini Highway

Automatic Traffic Recorders (ATRs) were set along Kuakini Highway at two locations: immediately south of Coconut Grove Marketplace and south of Oni Oni Street/Walua Road. These volumes were used to supplement manual turning movement counts.

The peak hour interval chosen for analysis was most consistent with Hualalai Road intersection. The AM, midday, and PM peaks were found to occur from 7:30 to 8:30 AM, 11:30-12:30 PM, and 4:30 to 5:30 PM, respectively. Peak hour volumes at the previously listed intersections can be found in Appendix A. Figure 4 shows the existing peak hour traffic volumes for the AM, midday, and PM peak periods, respectively.



D. Existing Intersection Operations

Intersections along Kuakini Highway were analyzed using the methodologies for unsignalized and signalized intersections documented in the *2000 Highway Capacity Manual (HCM).* An intersection's operating conditions can be broken down by approach and expressed as a qualitative measure known as Level-of-Service (LOS) ranging from A to F. LOS A denotes uncongested conditions with low delay; conversely, LOS F conditions would be congested with a comparatively higher delay. An intersection's overall LOS is determined by taking a weighted average of the LOS of individual traffic movement groups. Field observations were performed at selected intersections to verify the results of the intersection analysis. Appendix B has more detailed definitions of intersection LOS and intersection capacity analysis worksheets. Table 1 summarizes existing condition LOS and delays for the intersections studied along Kuakini Highway. For detailed analysis information, refer to Appendix C for intersection capacity analysis worksheets.

1. Hualalai Road

Construction to widen Kuakini Highway between Palani Road and Hualalai Road was taking place during the data collection. Volumes were compared against HDOT counts at station 8-K and were determined to be representative of existing traffic conditions along Kuakini Highway.

Overall, this intersection operated at LOS C or better in all peak hours analyzed. There was some congestion observed along Kuakini Highway in the vicinity of Hualalai Road. In the morning, the peak direction was northbound, while the southbound direction peaked during the evening. Traffic during the midday peak period tended to be slightly southbound oriented.

Table 1 Existing Intersection LOS and Delay

Intersection	AM Peak		Midday Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay
Hualalai Rd/ Kuakini Hwy	**C**	**21.2**	**C**	**20.7**	**B**	**19.9**
Kuakini EB Left	B	18.3	B	17.5	B	18.6
Kuakini EB Through/Right	B	16.1	B	15.9	B	16.7
Kuakini WB Left	C	26.7	C	27.8	C	33.3
Kuakini WB Through/Right	C	34.4	C	33.4	C	26.9
Kuakini NB Left	B	10.5	B	11.2	B	11.7
Kuakini NB Through/Right	C	20.2	B	19.4	B	16.7
Kuakini SB Left	B	10.4	B	11.0	B	10.3
Kuakini SB Through	C	21.7	C	22.2	C	21.2
Kuakini SB Right	B	19.7	B	19.4	B	16.5
Oni Oni St/Walua Rd/Kuakini Hwy	**Unsignalized**					
Walua EB Left/Through	C	25.0	C	20.8	C	20.6
Walua EB Right	A	9.3	A	9.7	A	9.8
Oni Oni WB Left/Through	C	15.6	C	16.1	C	17.4
Oni Oni WB Right	A	9.7	A	9.3	A	9.4
Kuakini NB Left/Through/Right	A	7.7	A	7.9	A	7.9
Kuakini SB Left/Through/Right	A	7.7	A	7.6	A	7.6
Queen Kaahumanu Hwy/Kuakini Hwy	**Unsignalized**					
Kuakini EB Left	C	17.5	C	18.5	C	18.4
Queen Kaahumanu NB Left	B	11.6	B	10.7	B	12.7

Delay in vehicles per hour.

2. Walua Road/Oni Oni Street

This unsignalized intersection operated acceptably during the evaluated peak hours. Key movements were the eastbound and westbound left-turns onto Kuakini Highway from Walua Road and from Oni Oni Street. These movements operated at LOS C throughout the day. The eastbound left-turn out of Walua Road was the heaviest minor street movement. Queuing of about 4-5 vehicles at most were observed during peak conditions. However, most of the time vehicles were able to make the turn easily because of the gaps between vehicle platoons.

3. Queen Kaahumanu Highway Extension

The eastbound left-turn movement at the intersection of Queen Kaahumanu Highway and Kuakini Highway operated at an acceptable LOS C during all evaluated peak hours. Field observations indicated that this eastbound left turn movement had a queue of at most 4-5 vehicles which occurred during the Midday peak hour. Currently, the left turn movement is accomplished in two steps. First, a vehicle crosses the southbound lane and then stops in the median storage area. Second, the vehicle merges into the northbound traffic flow. These steps reduce the actual delay because the vehicle does not have to wait for acceptable gap in both northbound and southbound traffic flows. Gaps in the northbound traffic flow along Queen Kaahumanu Highway Extension created by the adjacent traffic signal at Lako Street helped to facilitate this movement.

Queen Kaahumanu northbound left-turns operated well at LOS B for all evaluated peak hours.

Kuakini eastbound right-turns were not included in the intersection analyses since it does not directly interact with the rest of the intersection movements.

III. FUTURE CONDITIONS

The two build alternatives being considered in this study have similar alignments and roadway cross-sections. Both alternatives would widen Kuakini Highway to four lanes between Hualalai Road and the future Alii Highway. Therefore, the traffic operations for both build alternatives would be functionally the same and were analyzed as the "widened" scenario. This "widened" scenario was compared to a future "un-widened" scenario that represented the No Build alternative.

A. Future Roadway Network

There are several initiatives being pursued by the County of Hawaii DPW and the State of Hawaii Department of Transportation (HDOT) to improve the roadway network in the west Hawaii area. The proposed widening of Kuakini Highway between Hualalai Road and the future Alii Highway is one of those initiatives. Other major initiatives that have been recently completed or are planned are:

- widening of Kuakini Highway between Palani Road and Hualalai Road;
- extension of Lako Street to connect to Alii Drive;
- widening of Queen Kaahumanu Highway between Palani Road and landfill road;
- widening of Queen Kaahumanu Highway between landfill road and Kona Airport Road;
- extension of mid-level road (Keohokalole Highway) to Palani Road;
- extension of Nani Kailua Road to Alii Drive;
- extension of Hienalole Street to Palani Road;
- future Alii Highway between Keauhou Shopping Center and Queen Kaahumanu Highway extension.

In this context, the proposed widening of Kuakini Highway between Hualalai Road and Alii Highway is consistent with the future roadway network. It is a logical extension of the recently completed widening of Kuakini Highway between Palani Road and Hualalai Road and has a logical terminus at the future Alii Highway. It would also facilitate the extension of Nani Kailua Road by providing the added width for appropriate channelization where Nani Kailua Road would cross Kuakini Highway.

B. Year 2020 Traffic Volumes

The 2020 travel demand model for the Hawaii Long Range Land Transportation Plan was used as a basis for estimates of future AM and PM traffic volumes within the study area. Peak hour volumes at the intersections within the study corridor were estimated in a manner consistent with the regional forecast of traffic volume. Added to these volumes was traffic generated by future development along the corridor. Traffic generated from these developments was distributed and assigned into the network based on Year 2020 employment and residential land use data. Year 2020 peak hour traffic volumes are shown in Figure 5.

C. Year 2020 Traffic Operations

Kuakini Highway alternatives without and with the proposed widening were evaluated for Year 2020 traffic conditions using methodologies documented in the 2000 Highway Capacity Manual. Intersection level of service (LOS) and delay resulting from these analyses are summarized in Table 2.

Kuakini Highway between the future Alii Highway and the Queen Kaahumanu Highway Extension was assumed to remain as a two-lane roadway in both widened and un-widened scenarios. The future Alii Highway is expected to accommodate a significant share of the traffic traveling on Kuakini Highway within Kailua Village that is destined for the South Kona areas. Results of analyses of the segment of Kuakini Highway located between the future Alii Highway and Queen Kaahumanu Highway Extension are summarized in Table 3.

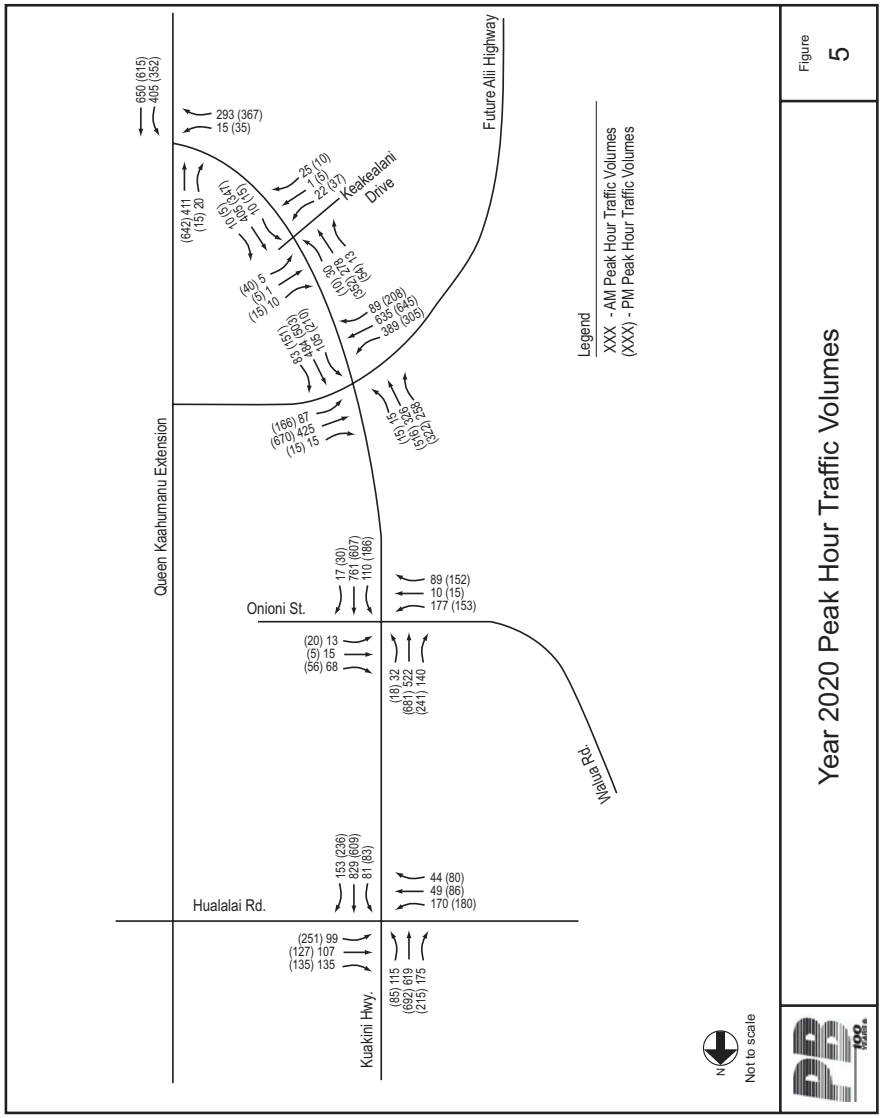


Table 2 Year 2020 Intersection LOS and Delay (North of Alii Highway)

Intersection	Without Widening				With Widening			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Hualalai Rd/ Kuakini Hwy	**C**	**35.0**	**D**	**51.7**	**C**	**31.0**	**C**	**34.0**
Hualalai EB Left	C	34.4	D	37.0	C	34.4	D	37.0
Hualalai EB Through/Right	C	34.4	C	33.0	C	34.4	C	33.0
Hualalai WB Left	C	24.4	D	38.6	C	24.4	D	38.6
Hualalai WB Through/Right	D	48.2	D	39.4	D	48.2	D	39.4
Kuakini NB Left	D	42.0	D	41.0	D	42.0	D	41.0
Kuakini NB Through/Right	C	28.8	C	30.7	C	28.8	C	30.7
Kuakini SB Left	D	45.9	D	41.0	D	45.9	D	41.0
Kuakini SB Through	D	42.6	F	105.9	C	25.0	C	32.7
Kuakini SB Right	C	20.7	C	24.5	C	25.0	C	32.7
Oni-Oni St/ Walua Rd/ Kuakini Hwy	**E**	**60.8**	**F**	**120.6**	**C**	**24.8**	**C**	**30.8**
Walua EB Left/Through	C	33.0	C	24.6	C	33.0	C	24.6
Walua EB Right	B	13.4	C	23.9	B	13.4	C	23.9
Oni-Oni WB Left/Through	D	45.9	D	36.3	D	45.9	D	36.3
Oni-Oni WB Right	C	25.1	D	37.2	C	25.1	D	37.2
Kuakini NB Left	D	35.8	D	38.4	D	35.8	D	38.4
Kuakini NB Through/Right	F	109.0	F	161.3	C	24.4	C	28.6
Kuakini SB Left	C	33.6	C	32.4	C	33.6	C	32.4
Kuakini SB Through	C	30.5	F	194.5	C	21.6	C	33.0
Kuakini SB Right	C	20.1	C	30.7	C	20.1	C	30.7
Alii Hwy/ Kuakini Hwy	**F**	**176.1**	**F**	**199.7**	**D**	**40.2**	**D**	**49.6**
Alii EB Left	F	282.1	F	265.1	D	46.7	D	48.4
Alii EB Through	F	436.1	F	408.0	E	67.0	E	59.0
Alii EB Right	B	19.9	B	19.9	B	19.9	B	19.9
Alii WB Left	D	38.0	E	57.9	D	38.0	E	57.9
Alii WB Through	F	169.4	F	438.1	D	38.9	E	66.7
Alii WB Right	B	18.8	B	17.0	B	18.8	B	17.0
Kuakini NB Left	D	40.9	E	55.9	D	40.9	E	55.9
Kuakini NB Through	E	58.7	E	67.4	C	29.1	C	29.4
Kuakini NB Right	B	12.8	B	15.2	B	12.8	B	15.2
Kuakini SB Left	D	37.4	D	35.7	D	37.4	D	35.7
Kuakini SB Through	C	32.6	E	74.0	C	32.5	E	74.0
Kuakini SB Right	B	14.9	B	17.8	B	14.9	B	17.8

Delays in vehicles per hour.

Table 3 Year 2020 Intersection LOS and Delay (South of Alii Highway)

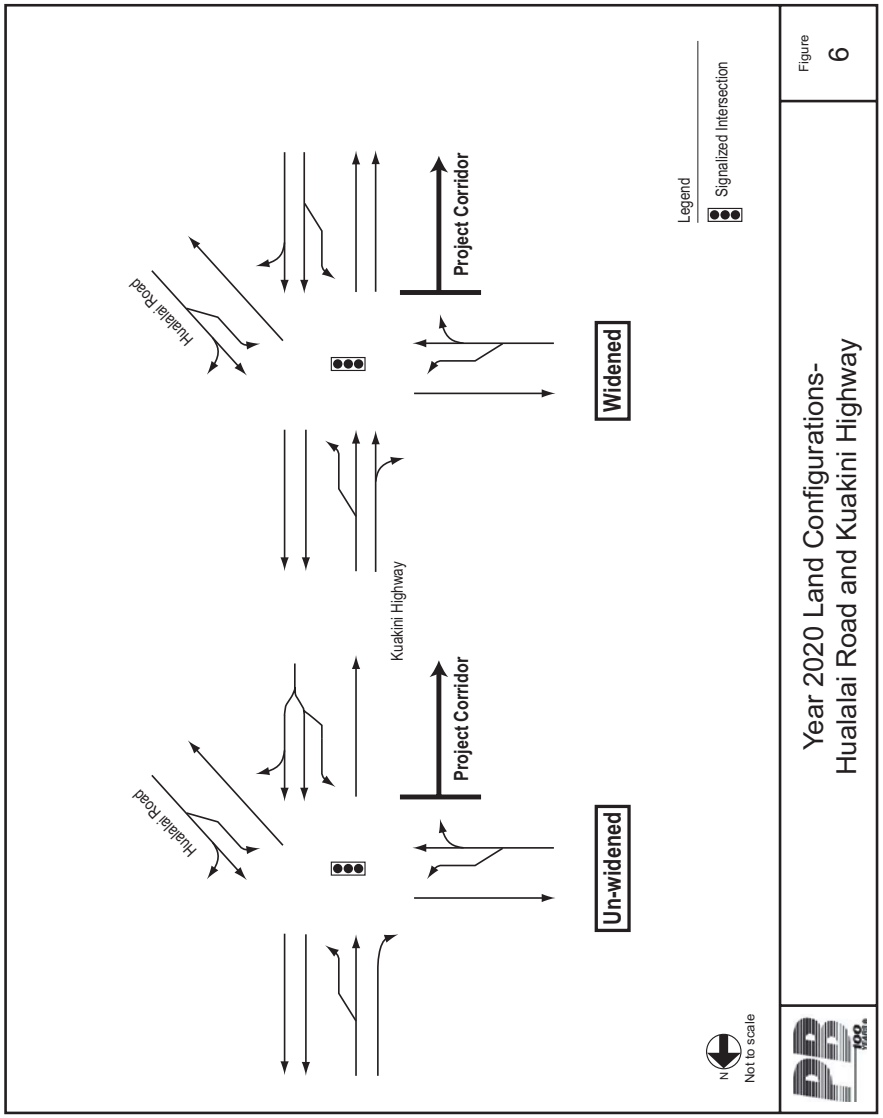
Intersection	AM Peak		PM Peak	
	LOS	Delay	LOS	Delay
Keakealani Dr/ Kuakini Hwy	**Unsignalized**			
Keakealani EB Left/Through/Right	C	15.4	C	19.3
Keakealani WB Left/Through/Right	B	14.0	C	19.7
Kuakini NB Left	A	7.9	A	8.3
Kuakini SB Left	A	8.3	A	8.1
Queen Kaahumanu Hwy/ Kuakini Hwy	**Unsignalized**			
Kuakini EB Left	C	18.0	C	18.9
Queen Kaahumanu NB Left	B	10.4	B	12.1

Delays in vehicles per hour.

1. Hualalai Road and Kuakini Highway

The widening of Kuakini Highway south of Hualalai Road is a logical extension of the recent widening of Kuakini Highway between Palani Road and Hualalai Road. It is recommended that the current Kuakini southbound approach configuration be modified during the widening to an exclusive left lane, one through lane, and a shared through/right lane. This configuration was better able to accommodate the forecasted southbound traffic demand on Kuakini Highway. Figure 6 illustrates the lane configuration recommendation before and after the proposed widening.

The Kuakini southbound through movement operated at LOS F under the un-widened southbound approach configuration of an exclusive left lane, one through lane, and an exclusive right lane. Adding another through lane in the southbound direction would reduce vehicular delay to LOS C. Overall, this intersection is expected to operate at LOS C or better under the widened scenario.



2. Oni Oni Street/ Walua Road and Kuakini Highway

Year 2020 traffic volumes through this intersection indicate that traffic signal warrants would be satisfied. Even with signalization, significant delay was observed in the Kuakini northbound and southbound through traffic under the un-widened scenario. Figure 7 illustrates the un-widened and widened lane configuration at this intersection. It was assumed that left-turn bays would be added on Kuakini Highway for both future scenarios. The northbound through/right movement improved with the widening, improving from LOS F to LOS C during the AM and PM peak hour time periods. The southbound through movement improved from LOS F to LOS C during the PM peak hour time period.

3. Alii Highway and Kuakini Highway

Figure 8 shows the un-widened and widened lane configurations recommended for this intersection. The most significant improvement from the widening occurs in the future Alii Highway eastbound movements. If Kuakini Highway is not widened, there can only be one left-turn lane from eastbound Alii Highway to northbound Kuakini Highway. This lane would operate at LOS F during the AM and PM peak hour time periods. With the widening, this movement can be served by double left-turn lanes, thereby improving operation to LOS D. The eastbound Alii Highway through movement would improve from LOS F to LOS D and E during the AM and PM peak hour time periods, respectively.

In the widened scenario, double eastbound left-turn lanes on the future Alii Highway were recommended to process the future demand from Alii Highway to Kuakini Highway, towards Kailua town. To facilitate channelization at the Kuakini Highway/Alii Highway intersection, future Alii Highway is recommended to be four lanes between Queen Kaahumanu Extension and the future mauka-makai road connecting Alii Highway to Alii Drive in the vicinity of the Kahakai development. South of the mauka-makai road, future Alii Highway will narrow to two lanes. Signalization is recommended at this intersection when warranted.

Figure 7

Year 2020 Lane Configurations-
Onioni Street/Walua Road and Kuakini Highway

Figure 8

Year 2020 Lane Configurations-
Alii Highway and Kuakini Highway

It is recommended to provide an additional through lane for the Kuakini northbound approach to increase the ability to accommodate the northbound traffic forecasted along Kuakini Highway, especially during the PM peak hour. This improvement would reduce the delay for the northbound through movement from LOS E to C.

4. Keakealani Drive and Kuakini Highway

With a roadway network that includes a future Alii Highway, the segment of Kuakini Highway south of future Alii Highway would remain a two-lane roadway.

Within this segment, the Keakealani Drive intersection would retain its existing configuration. For forecasted Year 2020 traffic conditions, this intersection would operate well at LOS C or better.

5. Queen Kaahumanu Highway Extension and Kuakini Highway

Again, with a roadway network that includes the future Alii Highway, this intersection would retain the same configuration as existing conditions. Future Alii Highway is projected to accommodate about fifty percent of the future traffic on Kuakini Highway north of Alii Highway, resulting in LOS C or better operation at this intersection.

D. Summary of Results

Based on the future intersection analyses, Kuakini Highway would benefit from widening to four lanes between Hualalai Road and Alii Highway. Because the Hualalai Road/Kuakini Highway intersection was already in its future configuration during existing conditions, there was not much of a difference between the un-widened and widened scenarios. However, modifying the Kuakini southbound lane configuration did improve that movement from LOS F to C during the PM peak.

The Oni Oni Street/Walua Road/Kuakini Highway intersection operated acceptably at LOS D or better under the "widened" scenario. The widening reduced delay for the Kuakini northbound and southbound through movements. Signalization and left-turn bays on Kuakini Highway were assumed for future analyses.

The future Alii Highway/Kuakini Highway intersection is expected to process heavier traffic volumes in the Alii Highway eastbound and westbound through and left movements, as well as the Kuakini southbound right-turn movement. Double eastbound left-turn lanes on Alii Highway were recommended under the widened scenario to process the heavy left-turn demand. Overall, the intersection operated at LOS E and better under the widened scenario.

The Keakealani Drive/Kuakini Highway and Queen Kaahumanu Highway Extension/Kuakini Highway intersections were assumed to remain in their existing, un-widened configurations. Future Alii Highway was assumed to accommodate approximately fifty percent of the regional north-south traffic using Kuakini Highway, and, therefore, was no need to widen the segment of Kuakini Highway south of future Alii Highway. These two intersections, although not within the project limits, were analyzed for completeness and were projected to operate acceptably at LOS C or better.

IV. Findings and Conclusions

Widening Kuakini Highway from Hualalai Road to Alii Highway will work with other planned roadway improvements in the Kailua-Kona area, to improve sub-regional and regional mobility in Kailua-Keauhou region. The widening would improve the Kailua-Kona-Keauhou roadway network, improve intersection operations within the project corridor, and accommodate future planned development along Kuakini Highway.

A. Roadway Network Improvements

The proposed widening of Kuakini Highway between Hualalai Road and the future Alii Highway is a logical extension of the current Kuakini Highway widening project between Palani Road and Hualalai Road. It will improve North-South mobility within the Kailua-Kona-Keauhou roadway network by providing better system redundancy to Queen Kaahumanu Highway and by facilitating connectivity with the future Alii Highway. The widening would also help to accommodate future modifications to the roadway network such as the proposed Nani Kailua Road Extension.

The segment of Kuakini Highway south of Alii Highway is expected to experience about fifty percent less traffic than the northern segment due to traffic being assigned to future Alii Highway. This segment would remain a two-lane facility.

B. Intersection Improvements

Key intersections along the Kuakini Highway study corridor are forecasted to be inadequate to handle the projected peak hour traffic volumes. To provide acceptable future traffic operations, the following intersection improvements are recommended in addition to the widening of Kuakini Highway:

- Provide a southbound through lane, and a through/right lane at Hualalai Road and Kuakini Highway;
- Add left-turn bays on Kuakini Highway at Oni Oni Street and Walua Road;
- Signalize Oni Oni Street/Walua Road/Kuakini Highway intersection;

- Signalize the future Alii Highway/Kuakini Highway intersection;
- Provide two through lanes on northbound Kuakini Highway approach at the future Alii Highway intersection;
- Construct future Alii Highway to four lanes between Queen Kaahumanu Extension and the mauka-makai road connecting Alii Highway and Alii Drive, located in the vicinity of the Kahakai development to facilitate proper channelization at the Kuakini Highway/ Alii Highway intersection.

C. Development Access

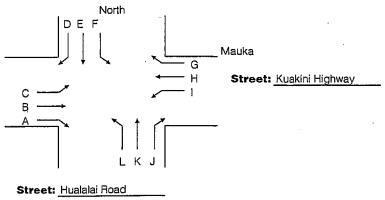
As development occurs within the Kuakini Highway study corridor, driveway access is expected to increase. Other projects are planned to help integrate project accesses but overall access will still increase. The widening of Kuakini Highway in this segment will allow through traffic to be processed while accommodating increased turning movement activity associated with the planned development.

APPENDICES

Appendix A Traffic Count Data

AM COUNT SHEET

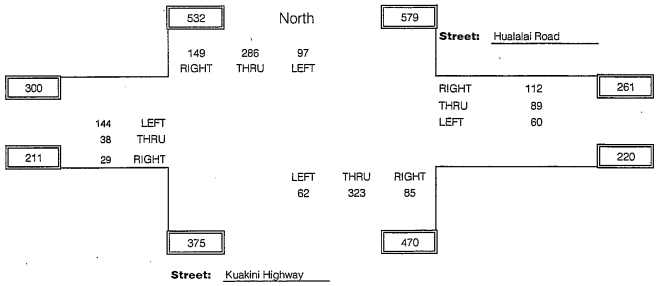
Intersection: Hualalai Rd/ Kuakini Hwy
Date: Tuesday, 8/9/05
By: W. Yoshioka
Weather: Sunny, clear



TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
7:00 AM - 7:15 AM	5	7	33	27	43	13	22	12	12	13	73	7	267	1308
7:15 AM - 7:30 AM	9	2	25	29	50	18	22	19	13	10	78	6	281	1402
7:30 AM - 7:45 AM	5	15	40	34	60	16	40	21	17	19	74	17	358	1474
7:45 AM - 8:00 AM	9	5	32	34	91	32	26	15	18	21	104	15	402	1450
8:00 AM - 8:15 AM	6	12	35	42	63	26	27	23	16	24	67	20	361	1392
8:15 AM - 8:30 AM	9	6	37	39	72	23	19	30	9	21	78	10	353	
8:30 AM - 8:45 AM	9	13	29	33	61	35	26	15	19	22	68	4	334	
8:45 AM - 9:00 AM	6	7	27	44	64	25	41	12	22	24	53	19	344	
Phf	0.806	0.633	0.900	0.887	0.786	0.758	0.700	0.742	0.833	0.885	0.776	0.775	Peak	Phf
7:30 AM - 8:30 AM	29	38	144	149	286	97	112	89	60	85	323	62	1474	0.917

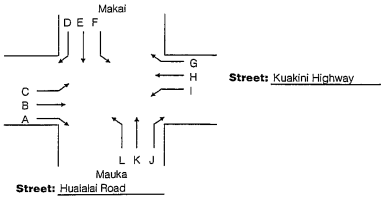
Peak Hour

7:30 AM - 8:30 AM



MIDDAY COUNT SHEET

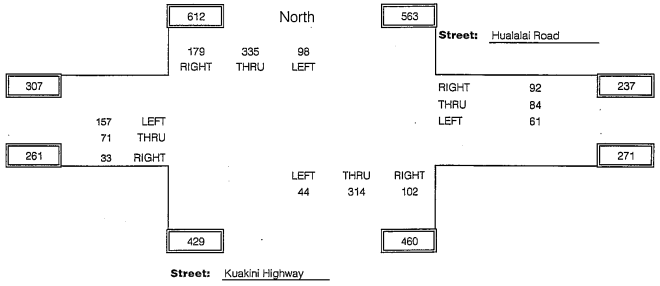
Intersection: Hualalai Rd/ Kuakini Hwy
Date: Tuesday, 8/9/2005
By: W. Yoshioka
Weather: Sunny, clear



TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
11:30 AM - 11:45 AM	6	14	39	48	79	21	25	25	14	16	84	9	380	1570
11:45 AM - 12:00 PM	10	17	35	47	91	28	23	23	15	17	76	11	393	1551
12:00 PM - 12:15 PM	9	18	36	42	93	23	24	17	20	27	89	8	406	1539
12:15 PM - 12:30 PM	8	22	47	42	72	26	20	19	12	42	65	16	391	1509
12:30 PM - 12:45 PM	13	8	38	38	72	35	22	11	22	20	74	8	361	1479
12:45 PM - 1:00 PM	6	7	32	48	101	18	17	26	16	27	77	6	381	
1:00 PM - 1:15 PM	9	18	45	46	78	27	19	21	16	20	66	11	376	
1:15 PM - 1:30 PM	5	7	36	47	85	32	12	25	18	16	72	6	361	
Phf	0.825	0.807	0.835	0.932	0.901	0.875	0.920	0.840	0.763	0.607	0.882	0.688	Peak	Phf
11:30 AM - 12:30 PM	33	71	157	179	335	98	92	84	61	102	314	44	1570	0.967

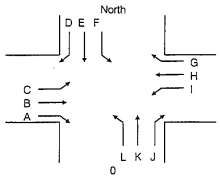
Peak Hour

11:30 AM - 12:30 PM



PM COUNT SHEET

Intersection: Hualalai Rd/ Kuakini Hwy
Date: 8/9/2005
By: W. Yoshioka
Weather: Sunny



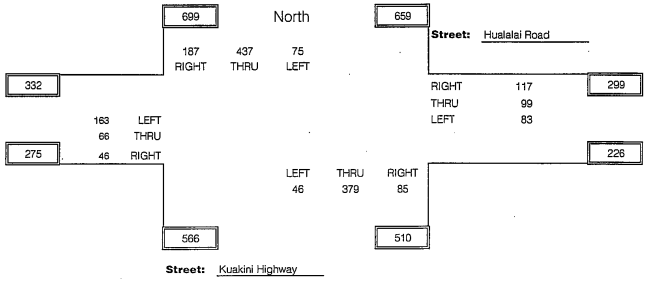
Street: Kuakini Highway

Street: Hualalai Road

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
3:00 PM - 3:15 PM	7	26	42	49	74	29	22	16	22	20	79	11	397	1636
3:15 PM - 3:30 PM	12	14	37	36	80	26	29	19	16	26	85	11	391	1643
3:30 PM - 3:45 PM	10	18	48	58	88	18	21	20	20	27	103	12	443	1647
3:45 PM - 4:00 PM	11	20	32	32	81	31	25	20	27	25	91	10	405	1641
4:00 PM - 4:15 PM	9	13	35	34	88	33	22	19	17	20	105	9	404	1658
4:15 PM - 4:30 PM	7	11	21	39	89	23	36	24	15	27	92	11	395	1734
4:30 PM - 4:45 PM	12	14	42	31	92	19	19	29	32	28	104	15	437	1783
4:45 PM - 5:00 PM	8	25	49	49	95	14	29	18	21	20	82	12	422	1747
5:00 PM - 5:15 PM	11	11	39	42	124	30	39	32	16	22	100	14	480	1710
5:15 PM - 5:30 PM	15	16	33	65	126	12	30	20	14	15	93	5	444	
5:30 PM - 5:45 PM	10	10	25	72	116	23	18	22	14	15	71	5	401	
5:45 PM - 6:00 PM	11	12	26	72	110	16	12	14	10	17	73	12	385	
Phf	0.767	0.660	0.832	0.719	0.867	0.625	0.750	0.773	0.648	0.759	0.911	0.767	Peak	Phf
4:30 PM - 5:30 PM	46	66	163	187	437	75	117	99	83	85	379	46	1783	0.929

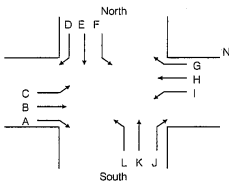
Peak Hour

4:30 PM - 5:30 PM



AM COUNT SHEET

Intersection: Onioni St/ Walua Rd/ Kuakini Hwy
Date: Tuesday, 8/9/05
By: Joy Wasal
Weather: Sunny, clear



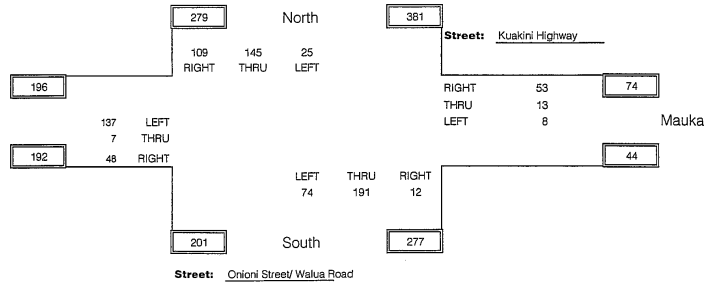
Street: Onioni Street/ Walua Road

Street: Kuakini Highway

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
7:00 AM - 7:15 AM	3	35	14	7	1	17	20	15	3	13	8	3	139	772
7:15 AM - 7:30 AM	3	49	9	3	4	20	25	45	2	10	3	5	178	831
7:30 AM - 7:45 AM	4	45	15	10	0	43	27	40	3	14	3	3	207	822
7:45 AM - 8:00 AM	2	59	20	14	3	41	35	40	10	18	4	2	248	770
8:00 AM - 8:15 AM	2	47	24	11	4	32	25	34	3	12	4	0	198	716
8:15 AM - 8:30 AM	4	40	15	13	0	21	22	31	9	9	2	3	169	
8:30 AM - 8:45 AM	3	41	14	14	2	17	17	31	4	10	0	2	155	
8:45 AM - 9:00 AM	5	48	15	14	1	28	22	43	5	8	1	4	194	
Phf	0.750	0.809	0.771	0.857	0.438	0.797	0.779	0.906	0.625	0.736	0.813	0.667	Peak	Phf
7:30 AM - 8:30 AM	12	191	74	48	7	137	109	145	25	53	13	8	822	0.829

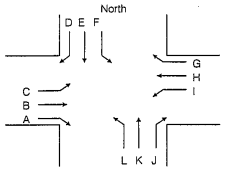
Peak Hour

7:30 AM - 8:30 AM



MIDDAY COUNT SHEET

Intersection: Onioni St/ Walua Rd/ Kuakini Hwy
Date: Tuesday, 8/9/2005
By: Joy Wasai
Weather: Sunny, clear

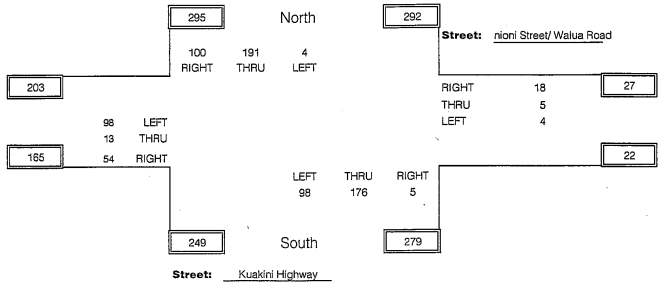


Street: Onioni Street/ Walua Road
Street: Kuakini Highway

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
11:30 AM - 11:45 AM	7	4	26	21	48	9	7	1	1	3	39	16	182	748
11:45 AM - 12:00 PM	11	3	24	28	51	8	4	2	0	2	41	14	188	754
12:00 PM - 12:15 PM	23	4	-25	25	48	8	4	2	2	0	58	15	164	762
12:15 PM - 12:30 PM	13	2	73	26	44	8	3	0	1	0	38	6	214	763
12:30 PM - 12:45 PM	21	0	19	28	51	5	6	2	2	2	36	16	188	736
12:45 PM - 1:00 PM	12	1	24	40	50	7	7	0	1	3	37	14	196	
1:00 PM - 1:15 PM	11	0	17	33	46	3	5	3	0	2	31	14	165	
1:15 PM - 1:30 PM	12	0	23	34	49	6	2	0	0	1	48	12	187	
Phf	0.587	0.813	0.336	0.893	0.936	0.917	0.643	0.625	0.500	0.417	0.759	0.797	Peak	Phf
11:30 AM - 12:30 PM	54	13	98	100	191	33	18	5	4	5	176	51	748	0.874

Peak Hour

11:30 AM - 12:30 PM

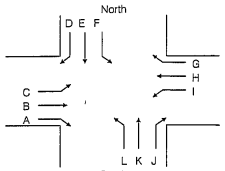


PARSONS BRINCKERHOFF

Kuakini Highway Widening
Ref. No. 16431A

PM COUNT SHEET

Intersection: Onioni St/ Walua Rd/ Kuakini Hwy
Date: 5/27/2005
By: Name
Weather: Sunny

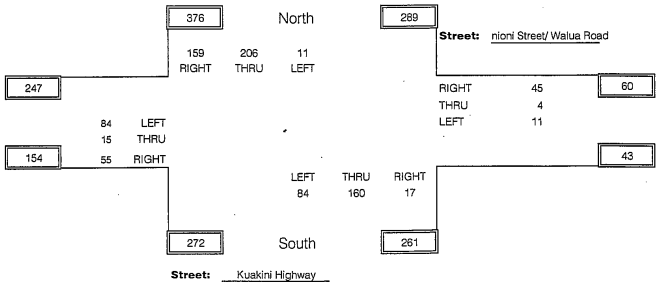


Street: Onioni Street/ Walua Road
Street: Kuakini Highway

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
3:00 PM - 3:15 PM	18	3	21	20	49	9	5	3	3	7	47	11	196	807
3:15 PM - 3:30 PM	12	6	26	30	58	6	2	4	4	1	43	9	201	814
3:30 PM - 3:45 PM	16	4	34	24	49	10	8	2	1	4	45	18	215	831
3:45 PM - 4:00 PM	14	4	25	29	43	10	4	2	3	6	45	10	195	824
4:00 PM - 4:15 PM	18	5	23	22	44	11	10	1	3	3	51	12	203	860
4:15 PM - 4:30 PM	15	3	22	36	51	13	9	0	2	2	55	10	218	876
4:30 PM - 4:45 PM	13	6	19	31	56	12	16	0	3	2	39	11	208	866
4:45 PM - 5:00 PM	15	3	21	32	61	13	10	0	2	5	47	22	231	
5:00 PM - 5:15 PM	13	1	23	41	53	14	7	2	4	7	41	13	219	
5:15 PM - 5:30 PM	14	5	21	55	36	11	12	2	2	3	33	14	208	
Phf	0.917	0.625	0.913	0.723	0.844	0.893	0.703	0.500	0.688	0.607	0.851	0.682	Peak	Phf
4:30 PM - 5:30 PM	55	15	84	159	206	50	45	4	11	17	160	60	866	0.937

Peak Hour

4:30 PM - 5:30 PM

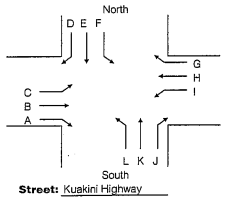


PARSONS BRINCKERHOFF

Kuakini Highway Widening
Ref. No. 16431A

AM COUNT SHEET

Intersection: Keakealani Drive/ Kuakini Hwy
Date: Wednesday, 8/10/05
By: Phillip Matsunaga
Weather: Sunny, clear

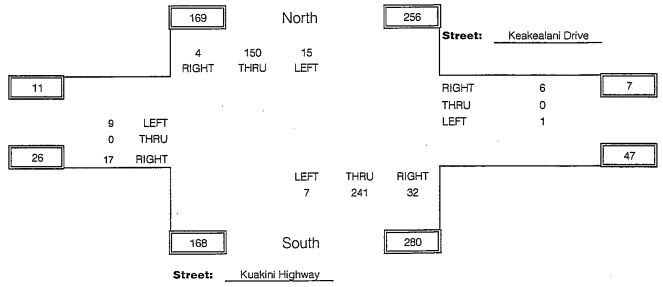


Street: Keakealani Drive
Street: Kuakini Highway

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
7:00 AM - 7:15 AM	1	0	2	0	17	1	1	0	0	0	43	0	65	450
7:15 AM - 7:30 AM	4	0	4	0	47	0	0	0	0	3	61	1	120	503
7:30 AM - 7:45 AM	5	0	4	0	46	3	1	0	0	6	62	0	127	482
7:45 AM - 8:00 AM	4	0	2	1	37	4	2	0	1	12	70	5	138	471
8:00 AM - 8:15 AM	2	0	1	3	33	3	0	0	0	9	67	0	118	468
8:15 AM - 8:30 AM	6	0	2	0	34	5	3	0	0	5	42	2	99	
8:30 AM - 8:45 AM	3	0	1	0	34	3	3	0	2	8	61	1	116	
8:45 AM - 9:00 AM	2	0	0	2	45	8	4	0	5	14	54	1	135	
Phf	0.708	#DIV/0!	0.563	0.333	0.815	0.750	0.500	#DIV/0!	0.250	0.667	0.861	0.350	Peak	Phf
7:30 AM - 8:30 AM	17	0	9	4	150	15	6	0	1	32	241	7	482	0.893

Peak Hour

7:30 AM - 8:30 AM



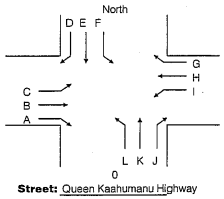
Street: Keakealani Drive
Street: Kuakini Highway

PARSONS BRINCKERHOFF

Kuakini Highway Widening
Ref. No. 16431A

AM COUNT SHEET

Intersection: Queen Kaahumanu Hwy/ Kuakini Hwy
Date: Tuesday, 8/9/05
By: C. Maruoka
Weather: Sunny, clear

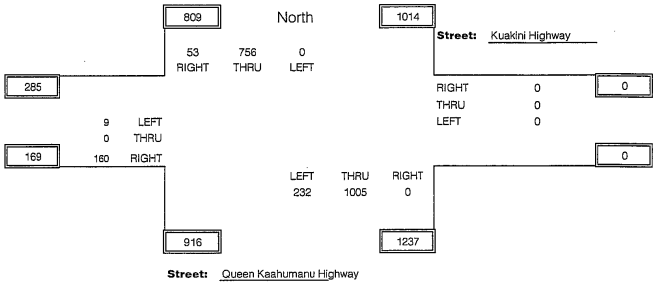


Street: Kuakini Highway
Street: Queen Kaahumanu Highway

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
7:00 AM - 7:15 AM	15	0	2	3	146	0	0	0	0	0	275	42	483	2231
7:15 AM - 7:30 AM	43	0	6	8	167	0	0	0	0	0	263	56	563	2285
7:30 AM - 7:45 AM	51	0	3	9	209	0	0	0	0	0	251	59	582	2215
7:45 AM - 8:00 AM	41	0	1	14	205	0	0	0	0	0	271	71	603	2169
8:00 AM - 8:15 AM	35	0	1	23	162	0	0	0	0	0	258	58	537	2074
8:15 AM - 8:30 AM	33	0	4	7	180	0	0	0	0	0	225	44	493	
8:30 AM - 8:45 AM	33	0	4	9	175	0	0	0	0	0	253	62	536	
8:45 AM - 9:00 AM	36	0	10	16	161	0	0	0	0	0	231	54	508	
Phf	0.784	#DIV/0!	0.563	0.576	0.904	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.927	0.817	Peak	Phf
7:30 AM - 8:30 AM	160	0	9	53	756	0	0	0	0	0	1005	232	2215	0.918

Peak Hour

7:30 AM - 8:30 AM



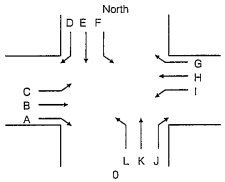
Street: Kuakini Highway
Street: Queen Kaahumanu Highway

PARSONS BRINCKERHOFF

Kuakini Highway Widening
Ref. No. 16431A

MIDDAY COUNT SHEET

Intersection: Queen Kaahumanu Hwy/ Kuakini Hwy
Date: Tuesday, 8/9/2005
By: C. Maruoka
Weather: Sunny, clear



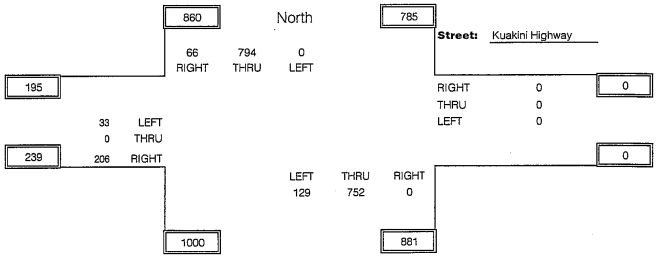
Street: Kuakini Highway

Street: Queen Kaahumanu Highway

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
11:30 AM - 11:45 AM	53	0	9	13	174	0	0	0	0	0	199	40	488	1980
11:45 AM - 12:00 PM	53	0	8	19	200	0	0	0	0	0	201	30	511	1998
12:00 PM - 12:15 PM	48	0	12	19	199	0	0	0	0	0	170	33	481	1973
12:15 PM - 12:30 PM	52	0	4	15	221	0	0	0	0	0	182	26	500	1956
12:30 PM - 12:45 PM	53	0	6	14	211	0	0	0	0	0	179	43	506	1969
12:45 PM - 1:00 PM	41	0	6	19	186	0	0	0	0	0	196	38	486	
1:00 PM - 1:15 PM	47	0	6	12	195	0	0	0	0	0	177	27	464	
1:15 PM - 1:30 PM	53	0	5	18	214	0	0	0	0	0	197	26	513	
Phf	0.972	#DIV/0!	0.688	0.868	0.898	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.935	0.806	Peak	Phf
11:30 AM - 12:30 PM	206	0	33	66	794	0	0	0	0	0	752	129	1980	0.969

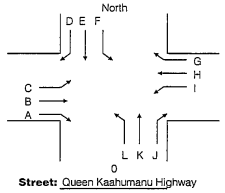
Peak Hour

11:30 AM - 12:30 PM



PM COUNT SHEET

Intersection: Queen Kaahumanu Hwy/ Kuakini Hwy
Date: 5/27/2005
By: C. Maruoka
Weather: Clear



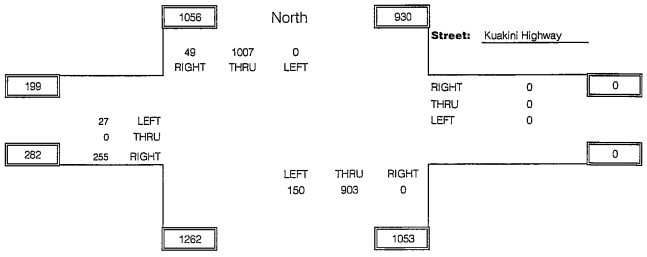
Street: Kuakini Highway

Street: Queen Kaahumanu Highway

TIME	A	B	C	D	E	F	G	H	I	J	K	L	Total Mvmt	Total Hour
3:00 PM - 3:15 PM	50	0	7	16	249	0	0	0	0	0	180	37	539	2343
3:15 PM - 3:30 PM	72	0	7	20	232	0	0	0	0	0	228	46	605	2419
3:30 PM - 3:45 PM	69	0	5	22	239	0	0	0	0	0	256	33	624	2419
3:45 PM - 4:00 PM	45	0	10	22	237	0	0	0	0	0	214	47	575	2404
4:00 PM - 4:15 PM	69	0	9	11	262	0	0	0	0	0	214	50	615	2471
4:15 PM - 4:30 PM	61	0	8	18	245	0	0	0	0	0	234	39	605	2443
4:30 PM - 4:45 PM	68	0	4	12	253	0	0	0	0	0	238	34	609	2391
4:45 PM - 5:00 PM	72	0	6	14	271	0	0	0	0	0	229	50	642	2316
5:00 PM - 5:15 PM	65	0	9	9	240	0	0	0	0	0	230	34	587	2184
5:15 PM - 5:30 PM	50	0	8	14	243	0	0	0	0	0	206	32	553	
5:30 PM - 5:45 PM	64	0	5	8	260	0	0	0	0	0	156	41	534	
5:45 PM - 6:00 PM	67	0	4	9	227	0	0	0	0	0	166	37	510	
Phf	0.885	#DIV/0!	0.750	0.875	0.929	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.949	0.750	Peak	Phf
4:30 PM - 5:30 PM	255	0	27	49	1007	0	0	0	0	0	903	150	2391	0.931

Peak Hour

4:30 PM - 5:30 PM



Appendix B Levels of Service Definitions

The *Highway Capacity Manual* defines six Levels of Service (LOS), labeled A through F, from best to worst conditions. Levels of Service for signalized and unsignalized intersections are defined in terms of average user delays. Delay is a measure of driver discomfort, frustration, fuel consumption, and lost travel time.

For unsignalized intersections, the *Highway Capacity Manual* evaluates gaps in the major street traffic flow and calculates available gaps for left-turns across oncoming traffic and for the left and right-turns onto the major roadway from the minor street.

LEVEL-OF-SERVICE A: Little or no delay.

LEVEL-OF-SERVICE B: Short traffic delays.

LEVEL-OF-SERVICE C: Average traffic delays.

LEVEL-OF-SERVICE D: Long traffic delays.

LEVEL-OF-SERVICE E: Very long traffic delays.

LEVEL-OF-SERVICE F: Demand volume exceeds capacity, resulting in extreme delays with queuing that may cause severe congestion and affect other movements at the intersection.

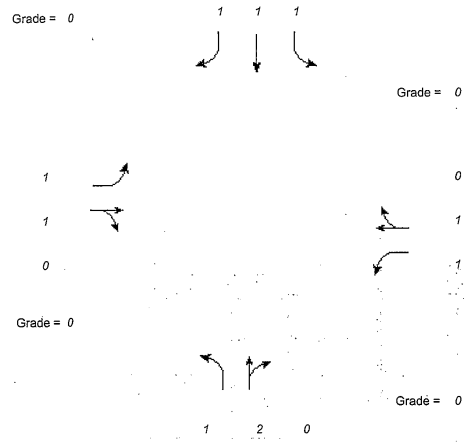
Appendix C Intersection Capacity Analysis Worksheets

INPUT WORKSHEET

General Information		Site Information	
Analyst	JW	Intersection	Hualalai Road/Kuakini Highway
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	8/18/2005	Jurisdiction	Hawaii County
Time Period	AM Peak	Analysis Year	2005

Project Description *Kuakini Hwy Widening - Hualalai/Kuakini - AM Peak - Existing*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	144	38	29	60	89	112	62	323	85	97	286	149
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Arrival type	3	3		3	3		3	3		3	3	3
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0		0	0	0

	EB Only	EW Perm	03	04	Excl. Left	NS Perm	07	08
Timing	G = 8.0	G = 14.0	G = 0.0	G = 0.0	G = 9.0	G = 24.0	G = 0.0	G = 0.0
	Y = 5	Y = 5	Y = 0	Y = 0	Y = 5	Y = 5	Y = 0	Y = 0

Duration of Analysis (hrs) = 0.25 | Cycle Length C = 75.0

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CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Hualalai/Kuakini - AM Peak - Existing*

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	TR		L	TR		L	TR		L	T	R
Adj. flow rate	160	74		67	223		69	453		108	318	166
Satflow rate	1805	1777		1347	1742		1805	3505		1805	1900	1615
Lost time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Green ratio	0.36	0.36		0.19	0.19		0.51	0.32		0.51	0.32	0.32
Lane group cap.	356	640		251	325		476	1122		481	608	517
v/c ratio	0.45	0.12		0.27	0.69		0.14	0.40		0.22	0.52	0.32
Flow ratio	0.09	0.04		0.05	0.13		0.04	0.13		0.06	0.17	0.10
Crit. lane group	Y	N			Y			N		Y	Y	N
Sum flow ratios	0.44											
Lost time/cycle	20.00											
Critical v/c ratio	0.61											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane group	L	TR		L	TR		L	TR		L	T	R
Adj. flow rate	160	74		67	223		69	453		108	318	166
Lane group cap.	356	640		251	325		476	1122		481	608	517
v/c ratio	0.45	0.12		0.27	0.69		0.14	0.40		0.22	0.52	0.32
Green ratio	0.36	0.36		0.19	0.19		0.51	0.32		0.51	0.32	0.32
Unif. delay d_1	17.4	16.0		26.1	28.5		10.3	19.9		10.2	20.8	19.3
Delay factor k	0.11	0.11		0.11	0.26		0.11	0.11		0.11	0.13	0.11
Increm. delay d_2	0.9	0.1		0.6	5.9		0.1	0.2		0.2	0.8	0.4
PF factor	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
Control delay	18.3	16.1		26.7	34.4		10.5	20.2		10.4	21.7	19.7
Lane group LOS	B	B		C	C		B	C		B	C	B
Apprch. delay	17.6			32.6			18.9			19.0		
Approach LOS	B			C			B			B		
Intersec. delay	21.2			Intersection LOS						C		

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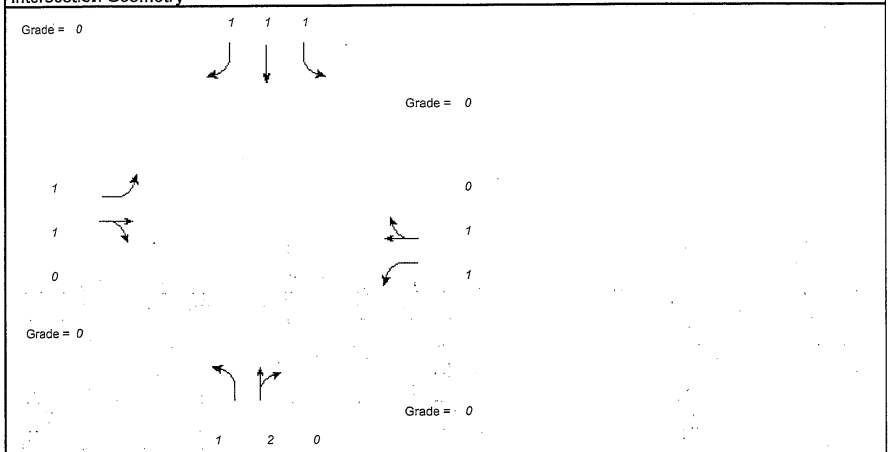
INPUT WORKSHEET

General Information		Site Information	
Analyst	JW	Intersection	Hualalai Road/Kuakini Highway
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	8/18/2005	Jurisdiction	Hawaii County
Time Period	Midday Peak	Analysis Year	2005

Project Description *Kuakini Hwy Widening - Hualalai/Kuakini -Mid Peak - Existing*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	157	71	33	61	84	92	44	314	102	98	335	179
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Ext. eff. green	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Arrival type	3	3		3	3		3	3		3	3	3
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0		0	0		0	0		0	0	0

	EB Only	EW Perm	03	04	Excl. Left	NS Perm	07	08
Timing	G = 10.0	G = 13.0	G = 0.0	G =	G = 7.0	G = 25.0	G = 0.0	G =
	Y = 5	Y = 5	Y = 0	Y =	Y = 5	Y = 5	Y = 0	Y =

Duration of Analysis (hrs) = 0.25 | Cycle Length C = 75.0

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CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Hualalai/Kuakini -Mid Peak - Existing*

Capacity Analysis

	EB			WB			NB			SB		
Lane group	L	TR		L	TR		L	TR		L	T	R
Adj. flow rate	174	116		68	195		49	462		109	372	199
Satflow rate	1805	1809		1296	1751		1805	3485		1805	1900	1615
Lost time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Green ratio	0.37	0.37		0.17	0.17		0.49	0.33		0.49	0.33	0.33
Lane group cap.	409	675		225	304		400	1162		442	633	538
v/c ratio	0.43	0.17		0.30	0.64		0.12	0.40		0.25	0.59	0.37
Flow ratio	0.10	0.06		0.05	0.11		0.03	0.13		0.06	0.20	0.12
Crit. lane group	Y	N			Y			N		Y	Y	N
Sum flow ratios	0.46											
Lost time/cycle	20.00											
Critical v/c ratio	0.63											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane group	L	TR		L	TR		L	TR		L	T	R
Adj. flow rate	174	116		68	195		49	462		109	372	199
Lane group cap.	409	675		225	304		400	1162		442	633	538
v/c ratio	0.43	0.17		0.30	0.64		0.12	0.40		0.25	0.59	0.37
Green ratio	0.37	0.37		0.17	0.17		0.49	0.33		0.49	0.33	0.33
Unif. delay d_1	16.7	15.7		27.0	28.8		11.1	19.2		10.7	20.7	19.0
Delay factor k	0.11	0.11		0.11	0.22		0.11	0.11		0.11	0.18	0.11
Increm. delay d_2	0.7	0.1		0.8	4.5		0.1	0.2		0.3	1.4	0.4
PF factor	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
Control delay	17.5	15.9		27.8	33.4		11.2	19.4		11.0	22.2	19.4
Lane group LOS	B	B		C	C		B	B		B	C	B
Apprch. delay	16.8			31.9			18.6			19.6		
Approach LOS	B			C			B			B		
Intersec. delay	20.7			Intersection LOS						C		

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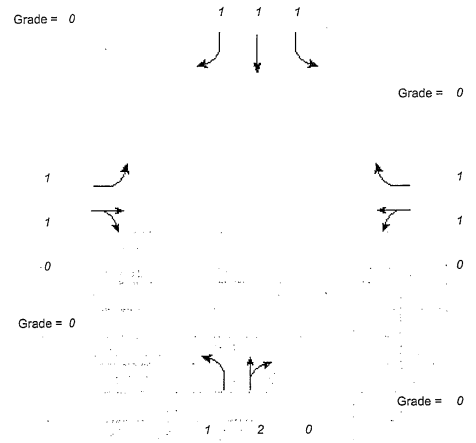
INPUT WORKSHEET

General Information		Site Information	
Analyst	JW	Intersection	Hualalai Road/Kuakini Highway
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	8/18/2005	Jurisdiction	Hawaii County
Time Period	PM Peak	Analysis Year	2005

Project Description *Kuakini Hwy Widening - Hualalai/Kuakini - PM Peak - Existing*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	163	66	46	83	99	117	46	379	85	75	437	187
% Heavy veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup lost time	2.0	2.0			2.0	2.0	2.0	2.0		2.0	2.0	2.0
Ext. eff. green	2.0	2.0			2.0	2.0	2.0	2.0		2.0	2.0	2.0
Arrival type	3	3			3	3	3	3		3	3	3
Unit Extension	3.0	3.0			3.0	3.0	3.0	3.0		3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0			12.0	12.0	12.0	12.0		12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/hr												
Bus stops/hr	0	0			0	0	0	0		0	0	0

	EB Only	EW Perm	03	04	Excl. Left	NS Perm	07	08
Timing	G = 7.0	G = 15.0	G = 0.0	G =	G = 4.0	G = 29.0	G = 0.0	G =
	Y = 5	Y = 5	Y = 0	Y =	Y = 5	Y = 5	Y = 0	Y =

Duration of Analysis (hrs) = 0.25 | Cycle Length C = 75.0

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CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Hualalai/Kuakini - PM Peak - Existing*

Capacity Analysis

	EB				WB		NB			SB		
Lane group	L	TR			LT	R	L	TR		L	T	R
Adj. flow rate	181	124			202	130	51	515		83	486	208
Satflow rate	1805	1783			1509	1615	1805	3519		1805	1900	1615
Lost time	2.0	2.0			2.0	2.0	2.0	2.0		2.0	2.0	2.0
Green ratio	0.36	0.36			0.20	0.20	0.51	0.39		0.51	0.39	0.39
Lane group cap.	366	642			302	323	305	1361		399	735	624
v/c ratio	0.49	0.19			0.67	0.40	0.17	0.38		0.21	0.66	0.33
Flow ratio	0.09	0.07			0.13	0.08	0.03	0.15		0.05	0.26	0.13
Crit. lane group	Y	N			Y	N		N		Y	Y	N
Sum flow ratios	0.53											
Lost time/cycle	20.00											
Critical v/c ratio	0.72											

Lane Group Capacity, Control Delay, and LOS Determination

	EB				WB		NB			SB		
Lane group	L	TR			LT	R	L	TR		L	T	R
Adj. flow rate	181	124			202	130	51	515		83	486	208
Lane group cap.	366	642			302	323	305	1361		399	735	624
v/c ratio	0.49	0.19			0.67	0.40	0.17	0.38		0.21	0.66	0.33
Green ratio	0.36	0.36			0.20	0.20	0.51	0.39		0.51	0.39	0.39
Unif. delay d_1	17.5	16.5			27.7	26.1	11.4	16.5		10.1	19.0	16.2
Delay factor k	0.11	0.11			0.24	0.11	0.11	0.11		0.11	0.24	0.11
Increm. delay d_2	1.1	0.1			5.6	0.8	0.3	0.2		0.3	2.2	0.3
PF factor	1.000	1.000			1.000	1.000	1.000	1.000		1.000	1.000	1.000
Control delay	18.6	16.7			33.3	26.9	11.7	16.7		10.3	21.2	16.5
Lane group LOS	B	B			C	C	B	B		B	C	B
Apprch. delay	17.8			30.8			16.3			18.8		
Approach LOS	B			C			B			B		
Intersec. delay	19.9			Intersection LOS						B		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Oni Oni St/Walua Rd/KuakiniHwy
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	9/2/2005	Analysis Year	2005
Analysis Time Period	AM Peak Existing		

Project Description: 16431-Kuakini Hwy Widening-Onioni/Walua/Kuakini-AM-Existing

East/West Street: Oni Oni Street/Walua Road | North/South Street: Kuakini Highway

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	74	191	12	25	145	109
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	82	212	13	27	161	121
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			1
Lanes	0	1	0	0	1	1
Configuration	LTR			LT		R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	137	7	48	8	13	53
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	152	7	53	8	14	58
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			1			0
Lanes	0	1	1	0	1	1
Configuration	LT		R	LT		R

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LT	LT		R	LT		R
v (vph)	82	27	22		58	159		53
C (m) (vph)	1430	1356	361		827	336		889
v/c	0.06	0.02	0.06		0.07	0.47		0.06
95% queue length	0.18	0.06	0.19		0.23	2.43		0.19
Control Delay	7.7	7.7	15.6		9.7	25.0		9.3
LOS	A	A	C		A	C		A
Approach Delay	--	--	11.3			21.1		
Approach LOS	--	--	B			C		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	OniOni St/Walua Rd/Kuakini Hwy
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	8/18/2005	Analysis Year	2005
Analysis Time Period	Midday Peak		

Project Description: Kuakini Hwy Widening-Onioni/Walua/Kuakini -Mid Pk - Existing

East/West Street: Oni Oni St/Walua Rd | North/South Street: Kuakini Highway

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	98	176	5	4	191	100
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	108	195	5	4	212	111
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			1
Lanes	0	1	0	0	1	1
Configuration	LTR			LT		R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	98	13	54	4	5	18
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	108	14	60	4	5	20
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			1			0
Lanes	0	1	1	0	1	1
Configuration	LT		R	LT		R

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LT	LT		R	LT		R
v (vph)	108	4	9		20	122		60
C (m) (vph)	1370	1384	332		848	349		833
v/c	0.08	0.00	0.03		0.02	0.35		0.07
95% queue length	0.26	0.01	0.08		0.07	1.53		0.23
Control Delay	7.9	7.6	16.1		9.3	20.8		9.7
LOS	A	A	C		A	C		A
Approach Delay	--	--	11.5			17.1		
Approach LOS	--	--	B			C		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Oni Oni/Walua/Kuakini
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	8/18/2005	Analysis Year	2005
Analysis Time Period	PM Peak		

Project Description: Kuakini Hwy Widening-Onioni/Walua/Kuakini - PM Pk - Existing

East/West Street: Oni Oni St/Walua Rd | North/South Street: Kuakini Highway

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	84	160	17	11	206	159
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	93	177	18	12	228	176
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			1
Lanes	0	1	0	0	1	1
Configuration	LTR			LT		R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	84	15	55	11	4	45
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	93	16	61	12	4	50
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			1			0
Lanes	0	1	1	0	1	1
Configuration	LT		R	LT		R

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LT	LT		R	LT		R
v (vph)	93	12	16		50	109		61
C (m) (vph)	1352	1390	306		861	339		816
v/c	0.07	0.01	0.05		0.06	0.32		0.07
95% queue length	0.22	0.03	0.16		0.18	1.36		0.24
Control Delay	7.9	7.6	17.4		9.4	20.6		9.8
LOS	A	A	C		A	C		A
Approach Delay	--	--	11.4			16.7		
Approach LOS	--	--	B			C		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Queen Kaahumanu/Kuakini Hwy
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	9/2/2005	Analysis Year	2005
Analysis Time Period	AM Peak Existing		

Project Description: 16431-Kuakini Hwy-QueenK/Kuakini-AM-Existing for NB LT

East/West Street: Kuakini Highway | North/South Street: Queen Kaahumanu Highway

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	232	1005			756	53
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	257	1116	0	0	840	58
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	9					
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	10	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	0	0	0	0	0
Configuration	L					

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		
v (vph)	257					10		
C (m) (vph)	765					108		
v/c	0.34					0.09		
95% queue length	1.48					0.30		
Control Delay	12.1					41.7		
LOS	B					E		
Approach Delay	--	--				41.7		
Approach LOS	--	--				E		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Queen Kaahumanu Hwy/KuakiniHwy
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	9/2/2005	Analysis Year	2005
Analysis Time Period	AM Peak Existing		

Project Description 16431-Kuakini Hwy-QueenK/Kuakini-AM-Existing-Pt1 EB LT PART 1
East/West Street: Kuakini Highway | North/South Street: Queen Kaahumanu Highway
Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	232	5			756	53
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	257	5	0	0	840	58
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			1
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	9					
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	10	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			1			0
Lanes	1	0	0	0	0	0
Configuration	L					

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		
v (vph)	257					10		
C (m) (vph)	804					300		
v/c	0.32					0.03		
95% queue length	1.38					0.10		
Control Delay	11.6					17.4		
LOS	B					C		
Approach Delay	--	--				17.4		
Approach LOS	--	--				C		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Queen Kaahumanu Hwy/KuakiniHwy
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	9/2/2005	Analysis Year	2005 (Pt 2)
Analysis Time Period	AM Peak Existing		

Project Description 16431-Kuakini Hwy-QueenK/Kuakini-AM-Existing-Pt 2 EB LT PART 2
East/West Street: Kuakini Highway | North/South Street: Queen Kaahumanu Highway
Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	5	1005			5	5
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	5	1116	0	0	5	5
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			1
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	9					
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	10	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			1			0
Lanes	1	0	0	0	0	0
Configuration	L					

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		
v (vph)	5					10		
C (m) (vph)	1630					295		
v/c	0.00					0.03		
95% queue length	0.01					0.10		
Control Delay	7.2					17.6		
LOS	A					C		
Approach Delay	--	--				17.6		
Approach LOS	--	--				C		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Queen Kaahumanu Hwy/Kuakini Hw
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	8/18/2005	Analysis Year	2005
Analysis Time Period	Midday Peak		

Project Description: 16431-Kuakini Hwy-QueenK/Kuakini-Midday-Existing FOR NB LT

East/West Street: Kuakini Highway | North/South Street: Queen Kaahumanu Highway

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	129	752			794	66
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	143	835	0	0	882	73
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			1
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	99					
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	110	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			1			0
Lanes	1	0	0	0	0	0
Configuration	L					

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		
v (vph)	143					110		
C (m) (vph)	775					210		
v/c	0.18					0.52		
95% queue length	0.67					2.71		
Control Delay	10.7					39.6		
LOS	B					E		
Approach Delay		--				39.6		
Approach LOS	--	--				E		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Queen Kaahumanu Hwy/Kuakini Hw
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	8/18/2005	Analysis Year	2005
Analysis Time Period	Midday Peak		

Project Description: 16431-Kuakini Hwy-QueenK/Kuakini-Midday-Existing-pt1 EB LT PART 1

East/West Street: Kuakini Highway | North/South Street: Queen Kaahumanu Highway

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	129	0			794	66
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	143	0	0	0	882	73
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			1
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	99					
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	110	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			1			0
Lanes	1	0	0	0	0	0
Configuration	L					

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		
v (vph)	143					110		
C (m) (vph)	775					354		
v/c	0.18					0.31		
95% queue length	0.67					1.30		
Control Delay	10.7					19.7		
LOS	B					C		
Approach Delay	--	--				19.7		
Approach LOS	--	--				C		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Queen Kaahumanu Hwy/Kuakini Hw
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	8/18/2005	Analysis Year	2005
Analysis Time Period	Midday Peak		

Project Description: 16431-Kuakini Hwy-QueenK/Kuakini-Midday-Existing-pt2 EB LT PART 2

East/West Street: Kuakini Highway | North/South Street: Queen Kaahumanu Highway

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	5	752			5	5
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	5	835	0	0	5	5
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			1
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	99					
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	110	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			1			0
Lanes	1	0	0	0	0	0
Configuration	L					

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		
v (vph)	5					110		
C (m) (vph)	1630					401		
v/c	0.00					0.27		
95% queue length	0.01					1.10		
Control Delay	7.2					17.3		
LOS	A					C		
Approach Delay	--	--				17.3		
Approach LOS	--	--				C		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Queen Kaahumanu Hwy/Kuakini Hw
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	8/18/2005	Analysis Year	2005
Analysis Time Period	PM Peak		

Project Description: Kuakini Hwy Widening-QueenK/Kuakini - PM Pk - Existing FOR NB LT

East/West Street: Kuakini Highway | North/South Street: Queen Kaahumanu Highway

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	150	903			1007	46
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	166	1003	0	0	1118	51
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			1
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	27					
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	30	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			1			0
Lanes	1	0	0	0	0	0
Configuration	L					

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		
v (vph)	166					30		
C (m) (vph)	632					150		
v/c	0.26					0.20		
95% queue length	1.05					0.72		
Control Delay	12.7					34.9		
LOS	B					D		
Approach Delay	--	--				34.9		
Approach LOS	--	--				D		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Queen Kaahumanu Hwy/Kuakini Hw
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	8/18/2005	Analysis Year	2005
Analysis Time Period	PM Peak		

Project Description: Kuakini Hwy Widening-QueenK/Kuakini - PM Pk - Existing-pt1 EB LT PART 1

East/West Street: Kuakini Highway | North/South Street: Queen Kaahumanu Highway

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	150	5			1007	46
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	166	5	0	0	1118	51
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			1
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	27					
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	30	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			1			0
Lanes	1	0	0	0	0	0
Configuration	L					

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		
v (vph)	166					30		
C (m) (vph)	632					272		
v/c	0.26					0.11		
95% queue length	1.05					0.37		
Control Delay	12.7					19.9		
LOS	B					C		
Approach Delay	--	--				19.9		
Approach LOS	--	--				C		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Queen Kaahumanu Hwy/Kuakini Hw
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	8/18/2005	Analysis Year	2005
Analysis Time Period	PM Peak		

Project Description: Kuakini Hwy Widening-QueenK/Kuakini - PM Pk - Existing-pt2 EB LT PART 2

East/West Street: Kuakini Highway | North/South Street: Queen Kaahumanu Highway

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	5	903			5	5
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	5	1003	0	0	5	5
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			1
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	27					
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR	30	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			1			0
Lanes	1	0	0	0	0	0
Configuration	L					

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		
v (vph)	5					30		
C (m) (vph)	1630					334		
v/c	0.00					0.09		
95% queue length	0.01					0.29		
Control Delay	7.2					16.8		
LOS	A					C		
Approach Delay	--	--				16.8		
Approach LOS	--	--				C		

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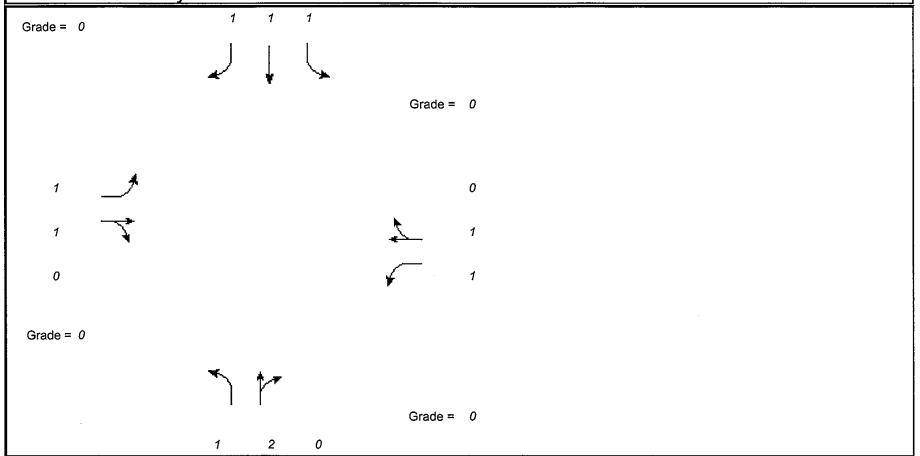
FULL REPORT

General Information		Site Information	
Analyst	*JW*	Intersection	*Hualalai Road/Kuakini Highway*
Agency or Co.	*PBQD*	Area Type	*All other areas*
Date Performed	*1/3/2007*	Jurisdiction	*Hawaii County*
Time Period	*AM Peak*	Analysis Year	*2020 (Unwidened)*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	*170*	*49*	*44*	*99*	*107*	*135*	*81*	*829*	*153*	*115*	*619*	*175*
% Heavy Veh	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Actuated (P/A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Startup Lost Time	*2.0*	*2.0*		*2.0*	*2.0*		*2.0*	*2.0*		*2.0*	*2.0*	*2.0*
Extension of Effective Green	*2.0*	*2.0*		*2.0*	*2.0*		*2.0*	*2.0*		*2.0*	*2.0*	*2.0*
Arrival Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	*3*
Unit Extension	*3.0*	*3.0*		*3.0*	*3.0*		*3.0*	*3.0*		*3.0*	*3.0*	*3.0*
Ped/Bike/RTOR Volume	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width	*12.0*	*12.0*		*12.0*	*12.0*		*12.0*	*12.0*		*12.0*	*12.0*	*12.0*
Parking (Y or N)	*N*		*N*	*N*		*N*	*N*		*N*	*N*		*N*
Parking/Hour												
Bus Stops/Hour	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	*0*
Pedestrian Timing	*3.2*			*3.2*			*3.2*			*3.2*		

	Excl. Left	EW Perm	03	04	Excl. Left	Thru & RT	07	08
Timing	G = *8.0*	G = *20.0*	G = *0.0*	G =	G = *12.0*	G = *40.0*	G = *0.0*	G =
	Y = *5*	Y = *5*	Y = *0*	Y =	Y = *5*	Y = *5*	Y = *0*	Y =
Duration of Analysis (hrs) = *0.25*						Cycle Length C = *100.0*		

VOLUME ADJUSTMENT AND SATURATION FLOW RATE WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Hualalai/Kuakini-AM Peak-2020-Unwiden*

Volume Adjustment

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume	*170*	*49*	*44*	*99*	*107*	*135*	*81*	*829*	*153*	*115*	*619*	*175*
PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Adjusted Flow Rate	*189*	*54*	*49*	*110*	*119*	*150*	*90*	*921*	*170*	*128*	*688*	*194*
Lane Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*T*	*R*
Adjusted Flow Rate	*189*	*103*		*110*	*269*		*90*	*1091*		*128*	*688*	*194*
Proportion of LT or RT	*1.000*	--	*0.476*	*1.000*	--	*0.558*	*1.000*	--	*0.156*	*1.000*	--	*1.000*

Saturation Flow Rate

Base Satflow	*1900*	*1900*		*1900*	*1900*		*1900*	*1900*		*1900*	*1900*	*1900*
Number of Lanes	*1*	*1*	*0*	*1*	*1*	*0*	*1*	*2*	*0*	*1*	*1*	*1*
f_W	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*
f_{HV}	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*
f_g	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*
f_p	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*
f_{bb}	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*
f_a	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*
f_{LU}	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*0.952*		*1.000*	*1.000*	*1.000*
f_{LT}	*0.950*	*1.000*	--	*0.950*	*1.000*	--	*0.950*	*1.000*	--	*0.950*	*1.000*	--
Secondary f_{LT}	*0.260*	*0.260*	--	*0.556*	*0.556*	--			--			--
f_{RT}	--	*0.929*		--	*0.916*		--	*0.977*		--	*1.000*	*0.850*
f_{Lpb}	*1.000*	*1.000*	--	*1.000*	*1.000*	--	*1.000*	*1.000*	--	*1.000*	*1.000*	--
f_{Rpb}	--	*1.000*		--	*1.000*		--	*1.000*		--	*1.000*	*1.000*
Adjusted Satflow	*1805*	*1764*		*1805*	*1741*		*1805*	*3533*		*1805*	*1900*	*1615*
Secondary Adjusted Satflow	*494*	*459*	--	*1057*	*969*	--			--			--

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Hualalai/Kuakini-AM Peak-2020-Unwiden*

Capacity Analysis

	EB			WB			NB			SB		
Lane Group	L	TR		L	TR		L	TR		L	T	R
Adjusted Flow Rate	189	103		110	269		90	1091		128	688	194
Satflow Rate	1805	1764		1805	1741		1805	3533		1805	1900	1615
Lost Time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Green Ratio	0.33	0.20		0.33	0.20		0.12	0.40		0.12	0.40	0.40
Lane Group Capacity	268	353		408	348		217	1413		217	760	646
v/c Ratio	0.71	0.29		0.27	0.77		0.41	0.77		0.59	0.91	0.30
Flow Ratio	0.08	0.06		0.06	0.15		0.05	0.31		0.07	0.36	0.12
Critical Lane Group	Y	N		N	Y		N	N		Y	Y	N
Sum Flow Ratios	0.67											
Lost Time/Cycle	20.00											
Critical v/c Ratio	0.83											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane Group	L	TR		L	TR		L	TR		L	T	R
Adjusted Flow Rate	189	103		110	269		90	1091		128	688	194
Lane Group Capacity	268	353		408	348		217	1413		217	760	646
v/c Ratio	0.71	0.29		0.27	0.77		0.41	0.77		0.59	0.91	0.30
Green Ratio	0.33	0.20		0.33	0.20		0.12	0.40		0.12	0.40	0.40
Uniform Delay d_1	26.3	34.0		24.0	37.9		40.7	26.0		41.7	28.2	20.5
Delay Factor k	0.27	0.11		0.11	0.32		0.11	0.32		0.18	0.43	0.11
Incremental Delay d_2	8.2	0.5		0.4	10.3		1.3	2.7		4.2	14.4	0.3
PF Factor	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
Control Delay	34.4	34.4		24.4	48.2		42.0	28.8		45.9	42.6	20.7
Lane Group LOS	C	C		C	D		D	C		D	D	C
Approach Delay	34.4			41.3			29.8			38.8		
Approach LOS	C			D			C			D		
Intersection Delay	35.0			Intersection LOS						C		

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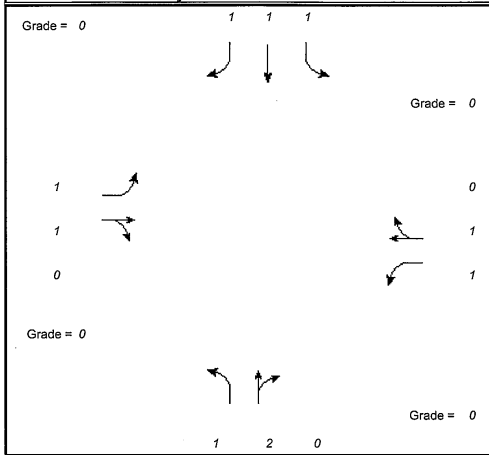
FULL REPORT

General Information		Site Information	
Analyst	*JW*	Intersection	*Hualalai Road/Kuakini Highway*
Agency or Co.	*PBQD*	Area Type	*All other areas*
Date Performed	*1/3/2007*	Jurisdiction	*Hawaii County*
Time Period	*PM Peak*	Analysis Year	*2020 (Unwidened)*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	180	86	80	251	127	135	83	609	236	85	692	215
% Heavy Veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup Lost Time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Extension of Effective Green	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Arrival Type	3	3		3	3		3	3		3	3	3
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/Hour												
Bus Stops/Hour	0	0		0	0		0	0		0	0	0
Pedestrian Timing	3.2			3.2			3.2			3.2		

	Excl. Left	EW Perm	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 7.0	G = 24.0	G = 0.0	G =	G = 13.0	G = 36.0	G = 0.0	G =
	Y = 5	Y = 5	Y = 0	Y =	Y = 5	Y = 5	Y = 0	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 100.0		

VOLUME ADJUSTMENT AND SATURATION FLOW RATE WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Hualalai/Kuakini-PM Peak-2020-Unwiden*

Volume Adjustment

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume	180	86	80	251	127	135	83	609	236	85	692	215
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adjusted Flow Rate	200	96	89	279	141	150	92	677	262	94	769	239
Lane Group	L	TR		L	TR		L	TR		L	T	R
Adjusted Flow Rate	200	185		279	291		92	939		94	769	239
Proportion of LT or RT	1.000	--	0.481	1.000	--	0.515	1.000	--	0.279	1.000	--	1.000

Saturation Flow Rate

Base Satflow	1900	1900		1900	1900		1900	1900		1900	1900	1900
Number of Lanes	1	1	0	1	1	0	1	2	0	1	1	1
f_W	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
f_{HV}	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
f_g	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
f_p	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
f_{bb}	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
f_a	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
f_{LU}	1.000	1.000		1.000	1.000		1.000	0.952		1.000	1.000	1.000
f_{LT}	0.950	1.000	--	0.950	1.000	--	0.950	1.000	--	0.950	1.000	--
Secondary f_{LT}	0.288	0.288	--	0.448	0.448	--			--			--
f_{RT}	--	0.928		--	0.923		--	0.958		--	1.000	0.850
f_{Lpb}	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--
f_{Rpb}	--	1.000		--	1.000		--	1.000		--	1.000	1.000
Adjusted Satflow	1805	1763		1805	1753		1805	3466		1805	1900	1615
Secondary Adjusted Satflow	547	507	--	852	786	--			--			--

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Hualalai/Kuakini-PM Peak-2020-Unwiden*

Capacity Analysis

	EB			WB			NB			SB		
Lane Group	L	TR		L	TR		L	TR		L	T	R
Adjusted Flow Rate	200	185		279	291		92	939		94	769	239
Satflow Rate	1805	1763		1805	1753		1805	3466		1805	1900	1615
Lost Time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Green Ratio	0.36	0.24		0.36	0.24		0.13	0.36		0.13	0.36	0.36
Lane Group Capacity	285	423		373	421		235	1248		235	684	581
v/c Ratio	0.70	0.44		0.75	0.69		0.39	0.75		0.40	1.12	0.41
Flow Ratio	0.07	0.10		0.07	0.17		0.05	0.27		0.05	0.40	0.15
Critical Lane Group	Y	N		N	N		N	N		Y	Y	N
Sum Flow Ratios	0.71											
Lost Time/Cycle	15.00											
Critical v/c Ratio	0.83											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane Group	L	TR		L	TR		L	TR		L	T	R
Adjusted Flow Rate	200	185		279	291		92	939		94	769	239
Lane Group Capacity	285	423		373	421		235	1248		235	684	581
v/c Ratio	0.70	0.44		0.75	0.69		0.39	0.75		0.40	1.12	0.41
Green Ratio	0.36	0.24		0.36	0.24		0.13	0.36		0.13	0.36	0.36
Uniform Delay d_1	29.4	32.3		30.5	34.6		39.9	28.1		39.9	32.0	24.0
Delay Factor k	0.27	0.11		0.30	0.26		0.11	0.31		0.11	0.50	0.11
Incremental Delay d_2	7.5	0.7		8.1	4.8		1.1	2.6		1.1	73.9	0.5
PF Factor	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	1.000
Control Delay	37.0	33.0		38.6	39.4		41.0	30.7		41.0	105.9	24.5
Lane Group LOS	D	C		D	D		D	C		D	F	C
Approach Delay	35.1			39.0			31.6			82.7		
Approach LOS	D			D			C			F		
Intersection Delay	51.7			Intersection LOS						D		

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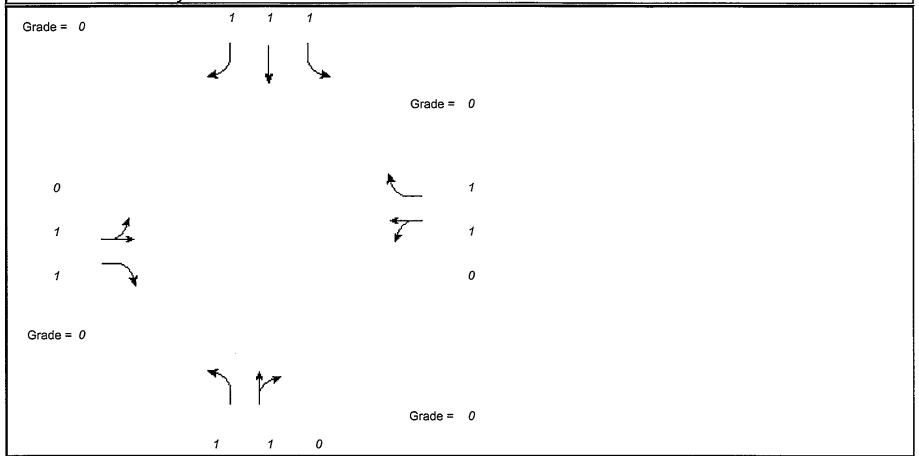
FULL REPORT

General Information		Site Information	
Analyst	*JW*	Intersection	*Walua Rd/Onioni St/Kuakini Hwy*
Agency or Co.	*PBQD*	Area Type	*All other areas*
Date Performed	*1/3/2007*	Jurisdiction	*Hawaii*
Time Period	*AM Peak*	Analysis Year	*2020 nowide w/ LT bays*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	*177*	*10*	*89*	*13*	*15*	*68*	*110*	*761*	*17*	*32*	*522*	*140*
% Heavy Veh	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Actuated (P/A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Startup Lost Time		*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*2.0*		*2.0*	*2.0*	*2.0*
Extension of Effective Green		*2.0*	*2.0*		*2.0*	*2.0*	*2.0*	*2.0*		*2.0*	*2.0*	*2.0*
Arrival Type		*3*	*3*		*3*	*3*	*3*	*3*		*3*	*3*	*3*
Unit Extension		*3.0*	*3.0*		*3.0*	*3.0*	*3.0*	*3.0*		*3.0*	*3.0*	*3.0*
Ped/Bike/RTOR Volume	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width		*12.0*	*12.0*		*12.0*	*12.0*	*12.0*	*12.0*		*12.0*	*12.0*	*12.0*
Parking (Y or N)	*N*		*N*	*N*		*N*	*N*		*N*	*N*		*N*
Parking/Hour												
Bus Stops/Hour		*0*	*0*		*0*	*0*	*0*	*0*		*0*	*0*	*0*
Pedestrian Timing	*3.2*			*3.2*			*3.2*			*3.2*		

	EB Only	EW Perm	03	04	Excl. Left	Thru & RT	07	08
Timing	G = *19.0*	G = *7.0*	G =	G =	G = *19.0*	G = *40.0*	G =	G =
	Y = *0*	Y = *5*	Y =	Y =	Y = *5*	Y = *5*	Y =	Y =

Duration of Analysis (hrs) = *0.25* | Cycle Length C = *100.0*

VOLUME ADJUSTMENT AND SATURATION FLOW RATE WORKSHEET

General Information

Project Description *Kuakini Hwy - Walua/Onioni/Kuakini AM-2020-nowide w/LT bays*

Volume Adjustment

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume	*177*	*10*	*89*	*13*	*15*	*68*	*110*	*761*	*17*	*32*	*522*	*140*
PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Adjusted Flow Rate	*197*	*11*	*99*	*14*	*17*	*76*	*122*	*846*	*19*	*36*	*580*	*156*
Lane Group		*LT*	*R*		*LT*	*R*	*L*	*TR*		*L*	*T*	*R*
Adjusted Flow Rate		*208*	*99*		*31*	*76*	*122*	*865*		*36*	*580*	*156*
Proportion of LT or RT	*0.947*	--	*1.000*	*0.452*	--	*1.000*	*1.000*	--	*0.022*	*1.000*	--	*1.000*

Saturation Flow Rate

Base Satflow		*1900*	*1900*		*1900*	*1900*	*1900*	*1900*		*1900*	*1900*	*1900*
Number of Lanes	*0*	*1*	*1*	*0*	*1*	*1*	*1*	*1*	*0*	*1*	*1*	*1*
f_W		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*
f_{HV}		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*
f_g		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*
f_p		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*
f_{bb}		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*
f_a		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*
f_{LU}		*1.000*	*1.000*		*1.000*	*1.000*	*1.000*	*1.000*		*1.000*	*1.000*	*1.000*
f_{LT}		*0.955*	--		*0.757*	--	*0.950*	*1.000*	--	*0.950*	*1.000*	--
Secondary f_{LT}		*0.618*	--			--			--			--
f_{RT}	--	*1.000*	*0.850*	--	*1.000*	*0.850*	--	*0.997*		--	*1.000*	*0.850*
f_{Lpb}		*1.000*	--		*1.000*	--	*1.000*	*1.000*	--	*1.000*	*1.000*	--
f_{Rpb}	--	*1.000*	*1.000*	--	*1.000*	*1.000*	--	*1.000*		--	*1.000*	*1.000*
Adjusted Satflow		*1814*	*1615*		*1438*	*1615*	*1805*	*1894*		*1805*	*1900*	*1615*
Secondary Adjusted Satflow		*1173*	--			--			--			--

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kuakini Hwy - Walua/Onioni/Kuakini AM-2020-nowide w/LT bays*

Capacity Analysis

	EB			WB			NB			SB		
Lane Group		LT	R		LT	R	L	TR		L	T	R
Adjusted Flow Rate		208	99		31	76	122	865		36	580	156
Satflow Rate		1814	1615		1438	1615	1805	1894		1805	1900	1615
Lost Time		2.0	2.0		2.0	2.0	2.0	2.0		2.0	2.0	2.0
Green Ratio		0.26	0.50		0.07	0.31	0.19	0.40		0.19	0.40	0.40
Lane Group Capacity		395	808		101	501	343	758		343	760	646
v/c Ratio		0.53	0.12		0.31	0.15	0.36	1.14		0.10	0.76	0.24
Flow Ratio		0.11	0.06		0.02	0.05	0.07	0.46		0.02	0.31	0.10
Critical Lane Group		Y	N		Y	N	Y	Y		N	N	N
Sum Flow Ratios	0.66											
Lost Time/Cycle	20.00											
Critical v/c Ratio	0.83											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane Group		LT	R		LT	R	L	TR		L	T	R
Adjusted Flow Rate		208	99		31	76	122	865		36	580	156
Lane Group Capacity		395	808		101	501	343	758		343	760	646
v/c Ratio		0.53	0.12		0.31	0.15	0.36	1.14		0.10	0.76	0.24
Green Ratio		0.26	0.50		0.07	0.31	0.19	0.40		0.19	0.40	0.40
Uniform Delay d_1		31.7	13.3		44.2	25.0	35.2	30.0		33.5	25.9	19.9
Delay Factor k		0.13	0.11		0.11	0.11	0.11	0.50		0.11	0.32	0.11
Incremental Delay d_2		1.3	0.1		1.7	0.1	0.6	79.0		0.1	4.6	0.2
PF Factor		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
Control Delay		33.0	13.4		45.9	25.1	35.8	109.0		33.6	30.5	20.1
Lane Group LOS		C	B		D	C	D	F		C	C	C
Approach Delay	26.7			31.1			99.9			28.6		
Approach LOS	C			C			F			C		
Intersection Delay	60.8			Intersection LOS						E		

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FULL REPORT

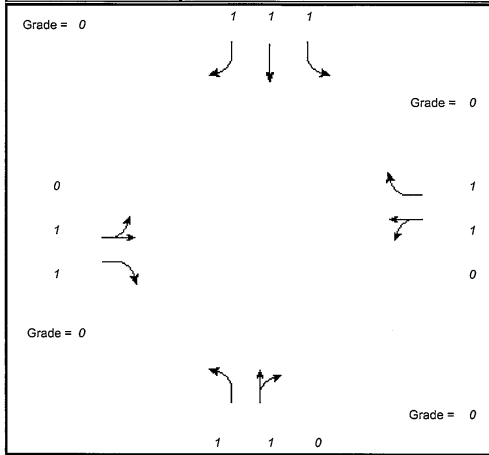
General Information

Analyst *JW*
Agency or Co. *PBQD*
Date Performed *1/3/2007*
Time Period *PM Peak*

Site Information

Intersection *Walua Rd/Onioni St/Kuakini Hwy*
Area Type *All other areas*
Jurisdiction *Hawaii*
Analysis Year *2020 nowide w/LT bays*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	153	15	152	20	5	56	186	607	30	18	681	241
% Heavy Veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup Lost Time		2.0	2.0		2.0	2.0	2.0	2.0		2.0	2.0	2.0
Extension of Effective Green		2.0	2.0		2.0	2.0	2.0	2.0		2.0	2.0	2.0
Arrival Type		3	3		3	3	3	3		3	3	3
Unit Extension		3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0		12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/Hour												
Bus Stops/Hour		0	0		0	0	0	0		0	0	0
Pedestrian Timing	3.2			3.2			3.2			3.2		

	EB Only	EW Perm	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 19.0	G = 16.0	G =	G =	G = 20.0	G = 30.0	G =	G =
	Y = 0	Y = 5	Y =	Y =	Y = 5	Y = 5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 100.0		

VOLUME ADJUSTMENT AND SATURATION FLOW RATE WORKSHEET

General Information

Project Description *Kuakini Hwy - Walua/Onioni/Kuakini-PM-nowide w/LT bays*

Volume Adjustment

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume	153	15	152	20	5	56	186	607	30	18	681	241
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adjusted Flow Rate	170	17	169	22	6	62	207	674	33	20	757	268
Lane Group		LT	R		LT	R	L	TR		L	T	R
Adjusted Flow Rate		187	169		28	62	207	707		20	757	268
Proportion of LT or RT	0.909	--	1.000	0.786	--	1.000	1.000	--	0.047	1.000	--	1.000

Saturation Flow Rate

Base Satflow		1900	1900		1900	1900	1900	1900		1900	1900	1900
Number of Lanes	0	1	1	0	1	1	1	1	0	1	1	1
f_W		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_{HV}		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_g		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_p		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_{bb}		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_a		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_{LU}		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_{LT}		0.957	--		0.732	--	0.950	1.000	--	0.950	1.000	--
Secondary f_{LT}		0.679	--			--			--			--
f_{RT}	--	1.000	0.850	--	1.000	0.850	--	0.993		--	1.000	0.850
f_{Lpb}		1.000	--		1.000	--	1.000	1.000	--	1.000	1.000	--
f_{Rpb}	--	1.000	1.000	--	1.000	1.000	--	1.000		--	1.000	1.000
Adjusted Satflow		1817	1615		1390	1615	1805	1887		1805	1900	1615
Secondary Adjusted Satflow		1291	--			--			--			--

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kuakini Hwy - Walua/Onioni/Kuakini-PM-nowide w/LT bays*

Capacity Analysis

	EB			WB			NB			SB		
Lane Group		LT	R		LT	R	L	TR		L	T	R
Adjusted Flow Rate		187	169		28	62	207	707		20	757	268
Satflow Rate		1817	1615		1390	1615	1805	1887		1805	1900	1615
Lost Time		2.0	2.0		2.0	2.0	2.0	2.0		2.0	2.0	2.0
Green Ratio		0.35	0.35		0.16	0.16	0.20	0.30		0.20	0.30	0.30
Lane Group Capacity		525	565		222	258	361	566		361	570	485
v/c Ratio		0.36	0.30		0.13	0.24	0.57	1.25		0.06	1.33	0.55
Flow Ratio		0.10	0.10		0.02	0.04	0.11	0.37		0.01	0.40	0.17
Critical Lane Group		Y	N		N	Y	Y	N		N	Y	N
Sum Flow Ratios	0.65											
Lost Time/Cycle	20.00											
Critical v/c Ratio	0.82											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane Group		LT	R		LT	R	L	TR		L	T	R
Adjusted Flow Rate		187	169		28	62	207	707		20	757	268
Lane Group Capacity		525	565		222	258	361	566		361	570	485
v/c Ratio		0.36	0.30		0.13	0.24	0.57	1.25		0.06	1.33	0.55
Green Ratio		0.35	0.35		0.16	0.16	0.20	0.30		0.20	0.30	0.30
Uniform Delay d_1		24.1	23.6		36.0	36.7	36.1	35.0		32.4	35.0	29.4
Delay Factor k		0.11	0.11		0.11	0.11	0.17	0.50		0.11	0.50	0.15
Incremental Delay d_2		0.4	0.3		0.3	0.5	2.2	126.3		0.1	159.5	1.4
PF Factor		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
Control Delay		24.6	23.9		36.3	37.2	38.4	161.3		32.4	194.5	30.7
Lane Group LOS		C	C		D	D	D	F		C	F	C
Approach Delay	24.2			36.9			133.4			149.4		
Approach LOS	C			D			F			F		
Intersection Delay	120.6			Intersection LOS						F		

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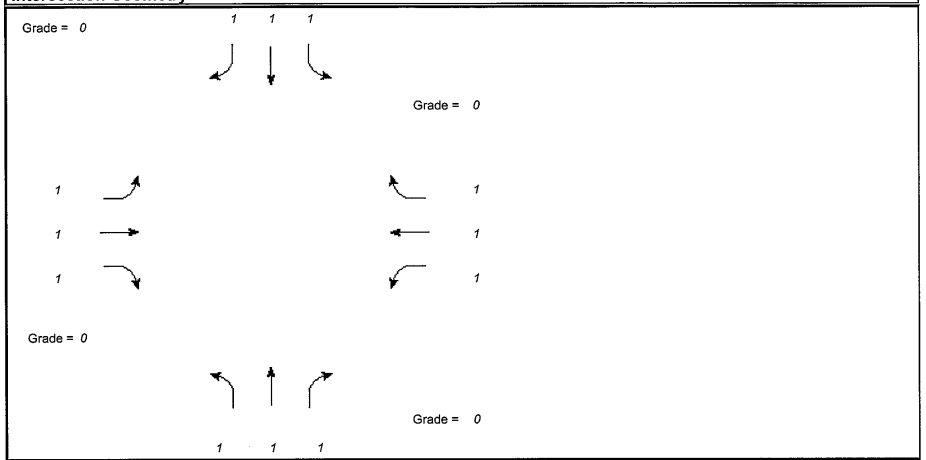
FULL REPORT

General Information		Site Information	
Analyst	JW	Intersection	Alii Highway/Kuakini Highway
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	1/3/2007	Jurisdiction	Hawaii County
Time Period	AM Peak	Analysis Year	2020 (unwidened)

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	389	635	89	87	425	15	105	484	83	15	326	258
% Heavy Veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup Lost Time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival Type	3	3	3	3	3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/Hour												
Bus Stops/Hour	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Timing	3.2			3.2			3.2			3.2		

	Excl. Left	Thru & RT	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 16.0	G = 20.0	G =	G =	G = 14.0	G = 30.0	G =	G =
	Y = 5	Y = 5	Y =	Y =	Y = 5	Y = 5	Y =	Y =
Duration of Analysis (hrs) = 0.25					Cycle Length C = 100.0			

VOLUME ADJUSTMENT AND SATURATION FLOW RATE WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Alii Hwy/Kuakini - AM Peak - 2020*

Volume Adjustment

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume	389	635	89	87	425	15	105	484	83	15	326	258
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adjusted Flow Rate	432	706	99	97	472	17	117	538	92	17	362	287
Lane Group	L	T	R	L	T	R	L	T	R	L	T	R
Adjusted Flow Rate	432	706	99	97	472	17	117	538	92	17	362	287
Proportion of LT or RT	1.000	--	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--	1.000

Saturation Flow Rate

Base Satflow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Number of Lanes	1	1	1	1	1	1	1	1	1	1	1	1
f_W	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_{HV}	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_g	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_p	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_{bb}	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_a	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_{LU}	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_{LT}	0.950	1.000	--	0.950	1.000	--	0.950	1.000	--	0.950	1.000	--
Secondary f_{LT}			--			--			--			--
f_{RT}	--	1.000	0.850	--	1.000	0.850	--	1.000	0.850	--	1.000	0.850
f_{Lpb}	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--
f_{Rpb}	--	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--	1.000	1.000
Adjusted Satflow	1805	1900	1615	1805	1900	1615	1805	1900	1615	1805	1900	1615
Secondary Adjusted Satflow			--			--			--			--

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Alii Hwy/Kuakini - AM Peak - 2020*

Capacity Analysis

	EB			WB			NB			SB		
Lane Group	L	T	R	L	T	R	L	T	R	L	T	R
Adjusted Flow Rate	432	706	99	97	472	17	117	538	92	17	362	287
Satflow Rate	1805	1900	1615	1805	1900	1615	1805	1900	1615	1805	1900	1615
Lost Time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green Ratio	0.16	0.20	0.39	0.16	0.20	0.39	0.14	0.30	0.51	0.14	0.30	0.51
Lane Group Capacity	289	380	630	289	380	630	253	570	824	253	570	824
v/c Ratio	1.49	1.86	0.16	0.34	1.24	0.03	0.46	0.94	0.11	0.07	0.64	0.35
Flow Ratio	0.24	0.37	0.06	0.05	0.25	0.01	0.06	0.28	0.06	0.01	0.19	0.18
Critical Lane Group	Y	Y	N	N	N	N	Y	Y	N	N	N	N
Sum Flow Ratios	0.96											
Lost Time/Cycle	20.00											
Critical v/c Ratio	1.20											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane Group	L	T	R	L	T	R	L	T	R	L	T	R
Adjusted Flow Rate	432	706	99	97	472	17	117	538	92	17	362	287
Lane Group Capacity	289	380	630	289	380	630	253	570	824	253	570	824
v/c Ratio	1.49	1.86	0.16	0.34	1.24	0.03	0.46	0.94	0.11	0.07	0.64	0.35
Green Ratio	0.16	0.20	0.39	0.16	0.20	0.39	0.14	0.30	0.51	0.14	0.30	0.51
Uniform Delay d_1	42.0	40.0	19.8	37.3	40.0	18.8	39.5	34.2	12.7	37.3	30.3	14.6
Delay Factor k	0.50	0.50	0.11	0.11	0.50	0.11	0.11	0.46	0.11	0.11	0.22	0.11
Incremental Delay d_2	240.1	396.1	0.1	0.7	129.4	0.0	1.3	24.6	0.1	0.1	2.3	0.3
PF Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control Delay	282.1	436.1	19.9	38.0	169.4	18.8	40.9	58.7	12.8	37.4	32.6	14.9
Lane Group LOS	F	F	B	D	F	B	D	E	B	D	C	B
Approach Delay	349.0			143.3			50.3			25.1		
Approach LOS	F			F			D			C		
Intersection Delay	176.1			Intersection LOS						F		

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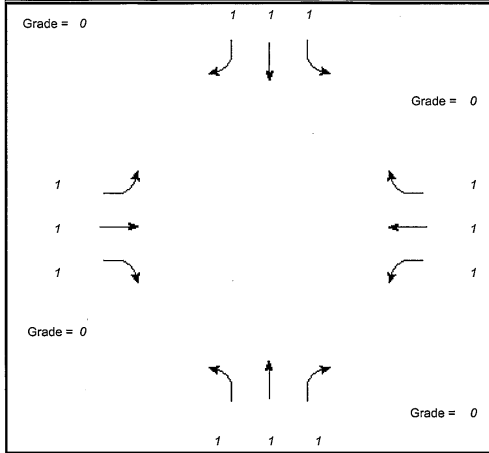
FULL REPORT

General Information		Site Information	
Analyst	*JW*	Intersection	*Alii Highway/Kuakini Highway*
Agency or Co.	*PBQD*	Area Type	*All other areas*
Date Performed	*1/3/2007*	Jurisdiction	*Hawaii County*
Time Period	*PM Peak*	Analysis Year	*2020 (unwidened)*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	305	645	208	166	670	15	210	503	151	15	516	322
% Heavy Veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup Lost Time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival Type	3	3	3	3	3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/Hour												
Bus Stops/Hour	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Timing	3.2			3.2			3.2			3.2		

	Excl. Left	Thru & RT	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 13.0	G = 21.0	G =	G =	G = 16.0	G = 30.0	G =	G =
	Y = 5	Y = 5	Y =	Y =	Y = 5	Y = 5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 100.0		

VOLUME ADJUSTMENT AND SATURATION FLOW RATE WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Alii Hwy/Kuakini - PM Peak - 2020*

Volume Adjustment

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume	305	645	208	166	670	15	210	503	151	15	516	322
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adjusted Flow Rate	339	717	231	184	744	17	233	559	168	17	573	358
Lane Group	L	T	R	L	T	R	L	T	R	L	T	R
Adjusted Flow Rate	339	717	231	184	744	17	233	559	168	17	573	358
Proportion of LT or RT	1.000	--	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--	1.000

Saturation Flow Rate

Base Satflow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Number of Lanes	1	1	1	1	1	1	1	1	1	1	1	1
f_W	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_{HV}	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_g	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_p	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_{bb}	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_a	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_{LU}	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_{LT}	0.950	1.000	--	0.950	1.000	--	0.950	1.000	--	0.950	1.000	--
Secondary f_{LT}			--			--			--			--
f_{RT}	--	1.000	0.850	--	1.000	0.850	--	1.000	0.850	--	1.000	0.850
f_{Lpb}	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--
f_{Rpb}	--	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--	1.000	1.000
Adjusted Satflow	1805	1900	1615	1805	1900	1615	1805	1900	1615	1805	1900	1615
Secondary Adjusted Satflow			--			--			--			--

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Alii Hwy/Kuakini - PM Peak - 2020*

Capacity Analysis

	EB			WB			NB			SB		
Lane Group	L	T	R	L	T	R	L	T	R	L	T	R
Adjusted Flow Rate	339	717	231	184	744	17	233	559	168	17	573	358
Satflow Rate	1805	1900	1615	1805	1900	1615	1805	1900	1615	1805	1900	1615
Lost Time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green Ratio	0.13	0.21	0.42	0.13	0.21	0.42	0.16	0.30	0.48	0.16	0.30	0.48
Lane Group Capacity	235	399	678	235	399	678	289	570	775	289	570	775
v/c Ratio	1.44	1.80	0.34	0.78	1.86	0.03	0.81	0.98	0.22	0.06	1.01	0.46
Flow Ratio	0.19	0.38	0.14	0.10	0.39	0.01	0.13	0.29	0.10	0.01	0.30	0.22
Critical Lane Group	Y	N	N	N	Y	N	Y	N	N	N	Y	N
Sum Flow Ratios	1.01											
Lost Time/Cycle	20.00											
Critical v/c Ratio	1.26											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane Group	L	T	R	L	T	R	L	T	R	L	T	R
Adjusted Flow Rate	339	717	231	184	744	17	233	559	168	17	573	358
Lane Group Capacity	235	399	678	235	399	678	289	570	775	289	570	775
v/c Ratio	1.44	1.80	0.34	0.78	1.86	0.03	0.81	0.98	0.22	0.06	1.01	0.46
Green Ratio	0.13	0.21	0.42	0.13	0.21	0.42	0.16	0.30	0.48	0.16	0.30	0.48
Uniform Delay d_1	43.5	39.5	19.6	42.1	39.5	17.0	40.5	34.7	15.1	35.6	35.0	17.4
Delay Factor k	0.50	0.50	0.11	0.33	0.50	0.11	0.35	0.48	0.11	0.11	0.50	0.11
Incremental Delay d_2	221.6	368.5	0.3	15.7	398.6	0.0	15.4	32.7	0.1	0.1	39.0	0.4
PF Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control Delay	265.1	408.0	19.9	57.9	438.1	17.0	55.9	67.4	15.2	35.7	74.0	17.8
Lane Group LOS	F	F	B	E	F	B	E	E	B	D	E	B
Approach Delay	300.7			356.5			55.5			52.1		
Approach LOS	F			F			E			D		
Intersection Delay	199.7			Intersection LOS						F		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Keakealani Dr/Kuakini Hwy
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	1/3/2007	Analysis Year	2020
Analysis Time Period	AM Peak		

Project Description: Kuakini Hwy Widening - Keakealani/Kuakini - AM Pk - 2020

East/West Street: Keakealani Drive | North/South Street: Kuakini Highway

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	10	405	10	30	278	13
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	11	450	11	33	308	14
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	1	1	1	1
Configuration	L	T	R	L	T	R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	22	1	25	5	1	10
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	24	1	27	5	1	11
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L		LTR			LTR	
v (veh/h)	11	33		17			52	
C (m) (veh/h)	1249	1111		416			398	
v/c	0.01	0.03		0.04			0.13	
95% queue length	0.03	0.09		0.13			0.45	
Control Delay (s/veh)	7.9	8.3		14.0			15.4	
LOS	A	A		B			C	
Approach Delay (s/veh)	--	--	14.0			15.4		
Approach LOS	--	--	B			C		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Keakealani Dr/Kuakini Hwy
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	1/3/2007	Analysis Year	2020
Analysis Time Period	PM Peak		

Project Description: Kuakini Hwy Widening - Keakealani/Kuakini - PM Pk -2020

East/West Street: Keakealani Drive | North/South Street: Kuakini Highway

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	15	347	5	10	352	54
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	16	385	5	11	391	60
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	1	1	1	1
Configuration	L	T	R	L	T	R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	37	5	10	40	5	15
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	41	5	11	44	5	16
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L		LTR			LTR	
v (veh/h)	16	11		65			57	
C (m) (veh/h)	1120	1180		310			308	
v/c	0.01	0.01		0.21			0.19	
95% queue length	0.04	0.03		0.78			0.67	
Control Delay (s/veh)	8.3	8.1		19.7			19.3	
LOS	A	A		C			C	
Approach Delay (s/veh)	--	--	19.7			19.3		
Approach LOS	--	--	C			C		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Queen Kaahumanu Hwy/KuakiniHwy
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	1/3/2007	Analysis Year	2020 (For NB LT)
Analysis Time Period	AM Peak		

Project Description: Kuakini Hwy Widening-Queen Kaahumanu/Kuakini- AM-2020-NBL

East/West Street: Kuakini Highway | North/South Street: Queen Kaahumanu Highway

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	405	650			411	20
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	450	722	0	0	456	22
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			1
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	15					
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	16	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			1			0
Lanes	1	0	0	0	0	0
Configuration	L					

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		
v (veh/h)	450					16		
C (m) (veh/h)	1115					101		
v/c	0.40					0.16		
95% queue length	1.98					0.54		
Control Delay (s/veh)	10.4					47.2		
LOS	B					E		
Approach Delay (s/veh)	--	--				47.2		
Approach LOS	--	--				E		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Queen Kaahumanu Hwy/KuakiniHwy
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	1/3/2007	Analysis Year	2020 (For EB LT Part 1)
Analysis Time Period	AM Peak		

Project Description: Kuakini Hwy Widening-Queen Kaahumanu/Kuakini- AM-2020-EBLPT1

East/West Street: Kuakini Highway | North/South Street: Queen Kaahumanu Highway

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	405	5			411	20
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	450	5	0	0	456	22
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			1
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	15					
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	16	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			1			0
Lanes	1	0	0	0	0	0
Configuration	L					

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		
v (veh/h)	450					16		
C (m) (veh/h)	1115					218		
v/c	0.40					0.07		
95% queue length	1.98					0.24		
Control Delay (s/veh)	10.4					22.8		
LOS	B					C		
Approach Delay (s/veh)	--	--				22.8		
Approach LOS	--	--				C		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Queen Kaahumanu Hwy/KuakiniHwy
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	1/3/2007	Analysis Year	2020 (For EB LT Part 2)
Analysis Time Period	AM Peak		

Project Description: Kuakini Hwy Widening-Queen Kaahumanu/Kuakini- AM-2020-EBLPT2

East/West Street: Kuakini Highway | North/South Street: Queen Kaahumanu Highway

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	5	650			5	5
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	5	722	0	0	5	5
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			1
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	15					
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	16	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			1			0
Lanes	1	0	0	0	0	0
Configuration	L					

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		
v (veh/h)	5					16		
C (m) (veh/h)	1630					453		
v/c	0.00					0.04		
95% queue length	0.01					0.11		
Control Delay (s/veh)	7.2					13.2		
LOS	A					B		
Approach Delay (s/veh)	--	--				13.2		
Approach LOS	--	--				B		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Queen Kaahumanu Hwy/Kuakini Hw
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	1/3/2007	Analysis Year	2020 (For NB LT)
Analysis Time Period	PM Peak		

Project Description: Kuakini Hwy Widening - Queen K/Kuakini - PM - 2020-NB LT

East/West Street: Kuakini Highway | North/South Street: Queen Kaahumanu Highway

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	352	615			642	15
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	391	683	0	0	713	16
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			1
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	35					
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	38	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			1			0
Lanes	1	0	0	0	0	0
Configuration	L					

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		
v (veh/h)	391					38		
C (m) (veh/h)	896					112		
v/c	0.44					0.34		
95% queue length	2.24					1.34		
Control Delay (s/veh)	12.1					52.8		
LOS	B					F		
Approach Delay (s/veh)	--	--				52.8		
Approach LOS	--	--				F		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Queen Kaahumanu Hwy/Kuakini Hw
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	1/3/2007	Analysis Year	2020 (For EB LT Part 1)
Analysis Time Period	PM Peak		

Project Description: Kuakini Hwy Widening - Queen K/Kuakini - PM - 2020-EBLPT1

East/West Street: Kuakini Highway | North/South Street: Queen Kaahumanu Highway

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	352	5			642	15
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	391	5	0	0	713	16
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			1
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	35					
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	38	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			1			0
Lanes	1	0	0	0	0	0
Configuration	L					

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		
v (veh/h)	391					38		
C (m) (veh/h)	896					223		
v/c	0.44					0.17		
95% queue length	2.24					0.60		
Control Delay (s/veh)	12.1					24.4		
LOS	B					C		
Approach Delay (s/veh)	--	--				24.4		
Approach LOS	--	--				C		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JW	Intersection	Queen Kaahumanu Hwy/Kuakini Hw
Agency/Co.	PBQD	Jurisdiction	Hawaii County
Date Performed	1/3/2007	Analysis Year	2020 (For EB LT Part 2)
Analysis Time Period	PM Peak		

Project Description: Kuakini Hwy Widening - Queen K/Kuakini - PM - 2020-EBLPT2

East/West Street: Kuakini Highway | North/South Street: Queen Kaahumanu Highway

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	5	615			5	5
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	5	683	0	0	5	5
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			1
Lanes	1	1	0	0	1	1
Configuration	L	T			T	R
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	35					
Peak-Hour Factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate, HFR (veh/h)	38	0	0	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			1			0
Lanes	1	0	0	0	0	0
Configuration	L					

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		
v (veh/h)	5					38		
C (m) (veh/h)	1630					471		
v/c	0.00					0.08		
95% queue length	0.01					0.26		
Control Delay (s/veh)	7.2					13.3		
LOS	A					B		
Approach Delay (s/veh)	--	--				13.3		
Approach LOS	--	--				B		

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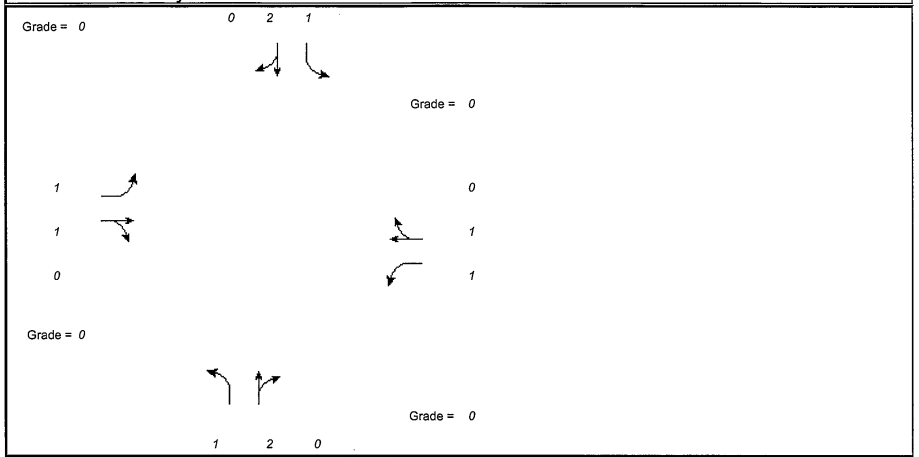
FULL REPORT

General Information		Site Information	
Analyst	*JW*	Intersection	*Hualalai Road/Kuakini Highway*
Agency or Co.	*PBQD*	Area Type	*All other areas*
Date Performed	*1/3/2007*	Jurisdiction	*Hawaii County*
Time Period	*AM Peak*	Analysis Year	*2020 (2 SB thrus-Widened)*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	*170*	*49*	*44*	*99*	*107*	*135*	*81*	*829*	*153*	*115*	*619*	*175*
% Heavy Veh	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Actuated (P/A)	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*	*A*
Startup Lost Time	*2.0*	*2.0*		*2.0*	*2.0*		*2.0*	*2.0*		*2.0*	*2.0*	
Extension of Effective Green	*2.0*	*2.0*		*2.0*	*2.0*		*2.0*	*2.0*		*2.0*	*2.0*	
Arrival Type	*3*	*3*		*3*	*3*		*3*	*3*		*3*	*3*	
Unit Extension	*3.0*	*3.0*		*3.0*	*3.0*		*3.0*	*3.0*		*3.0*	*3.0*	
Ped/Bike/RTOR Volume	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lane Width	*12.0*	*12.0*		*12.0*	*12.0*		*12.0*	*12.0*		*12.0*	*12.0*	
Parking (Y or N)	*N*		*N*	*N*		*N*	*N*		*N*	*N*		*N*
Parking/Hour												
Bus Stops/Hour	*0*	*0*		*0*	*0*		*0*	*0*		*0*	*0*	
Pedestrian Timing	*3.2*			*3.2*			*3.2*			*3.2*		

	Excl. Left	EW Perm	03	04	Excl. Left	Thru & RT	07	08
Timing	G = *8.0*	G = *20.0*	G = *0.0*	G =	G = *12.0*	G = *40.0*	G = *0.0*	G =
	Y = *5*	Y = *5*	Y = *0*	Y =	Y = *5*	Y = *5*	Y = *0*	Y =
Duration of Analysis (hrs) = *0.25*						Cycle Length C = *100.0*		

VOLUME ADJUSTMENT AND SATURATION FLOW RATE WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Hualalai/Kuakini-AM Peak-2020-2SBthru*

Volume Adjustment

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume	*170*	*49*	*44*	*99*	*107*	*135*	*81*	*829*	*153*	*115*	*619*	*175*
PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Adjusted Flow Rate	*189*	*54*	*49*	*110*	*119*	*150*	*90*	*921*	*170*	*128*	*688*	*194*
Lane Group	*L*	*TR*		*L*	*TR*		*L*	*TR*		*L*	*TR*	
Adjusted Flow Rate	*189*	*103*		*110*	*269*		*90*	*1091*		*128*	*882*	
Proportion of LT or RT	*1.000*	--	*0.476*	*1.000*	--	*0.558*	*1.000*	--	*0.156*	*1.000*	--	*0.220*

Saturation Flow Rate

Base Satflow	*1900*	*1900*		*1900*	*1900*		*1900*	*1900*		*1900*	*1900*	
Number of Lanes	*1*	*1*	*0*	*1*	*1*	*0*	*1*	*2*	*0*	*1*	*2*	*0*
f_W	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
f_{HV}	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
f_g	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
f_p	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
f_{bb}	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
f_a	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*1.000*	
f_{LU}	*1.000*	*1.000*		*1.000*	*1.000*		*1.000*	*0.952*		*1.000*	*0.952*	
f_{LT}	*0.950*	*1.000*	--	*0.950*	*1.000*	--	*0.950*	*1.000*	--	*0.950*	*1.000*	--
Secondary f_{LT}	*0.260*	*0.260*	--	*0.556*	*0.556*	--			--			--
f_{RT}	--	*0.929*		--	*0.916*		--	*0.977*		--	*0.967*	
f_{Lpb}	*1.000*	*1.000*	--	*1.000*	*1.000*	--	*1.000*	*1.000*	--	*1.000*	*1.000*	--
f_{Rpb}	--	*1.000*		--	*1.000*		--	*1.000*		--	*1.000*	
Adjusted Satflow	*1805*	*1764*		*1805*	*1741*		*1805*	*3533*		*1805*	*3498*	
Secondary Adjusted Satflow	*494*	*459*	--	*1057*	*969*	--			--			--

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Hualalai/Kuakini-AM Peak-2020-2SBthru*

Capacity Analysis

	EB			WB			NB			SB		
Lane Group	L	TR		L	TR		L	TR		L	TR	
Adjusted Flow Rate	189	103		110	269		90	1091		128	882	
Satflow Rate	1805	1764		1805	1741		1805	3533		1805	3498	
Lost Time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Green Ratio	0.33	0.20		0.33	0.20		0.12	0.40		0.12	0.40	
Lane Group Capacity	268	353		408	348		217	1413		217	1399	
v/c Ratio	0.71	0.29		0.27	0.77		0.41	0.77		0.59	0.63	
Flow Ratio	0.08	0.06		0.06	0.15		0.05	0.31		0.07	0.25	
Critical Lane Group	Y	N		N	Y		N	Y		Y	N	
Sum Flow Ratios	0.61											
Lost Time/Cycle	20.00											
Critical v/c Ratio	0.77											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane Group	L	TR		L	TR		L	TR		L	TR	
Adjusted Flow Rate	189	103		110	269		90	1091		128	882	
Lane Group Capacity	268	353		408	348		217	1413		217	1399	
v/c Ratio	0.71	0.29		0.27	0.77		0.41	0.77		0.59	0.63	
Green Ratio	0.33	0.20		0.33	0.20		0.12	0.40		0.12	0.40	
Uniform Delay d_1	26.3	34.0		24.0	37.9		40.7	26.0		41.7	24.1	
Delay Factor k	0.27	0.11		0.11	0.32		0.11	0.32		0.18	0.21	
Incremental Delay d_2	8.2	0.5		0.4	10.3		1.3	2.7		4.2	0.9	
PF Factor	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Control Delay	34.4	34.4		24.4	48.2		42.0	28.8		45.9	25.0	
Lane Group LOS	C	C		C	D		D	C		D	C	
Approach Delay	34.4			41.3			29.8			27.6		
Approach LOS	C			D			C			C		
Intersection Delay	31.0			Intersection LOS						C		

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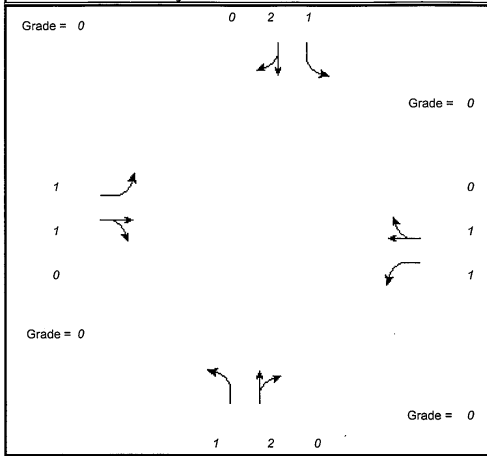
FULL REPORT

General Information		Site Information	
Analyst	*JW*	Intersection	*Hualalai Road/Kuakini Highway*
Agency or Co.	*PBQD*	Area Type	*All other areas*
Date Performed	*1/3/2007*	Jurisdiction	*Hawaii County*
Time Period	*PM Peak*	Analysis Year	*2020 (2 SB thrus-Widened)*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	180	86	80	251	127	135	83	609	236	85	692	215
% Heavy Veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup Lost Time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Extension of Effective Green	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Arrival Type	3	3		3	3		3	3		3	3	
Unit Extension	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/Hour												
Bus Stops/Hour	0	0		0	0		0	0		0	0	
Pedestrian Timing	3.2			3.2			3.2			3.2		

	Excl. Left	EW Perm	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 7.0	G = 24.0	G = 0.0	G =	G = 13.0	G = 36.0	G = 0.0	G =
	Y = 5	Y = 5	Y = 0	Y =	Y = 5	Y = 5	Y = 0	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 100.0		

VOLUME ADJUSTMENT AND SATURATION FLOW RATE WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Hualalai/Kuakini-PM Peak-2020-2SBthru*

Volume Adjustment

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume	180	86	80	251	127	135	83	609	236	85	692	215
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adjusted Flow Rate	200	96	89	279	141	150	92	677	262	94	769	239
Lane Group	L	TR		L	TR		L	TR		L	TR	
Adjusted Flow Rate	200	185		279	291		92	939		94	1008	
Proportion of LT or RT	1.000	--	0.481	1.000	--	0.515	1.000	--	0.279	1.000	--	0.237

Saturation Flow Rate

Base Satflow	1900	1900		1900	1900		1900	1900		1900	1900	
Number of Lanes	1	1	0	1	1	0	1	2	0	1	2	0
f_W	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
f_{HV}	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
f_g	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
f_p	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
f_{bb}	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
f_a	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
f_{LU}	1.000	1.000		1.000	1.000		1.000	0.952		1.000	0.952	
f_{LT}	0.950	1.000	--	0.950	1.000	--	0.950	1.000	--	0.950	1.000	--
Secondary f_{LT}	0.288	0.288	--	0.448	0.448	--			--			--
f_{RT}	--	0.928		--	0.923		--	0.958		--	0.964	
f_{Lpb}	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--
f_{Rpb}	--	1.000		--	1.000		--	1.000		--	1.000	
Adjusted Satflow	1805	1763		1805	1753		1805	3466		1805	3489	
Secondary Adjusted Satflow	547	507	--	852	786	--			--			--

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Hualalai/Kuakini-PM Peak-2020-2SBthru*

Capacity Analysis

	EB			WB			NB			SB		
Lane Group	L	TR		L	TR		L	TR		L	TR	
Adjusted Flow Rate	200	185		279	291		92	939		94	1008	
Satflow Rate	1805	1763		1805	1753		1805	3466		1805	3489	
Lost Time	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Green Ratio	0.36	0.24		0.36	0.24		0.13	0.36		0.13	0.36	
Lane Group Capacity	285	423		373	421		235	1248		235	1256	
v/c Ratio	0.70	0.44		0.75	0.69		0.39	0.75		0.40	0.80	
Flow Ratio	0.07	0.10		0.07	0.17		0.05	0.27		0.05	0.29	
Critical Lane Group	N	N		Y	N		N	N		Y	Y	
Sum Flow Ratios	0.59											
Lost Time/Cycle	15.00											
Critical v/c Ratio	0.69											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane Group	L	TR		L	TR		L	TR		L	TR	
Adjusted Flow Rate	200	185		279	291		92	939		94	1008	
Lane Group Capacity	285	423		373	421		235	1248		235	1256	
v/c Ratio	0.70	0.44		0.75	0.69		0.39	0.75		0.40	0.80	
Green Ratio	0.36	0.24		0.36	0.24		0.13	0.36		0.13	0.36	
Uniform Delay d_1	29.4	32.3		30.5	34.6		39.9	28.1		39.9	28.8	
Delay Factor k	0.27	0.11		0.30	0.26		0.11	0.31		0.11	0.35	
Incremental Delay d_2	7.5	0.7		8.1	4.8		1.1	2.6		1.1	3.9	
PF Factor	1.000	1.000		1.000	1.000		1.000	1.000		1.000	1.000	
Control Delay	37.0	33.0		38.6	39.4		41.0	30.7		41.0	32.7	
Lane Group LOS	D	C		D	D		D	C		D	C	
Approach Delay	35.1			39.0			31.6			33.4		
Approach LOS	D			D			C			C		
Intersection Delay	34.0			Intersection LOS						C		

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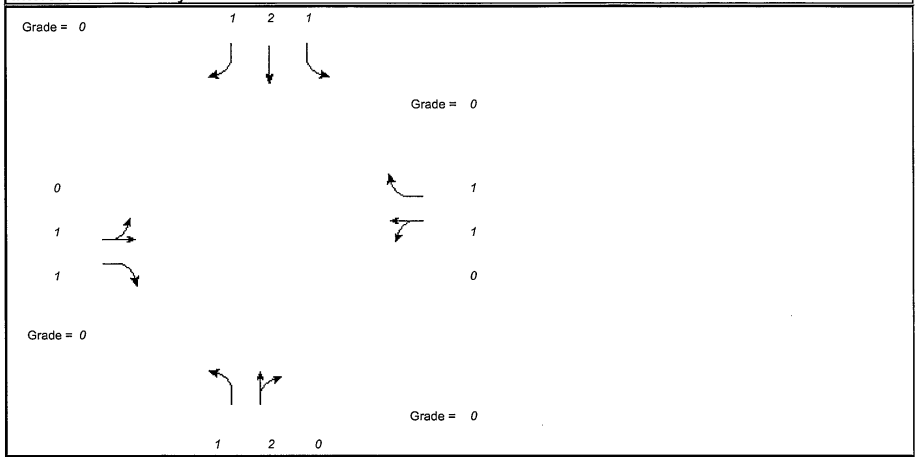
FULL REPORT

General Information		Site Information	
Analyst	JW	Intersection	Walua Rd/Onioni St/Kuakini Hwy
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	1/3/2007	Jurisdiction	Hawaii
Time Period	AM Peak	Analysis Year	2020 wide w/ LT bays

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	177	10	89	13	15	68	110	761	17	32	522	140
% Heavy Veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup Lost Time		2.0	2.0		2.0	2.0	2.0	2.0		2.0	2.0	2.0
Extension of Effective Green		2.0	2.0		2.0	2.0	2.0	2.0		2.0	2.0	2.0
Arrival Type		3	3		3	3	3	3		3	3	3
Unit Extension		3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0		12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/Hour												
Bus Stops/Hour		0	0		0	0	0	0		0	0	0
Pedestrian Timing	3.2			3.2			3.2			3.2		

	EB Only	EW Perm	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 19.0	G = 7.0	G =	G =	G = 19.0	G = 40.0	G =	G =
	Y = 0	Y = 5	Y =	Y =	Y = 5	Y = 5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 100.0		

VOLUME ADJUSTMENT AND SATURATION FLOW RATE WORKSHEET

General Information

Project Description *Kuakini Hwy - Walua/Onioni/Kuakini -AM-2020-wide w/LT bays*

Volume Adjustment

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume	177	10	89	13	15	68	110	761	17	32	522	140
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adjusted Flow Rate	197	11	99	14	17	76	122	846	19	36	580	156
Lane Group		LT	R		LT	R	L	TR		L	T	R
Adjusted Flow Rate		208	99		31	76	122	865		36	580	156
Proportion of LT or RT	0.947	--	1.000	0.452	--	1.000	1.000	--	0.022	1.000	--	1.000

Saturation Flow Rate

Base Satflow		1900	1900		1900	1900	1900	1900		1900	1900	1900
Number of Lanes	0	1	1	0	1	1	1	2	0	1	2	1
f_W		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_{HV}		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_g		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_p		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_{bb}		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_a		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_{LU}		1.000	1.000		1.000	1.000	1.000	0.952		1.000	0.952	1.000
f_{LT}		0.955	--		0.757	--	0.950	1.000	--	0.950	1.000	--
Secondary f_{LT}		0.618	--			--			--			--
f_{RT}	--	1.000	0.850	--	1.000	0.850	--	0.997		--	1.000	0.850
f_{Lpb}		1.000	--		1.000	--	1.000	1.000	--	1.000	1.000	--
f_{Rpb}	--	1.000	1.000	--	1.000	1.000	--	1.000		--	1.000	1.000
Adjusted Satflow		1814	1615		1438	1615	1805	3606		1805	3618	1615
Secondary Adjusted Satflow		1173	--			--			--			--

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kuakini Hwy - Walua/Onioni/Kuakini -AM-2020-wide w/LT bays*

Capacity Analysis

	EB			WB			NB			SB		
Lane Group		LT	R		LT	R	L	TR		L	T	R
Adjusted Flow Rate		208	99		31	76	122	865		36	580	156
Satflow Rate		1814	1615		1438	1615	1805	3606		1805	3618	1615
Lost Time		2.0	2.0		2.0	2.0	2.0	2.0		2.0	2.0	2.0
Green Ratio		0.26	0.50		0.07	0.31	0.19	0.40		0.19	0.40	0.40
Lane Group Capacity		395	808		101	501	343	1442		343	1447	646
v/c Ratio		0.53	0.12		0.31	0.15	0.36	0.60		0.10	0.40	0.24
Flow Ratio		0.11	0.06		0.02	0.05	0.07	0.24		0.02	0.16	0.10
Critical Lane Group		Y	N		Y	N	Y	Y		N	N	N
Sum Flow Ratios	0.44											
Lost Time/Cycle	20.00											
Critical v/c Ratio	0.55											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane Group		LT	R		LT	R	L	TR		L	T	R
Adjusted Flow Rate		208	99		31	76	122	865		36	580	156
Lane Group Capacity		395	808		101	501	343	1442		343	1447	646
v/c Ratio		0.53	0.12		0.31	0.15	0.36	0.60		0.10	0.40	0.24
Green Ratio		0.26	0.50		0.07	0.31	0.19	0.40		0.19	0.40	0.40
Uniform Delay d_1		31.7	13.3		44.2	25.0	35.2	23.7		33.5	21.4	19.9
Delay Factor k		0.13	0.11		0.11	0.11	0.11	0.19		0.11	0.11	0.11
Incremental Delay d_2		1.3	0.1		1.7	0.1	0.6	0.7		0.1	0.2	0.2
PF Factor		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
Control Delay		33.0	13.4		45.9	25.1	35.8	24.4		33.6	21.6	20.1
Lane Group LOS		C	B		D	C	D	C		C	C	C
Approach Delay	26.7			31.1			25.8			21.9		
Approach LOS	C			C			C			C		
Intersection Delay	24.8			Intersection LOS						C		

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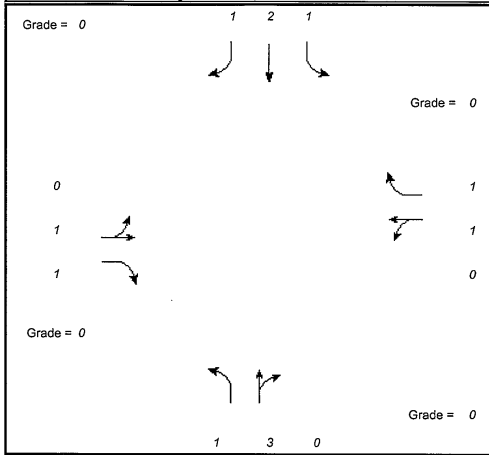
FULL REPORT

General Information		Site Information	
Analyst	*JW*	Intersection	*Walua Rd/Onioni St/Kuakini Hwy*
Agency or Co.	*PBQD*	Area Type	*All other areas*
Date Performed	*1/3/2007*	Jurisdiction	*Hawaii*
Time Period	*PM Peak*	Analysis Year	*2020 wide w/LT bays*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	153	15	152	20	5	56	186	607	30	18	681	241
% Heavy Veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup Lost Time		2.0	2.0		2.0	2.0	2.0	2.0		2.0	2.0	2.0
Extension of Effective Green		2.0	2.0		2.0	2.0	2.0	2.0		2.0	2.0	2.0
Arrival Type		3	3		3	3	3	3		3	3	3
Unit Extension		3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0		12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/Hour												
Bus Stops/Hour		0	0		0	0	0	0		0	0	0
Pedestrian Timing	3.2			3.2			3.2			3.2		

	EB Only	EW Perm	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 19.0	G = 16.0	G =	G =	G = 20.0	G = 30.0	G =	G =
	Y = 0	Y = 5	Y =	Y =	Y = 5	Y = 5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 100.0		

VOLUME ADJUSTMENT AND SATURATION FLOW RATE WORKSHEET

General Information

Project Description *Kuakini Hwy - Walua/Onioni/Kuakini-PM-2020-wide w/LT bays*

Volume Adjustment

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume	153	15	152	20	5	56	186	607	30	18	681	241
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adjusted Flow Rate	170	17	169	22	6	62	207	674	33	20	757	268
Lane Group		LT	R		LT	R	L	TR		L	T	R
Adjusted Flow Rate		187	169		28	62	207	707		20	757	268
Proportion of LT or RT	0.909	--	1.000	0.786	--	1.000	1.000	--	0.047	1.000	--	1.000

Saturation Flow Rate

Base Satflow		1900	1900		1900	1900	1900	1900		1900	1900	1900
Number of Lanes	0	1	1	0	1	1	1	3	0	1	2	1
f_W		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_{HV}		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_g		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_p		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_{bb}		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_a		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
f_{LU}		1.000	1.000		1.000	1.000	1.000	0.908		1.000	0.952	1.000
f_{LT}		0.957	--		0.732	--	0.950	1.000	--	0.950	1.000	--
Secondary f_{LT}		0.679	--			--			--			--
f_{RT}	--	1.000	0.850	--	1.000	0.850	--	0.993		--	1.000	0.850
f_{Lpb}		1.000	--		1.000	--	1.000	1.000	--	1.000	1.000	--
f_{Rpb}	--	1.000	1.000	--	1.000	1.000	--	1.000		--	1.000	1.000
Adjusted Satflow		1817	1615		1390	1615	1805	5139		1805	3618	1615
Secondary Adjusted Satflow		1291	--			--			--			--

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kuakini Hwy - Walua/Onioni/Kuakini-PM-2020-wide w/LT bays*

Capacity Analysis

	EB			WB			NB			SB		
Lane Group		LT	R		LT	R	L	TR		L	T	R
Adjusted Flow Rate		187	169		28	62	207	707		20	757	268
Satflow Rate		1817	1615		1390	1615	1805	5139		1805	3618	1615
Lost Time		2.0	2.0		2.0	2.0	2.0	2.0		2.0	2.0	2.0
Green Ratio		0.35	0.35		0.16	0.16	0.20	0.30		0.20	0.30	0.30
Lane Group Capacity		525	565		222	258	361	1542		361	1085	485
v/c Ratio		0.36	0.30		0.13	0.24	0.57	0.46		0.06	0.70	0.55
Flow Ratio		0.10	0.10		0.02	0.04	0.11	0.14		0.01	0.21	0.17
Critical Lane Group		Y	N		N	Y	Y	N		N	Y	N
Sum Flow Ratios	0.47											
Lost Time/Cycle	20.00											
Critical v/c Ratio	0.58											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane Group		LT	R		LT	R	L	TR		L	T	R
Adjusted Flow Rate		187	169		28	62	207	707		20	757	268
Lane Group Capacity		525	565		222	258	361	1542		361	1085	485
v/c Ratio		0.36	0.30		0.13	0.24	0.57	0.46		0.06	0.70	0.55
Green Ratio		0.35	0.35		0.16	0.16	0.20	0.30		0.20	0.30	0.30
Uniform Delay d_1		24.1	23.6		36.0	36.7	36.1	28.4		32.4	31.0	29.4
Delay Factor k		0.11	0.11		0.11	0.11	0.17	0.11		0.11	0.26	0.15
Incremental Delay d_2		0.4	0.3		0.3	0.5	2.2	0.2		0.1	2.0	1.4
PF Factor		1.000	1.000		1.000	1.000	1.000	1.000		1.000	1.000	1.000
Control Delay		24.6	23.9		36.3	37.2	38.4	28.6		32.4	33.0	30.7
Lane Group LOS		C	C		D	D	D	C		C	C	C
Approach Delay	24.2			36.9			30.8			32.4		
Approach LOS	C			D			C			C		
Intersection Delay	30.8			Intersection LOS						C		

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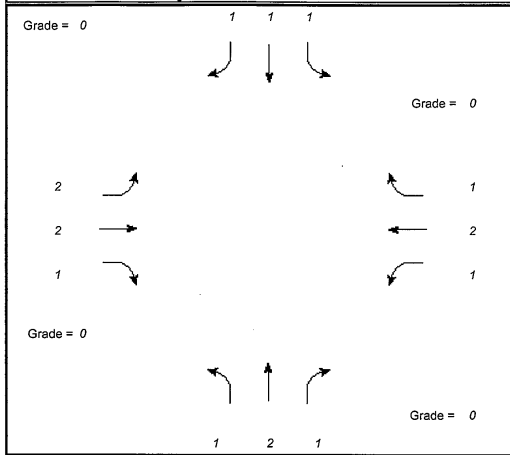
FULL REPORT

General Information		Site Information	
Analyst	JW	Intersection	Alii Highway/Kuakini Highway
Agency or Co.	PBQD	Area Type	All other areas
Date Performed	1/3/2007	Jurisdiction	Hawaii County
Time Period	AM Peak	Analysis Year	2020 (widened)

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	389	635	89	87	425	15	105	484	83	15	325	258
% Heavy Veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup Lost Time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival Type	3	3	3	3	3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/Hour												
Bus Stops/Hour	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Timing	3.2			3.2			3.2			3.2		

Timing	Excl. Left	Thru & RT	03	04	Excl. Left	Thru & RT	07	08
	G = 16.0	G = 20.0	G =	G =	G = 14.0	G = 30.0	G =	G =
	Y = 5	Y = 5	Y =	Y =	Y = 5	Y = 5	Y =	Y =
Duration of Analysis (hrs) = 0.25					Cycle Length C = 100.0			

VOLUME ADJUSTMENT AND SATURATION FLOW RATE WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Alii Hwy/Kuakini-AM Peak-2020-swide*

Volume Adjustment

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume	389	635	89	87	425	15	105	484	83	15	325	258
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adjusted Flow Rate	432	706	99	97	472	17	117	538	92	17	361	287
Lane Group	L	T	R	L	T	R	L	T	R	L	T	R
Adjusted Flow Rate	432	706	99	97	472	17	117	538	92	17	361	287
Proportion of LT or RT	1.000	--	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--	1.000

Saturation Flow Rate

Base Satflow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Number of Lanes	2	2	1	1	2	1	1	2	1	1	1	1
f_W	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_{HV}	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_g	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_p	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_{bb}	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_a	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_{LU}	0.971	0.952	1.000	1.000	0.952	1.000	1.000	0.952	1.000	1.000	1.000	1.000
f_{LT}	0.950	1.000	--	0.950	1.000	--	0.950	1.000	--	0.950	1.000	--
Secondary f_{LT}			--			--			--			--
f_{RT}	--	1.000	0.850	--	1.000	0.850	--	1.000	0.850	--	1.000	0.850
f_{Lpb}	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--
f_{Rpb}	--	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--	1.000	1.000
Adjusted Satflow	3505	3618	1615	1805	3618	1615	1805	3618	1615	1805	1900	1615
Secondary Adjusted Satflow			--			--			--			--

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Alii Hwy/Kuakini-AM Peak-2020-swide*

Capacity Analysis

	EB			WB			NB			SB		
Lane Group	L	T	R	L	T	R	L	T	R	L	T	R
Adjusted Flow Rate	432	706	99	97	472	17	117	538	92	17	361	287
Satflow Rate	3505	3618	1615	1805	3618	1615	1805	3618	1615	1805	1900	1615
Lost Time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green Ratio	0.16	0.20	0.39	0.16	0.20	0.39	0.14	0.30	0.51	0.14	0.30	0.51
Lane Group Capacity	561	724	630	289	724	630	253	1085	824	253	570	824
v/c Ratio	0.77	0.98	0.16	0.34	0.65	0.03	0.46	0.50	0.11	0.07	0.63	0.35
Flow Ratio	0.12	0.20	0.06	0.05	0.13	0.01	0.06	0.15	0.06	0.01	0.19	0.18
Critical Lane Group	Y	Y	N	N	N	N	Y	N	N	N	Y	N
Sum Flow Ratios	0.57											
Lost Time/Cycle	20.00											
Critical v/c Ratio	0.72											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane Group	L	T	R	L	T	R	L	T	R	L	T	R
Adjusted Flow Rate	432	706	99	97	472	17	117	538	92	17	361	287
Lane Group Capacity	561	724	630	289	724	630	253	1085	824	253	570	824
v/c Ratio	0.77	0.98	0.16	0.34	0.65	0.03	0.46	0.50	0.11	0.07	0.63	0.35
Green Ratio	0.16	0.20	0.39	0.16	0.20	0.39	0.14	0.30	0.51	0.14	0.30	0.51
Uniform Delay d_1	40.2	39.8	19.8	37.3	36.8	18.8	39.5	28.8	12.7	37.3	30.2	14.6
Delay Factor k	0.32	0.48	0.11	0.11	0.23	0.11	0.11	0.11	0.11	0.11	0.21	0.11
Incremental Delay d_2	6.5	27.3	0.1	0.7	2.1	0.0	1.3	0.4	0.1	0.1	2.3	0.3
PF Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control Delay	46.7	67.0	19.9	38.0	38.9	18.8	40.9	29.1	12.8	37.4	32.5	14.9
Lane Group LOS	D	E	B	D	D	B	D	C	B	D	C	B
Approach Delay	56.2			38.2			29.0			25.0		
Approach LOS	E			D			C			C		
Intersection Delay	40.2			Intersection LOS						D		

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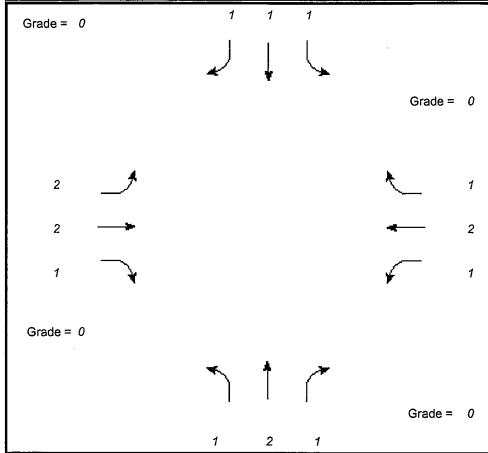
HCS+™ Version 5.21 Generated: 1/8/2007 4:54 PM

FULL REPORT

General Information		Site Information	
Analyst	*JW*	Intersection	*Alii Highway/Kuakini Highway*
Agency or Co.	*PBQD*	Area Type	*All other areas*
Date Performed	*1/3/2007*	Jurisdiction	*Hawaii County*
Time Period	*PM Peak*	Analysis Year	*2020 (widened)*

Intersection Geometry



Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume (vph)	305	645	208	166	670	15	210	503	151	15	516	322
% Heavy Veh	0	0	0	0	0	0	0	0	0	0	0	0
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Actuated (P/A)	A	A	A	A	A	A	A	A	A	A	A	A
Startup Lost Time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Arrival Type	3	3	3	3	3	3	3	3	3	3	3	3
Unit Extension	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ped/Bike/RTOR Volume	0	0	0	0	0	0	0	0	0	0	0	0
Lane Width	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Parking (Y or N)	N		N	N		N	N		N	N		N
Parking/Hour												
Bus Stops/Hour	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Timing	3.2			3.2			3.2			3.2		

	Excl. Left	Thru & RT	03	04	Excl. Left	Thru & RT	07	08
Timing	G = 13.0	G = 21.0	G =	G =	G = 16.0	G = 30.0	G =	G =
	Y = 5	Y = 5	Y =	Y =	Y = 5	Y = 5	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 100.0		

VOLUME ADJUSTMENT AND SATURATION FLOW RATE WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Alii Hwy/Kuakini-PM Peak-2020-swide*

Volume Adjustment

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Volume	305	645	208	166	670	15	210	503	151	15	516	322
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adjusted Flow Rate	339	717	231	184	744	17	233	559	168	17	573	358
Lane Group	L	T	R	L	T	R	L	T	R	L	T	R
Adjusted Flow Rate	339	717	231	184	744	17	233	559	168	17	573	358
Proportion of LT or RT	1.000	--	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--	1.000

Saturation Flow Rate

Base Satflow	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Number of Lanes	2	2	1	1	2	1	1	2	1	1	1	1
f_W	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_{HV}	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_g	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_p	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_{bb}	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_a	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
f_{LU}	0.971	0.952	1.000	1.000	0.952	1.000	1.000	0.952	1.000	1.000	1.000	1.000
f_{LT}	0.950	1.000	--	0.950	1.000	--	0.950	1.000	--	0.950	1.000	--
Secondary f_{LT}			--			--			--			--
f_{RT}	--	1.000	0.850	--	1.000	0.850	--	1.000	0.850	--	1.000	0.850
f_{Lpb}	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--
f_{Rpb}	--	1.000	1.000	--	1.000	1.000	--	1.000	1.000	--	1.000	1.000
Adjusted Satflow	3505	3618	1615	1805	3618	1615	1805	3618	1615	1805	1900	1615
Secondary Adjusted Satflow			--			--			--			--

CAPACITY AND LOS WORKSHEET

General Information

Project Description *Kuakini Hwy Widening - Alii Hwy/Kuakini-PM Peak-2020-swide*

Capacity Analysis

	EB			WB			NB			SB		
Lane Group	L	T	R	L	T	R	L	T	R	L	T	R
Adjusted Flow Rate	339	717	231	184	744	17	233	559	168	17	573	358
Satflow Rate	3505	3618	1615	1805	3618	1615	1805	3618	1615	1805	1900	1615
Lost Time	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Green Ratio	0.13	0.21	0.42	0.13	0.21	0.42	0.16	0.30	0.48	0.16	0.30	0.48
Lane Group Capacity	456	760	678	235	760	678	289	1085	775	289	570	775
v/c Ratio	0.74	0.94	0.34	0.78	0.98	0.03	0.81	0.52	0.22	0.06	1.01	0.46
Flow Ratio	0.10	0.20	0.14	0.10	0.21	0.01	0.13	0.15	0.10	0.01	0.30	0.22
Critical Lane Group	N	N	N	Y	Y	N	Y	N	N	N	Y	N
Sum Flow Ratios	0.74											
Lost Time/Cycle	20.00											
Critical v/c Ratio	0.92											

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Lane Group	L	T	R	L	T	R	L	T	R	L	T	R
Adjusted Flow Rate	339	717	231	184	744	17	233	559	168	17	573	358
Lane Group Capacity	456	760	678	235	760	678	289	1085	775	289	570	775
v/c Ratio	0.74	0.94	0.34	0.78	0.98	0.03	0.81	0.52	0.22	0.06	1.01	0.46
Green Ratio	0.13	0.21	0.42	0.13	0.21	0.42	0.16	0.30	0.48	0.16	0.30	0.48
Uniform Delay d_1	41.9	38.9	19.6	42.1	39.3	17.0	40.5	29.0	15.1	35.6	35.0	17.4
Delay Factor k	0.30	0.46	0.11	0.33	0.48	0.11	0.35	0.12	0.11	0.11	0.50	0.11
Incremental Delay d_2	6.5	20.1	0.3	15.7	27.4	0.0	15.4	0.4	0.1	0.1	39.0	0.4
PF Factor	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Control Delay	48.4	59.0	19.9	57.9	66.7	17.0	55.9	29.4	15.2	35.7	74.0	17.8
Lane Group LOS	D	E	B	E	E	B	E	C	B	D	E	B
Approach Delay	49.2			64.1			33.4			52.1		
Approach LOS	D			E			C			D		
Intersection Delay	49.6			Intersection LOS						D		

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APPENDIX E ARCHAEOLOGICAL INVENTORY SURVEY

— Final Report —

Archaeological Inventory Survey for the Kuakini Highway Improvements Project, Phase 2, Hualalai Road to Ali‘i Highway, Kailua-Kona, Hawai‘i

TMK: 7-5-8, 9, 10, 17, 18, 19, and 30 (POR.)

by
Coral M. Rasmussen

International Archaeological Research Institute, Inc.
July 2008

— FINAL REPORT —

ARCHAEOLOGICAL INVENTORY SURVEY FOR THE KUAKINI HIGHWAY IMPROVEMENTS PROJECT, PHASE 2, HUALALAI ROAD TO ALI‘I HIGHWAY, KAILUA-KONA, HAWAI‘I

TMK: 7-5-8, 9, 10, 17, 18, 19, AND 30 (por.)

by
Coral M. Rasmussen, M.A.

Prepared for:

Parsons Brinckerhoff Quade & Douglas, Inc.
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, Hawai‘i 96813

International Archaeological Research, Institute, Inc.
2081 Young Street
Honolulu, Hawai‘i 96826

July 2008

Cover page shows portion of Kuakini Wall, view to northeast.

PREFACE

The following report presents the results of the archaeological survey, completed in 2005, for the Kuakini Highway Improvements Project. The report documents survey conditions and status of the highway at the time of the survey, research, and analysis (2005-2006).

ABSTRACT

International Archaeological Research Institute, Inc. (IARII) conducted an archaeological inventory survey for the Kuakini Highway Improvements Project in Kailua-Kona, island of Hawai‘i for Parsons Brinckerhoff Quade & Douglas, Inc. This portion of the highway covers nine traditional *ahupua‘a*. The Tax Map Key (TMK) includes 7-5-8, 9, 10, 17, 18, 19, and 30.

The archaeological inventory survey consisted of an area 2 km (1.2 miles) long and 30.5 m (100 ft) wide on either side of the Kuakini Highway centerline. This corridor, which encompasses more area than that needed for construction purposes, was necessary for planning so that significant archaeological sites could be avoided. Twenty archaeological sites were recorded within the archaeological survey corridor, 16 of which had been identified during prior archaeological projects. Fourteen sites are located within the Area of Potential Effect (APE). This archaeological project did not include subsurface testing since most of the sites had been previously identified and no further archaeological work recommended.

The following 14 sites are located within the proposed APE, either within or near the project footprint of the proposed highway improvements. Four structures in Site 5608 have been previously designated for preservation. Preservation is recommended for Site 6302, known as the Kuakini Wall. Rock walls (Sites 6300, 11059 Feature 8, 15508, 22057, 23665, and 23666) and a walled enclosure for ranching (Site 23662) have been adequately documented; no further archaeological work is recommended. The modified outcrop (Site 26101) has also been adequately recorded with no further archaeological work recommended. Avoidance is recommended for a C-shaped wall (Site 26100) likely used for temporary habitation and for a broken lava bubble with few marine shells (Site 26102). If avoidance is not possible, appropriate mitigation measures need to be undertaken. Laniakea Cave (Site 7248) has been identified as possibly extending below Kuakini Highway. The openings of the cave are not within the archaeological survey area, and therefore the cave was not entered and documented. A small opening possibly leading to the cave is located southeast of the intersection of Kuakini Highway and Hualalai Road. A grate covers this opening and access was not possible. A memorial marking the human remains (Site 21189) beneath the sidewalk next to Coconut Grove Market Place is also within the APE. Preservation is recommended for this feature. An additional inadvertent discovery of human remains along Kuakini Highway was found following the archaeological inventory survey for this project. Determinations regarding the remains are currently underway.

Sites located outside of the proposed APE consist of agricultural and boundary features. They include *kuaiwi* (agricultural walls), rock mounds, and possibly modified outcrops. Site numbers were assigned during prior archaeological projects (Sites 11059 Feature 4, 22045, 22053, 22054, 23686) with the exception of Site 26099, which was discovered during the present project. These agricultural sites were adequately documented, and no further archaeological work recommended. One boundary feature consisting of a ranching wall (Site 15514) was also adequately documented and no further archaeological work recommended.

Protective measures will need to be implemented to mitigate potential impacts to six archaeological sites or portions of sites that lie within the APE, and for which preservation or avoidance is recommended. Protective measures may include enclosing the sites or portions of the sites with orange construction fencing. Monitoring is recommended during construction activities due to the possibility of impacting significant subsurface features.

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I. INTRODUCTION

International Archaeological Research Institute, Inc. (IARII) conducted an archaeological inventory survey for the Kuakini Highway Improvements Project, Phase 2 for Parsons Brinckerhoff Quade & Douglas, Inc. The limits of fieldwork were from Hualalai Road to the future Ali‘i Highway intersection (Fig. 1). The archaeological inventory survey consisted of an area 2 km (1.2 miles) long and 30.5 m (100 ft) wide on either side of the Kuakini Highway centerline.

Planned highway improvements have the potential to affect archaeological sites adjacent to the existing road. The survey identified 20 archaeological sites with 25 component features. Although 16 of the sites were previously recorded, four new sites (with one feature each) were also identified. Site significance is evaluated in terms of the criteria of eligibility for nomination to the National and State Registers of Historic Places, the potential for direct and indirect adverse impacts from the improvement project assessed, and recommendations provided for treatment of historic properties in the proposed Area of Potential Effect (APE).

The present report documents the archaeological investigations undertaken for this project. A cultural impact assessment study was undertaken concurrently by Social Research Pacific, Inc. (Prasad 2006).

PROJECT DESCRIPTION

The Kuakini Highway Improvement Project is located within the North Kona District and covers nine *ahupua‘a* (traditional land division) (Table 1; Fig. 2). The Tax Map Key (TMK) includes 7-5-8, 9, 10, 17, 18, 19, and 30 (Table 1).

Archaeologists conducted a surface survey of a 200 ft (61 m) wide corridor along Kuakini Highway: 100 ft (30.5 m) on both the east and west sides of the existing centerline. The actual road improvement project was anticipated to be narrower. The larger survey area was intended to be a conservative estimate until conceptual designs can be prepared. The corridor is 2 km long and includes commercial properties, condominiums, and undeveloped lands. Subsequent to completion of the inventory survey, Parsons Brinckerhoff Quade & Douglas, Inc. determined that additional property might be needed to cover the construction staging areas. Proposed construction staging areas were therefore not surveyed in their entirety.

Although no subsurface testing was conducted during the survey, most of the sites had been previously identified and tested during prior archaeological projects. No surface cultural material was observed or collected.

Table 1. *Ahupua‘a* Located Within the Kuakini Highway Improvements Project.

Ahupua‘a	**Tax Map Key (TMK)**
Hienaloli 6th	7-5-09:32, 48, 52
‘Auhaukea‘ē 2nd	7-5-09:25, 55
‘Auhaukea‘ē 1st	7-5-09:29, 53, 54, 59
Pua‘a 3rd	7-5-18:12, 28
Pua‘a 2nd	7-5-10:3, 7-5-18:28, 7-5-09:3, 4, 10, 40, 56
Pua‘a 1st	7-5-09:21, 23, 57
Wai‘aha 2nd	7-5-17:37, 7-5-18:41, 43, 7-5-30:24, 25
Wai‘aha 1st	7-5-17:37, 7-5-18:7, 89, 90, 91, 92, 94, 95, 7-5-10:85
Kahului 1st	7-5-19:38, 7-5-17:5

FIELDWORK SCHEDULE AND PERSONNEL

Fieldwork for the Kuakini Highway Improvements Project survey was conducted between 24 and 28 October 2005. Coral M. Rasmussen, M.A., directed the fieldwork. The field crew consisted of Mara Mulrooney, M.A. and Timothy Reith, B.A. David Welch, Ph.D., served as the Principal Investigator.

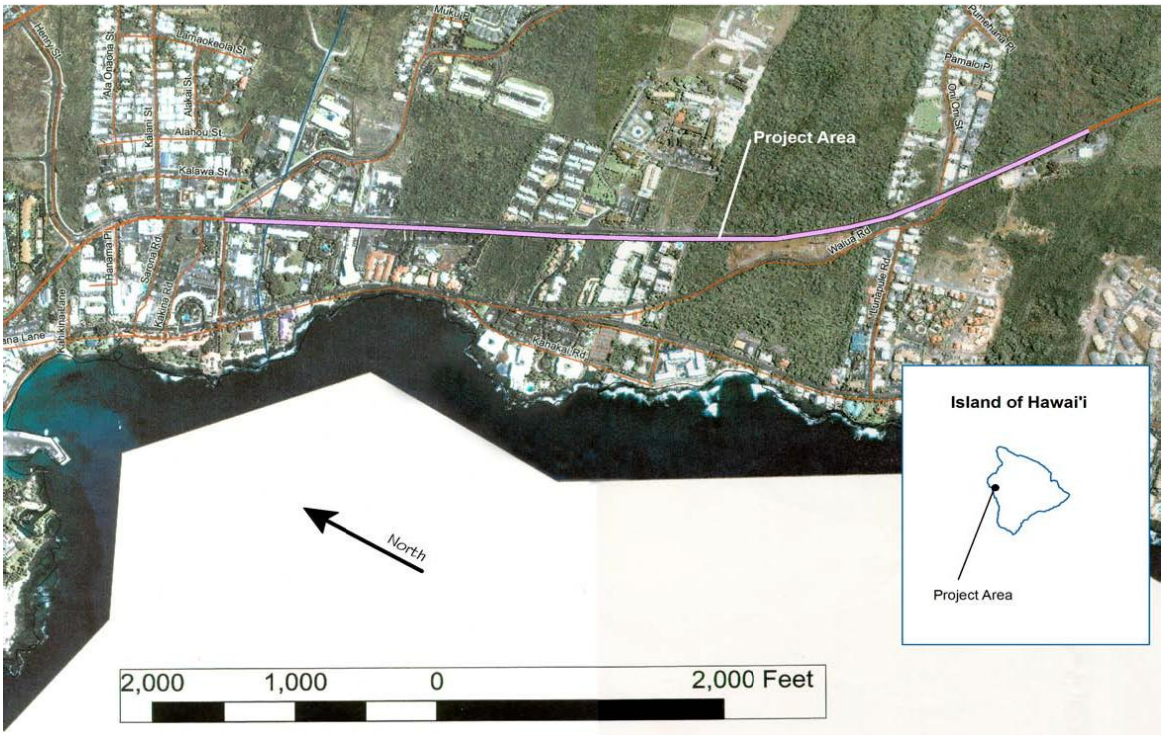

Figure 1. Location of the Kuakini Highway Improvements Project, Kailua-Kona, Hawai'i.

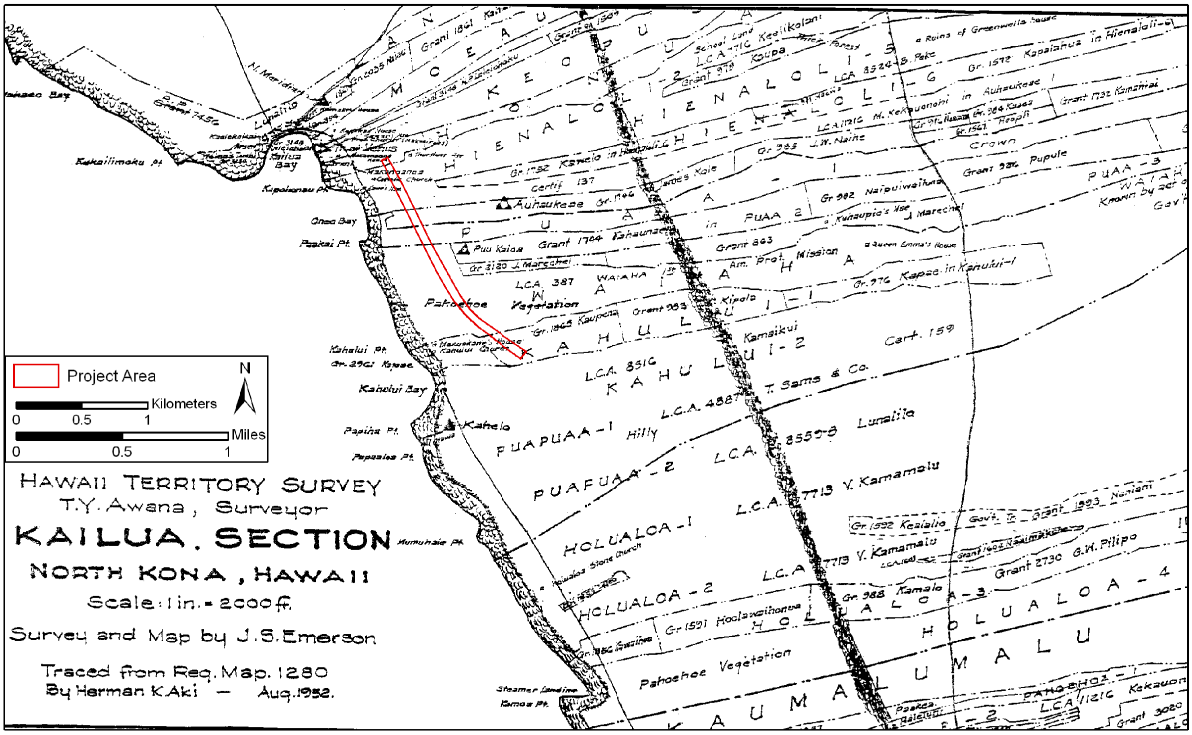

Figure 2. *Ahupua'a* locations along the Kuakini Highway Improvements Project, Kailua-Kona, Hawai'i.

II. ENVIRONMENTAL AND HISTORICAL CONTEXT

PHYSICAL SETTING

The Kuakini Highway Improvements Project is located on the island of Hawai‘i, on the western slope of Hualālai Volcano, within the physiographic region known as the Kona Lava Plain. This is an area of geologically recent lava flows (Armstrong 1973; Macdonald et al. 1983). Much of Hualālai's southern slope, above the town of Kailua-Kona, consists of intertwined lava flows from Mauna Loa and Hualālai (Macdonald et al. 1983:366). The project area is located between 150 and 600 m (492 - 1968 ft) inland of the west-facing shore of Hawai‘i Island (Fig. 3) and ranges in elevation from ca. 12 to 49 m (40 to 160 ft) above mean sea level.

This part of the Kona coast is very arid and hot. The average annual rainfall is less than 20 inches with the heaviest seasonal rain falling between May and September (Giambelluca 1986). Although there are no permanent surface drainages, there are coastal seeps and springs. Residents in the *ahupua‘a* of Kahului collected water from Kahului Stream and a number of small springs in the area (Maly 1998). The part of Kona in which the project area is located is prone to occasional heavy rainfall that causes flash floods and erosion.

Two major soil types are present within the project area (Sato et al. 1973:85). Punaluu Extremely Rocky Peat (rPYD) is found on the north portion of Kuakini Highway. The surface layer is about 4 inches thick and overlies pahoehoe bedrock. Rock outcrops appear on 40 to 50 percent of the surface. This soil is used for pasture. The second soil type, Waiaha Extremely Stony Silt Loam (WHC), is present on the south portion of Kuakini Highway. It is very dark brown extremely stony silt loam, 4 to 14 inches thick, which overlies pahoehoe bedrock. This soil is also used for pasture.

Vegetation in the project area is dominated by high grasses (6 to 7 ft) and scattered *koa haole* (*Leucaena leucocephala*) and *kiawe* (*Prosopis pallida*). Coconut palm trees are present near houses and condominiums. Ornamental trees and bushes, such as plumeria and bougainvillea, have been planted along Kuakini Highway.

CULTURAL GEOGRAPHY

The Kuakini Highway Improvements Project passes through nine *ahupua‘a* within the traditional district of Kona (Table 2; see also Table 1). The nine *ahupua‘a* are divided into five named sections, some of which are further divided into 1st, 2nd, and 3rd.

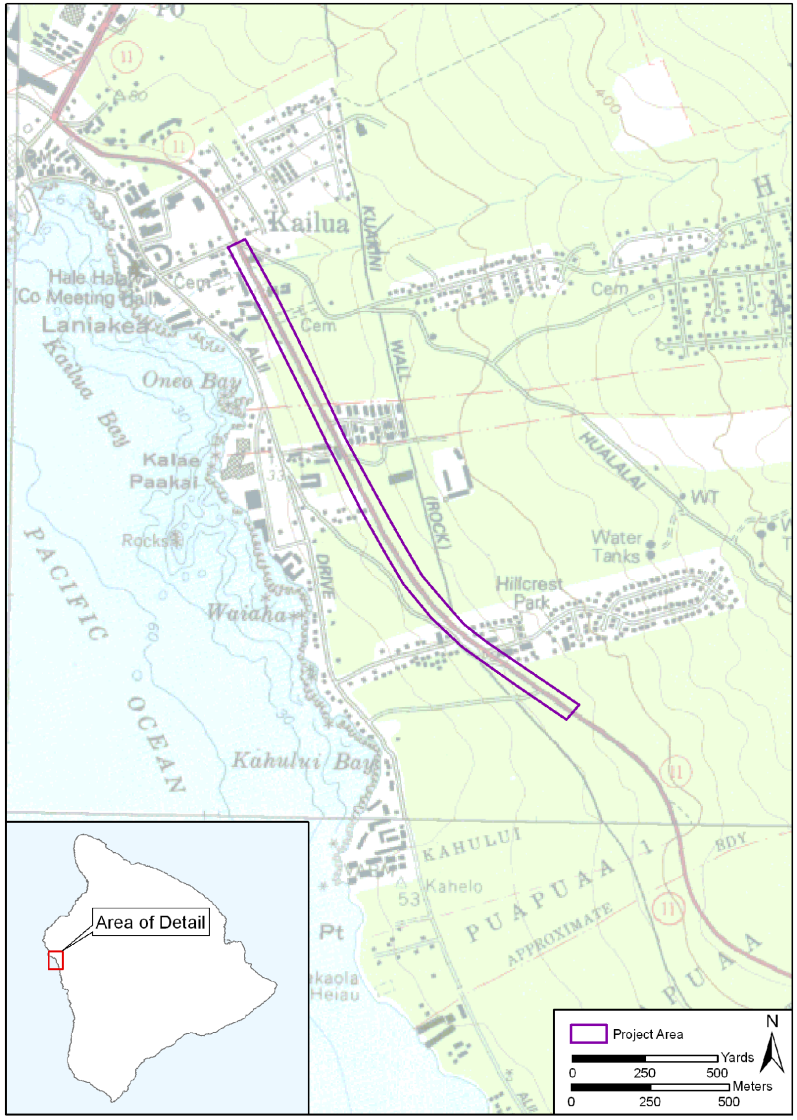

Figure 3. Location of Kuakini Highway Improvements Project shown on Kailua Quadrangle, 7.5 minute series, 1982 USGS map.

Table 2. *Ahupua'a* Names and Their Possible Meanings.

Ahupua'a	Meaning	Reference
Hienaloli	*hiena* is a polishing stone; *loli* is to change	Pukui and Elbert 1986:68, 211
'Auhaukea'e	No form of the entire word 'Auhaukea'e could be found; however *'auhau* means tax, femur and humerus, or stalk of a *hau* tree; *kea* means white, clear, shiny and can indicate gray-haired person, a variety of sugarcane especially used in medicine, and shared property; *'e* is used for emphasis.	Pukui and Elbert 1986:31, 36, 140, 141
Pua'a	Means pig; many references to *pua'a* are to Kama-pua'a; banks of fog or clouds, often as gathered over a mountain summit, a sign of rain and believed to be the cloud forms of Kama-pua'a.	Pukui and Elbert 1986:344
Wai'aha	Gathering water.	Pukui et al. 1976:219
Kahului	Probably means "the winning."	Pukui et al. 1976:67

A discussion of the cultural geography should include Kailua Bay. Kailua means "two seas," probably indicating two currents (Pukui and Elbert 1986:69). There were important fishing grounds, a safe harbor for canoes, and an ancient surfing area at the bay. The area east of the bay was a major settlement. An *ali'i* (chiefly) compound was located adjacent to the bay. This area was also of religious significance as can be attested by the number of *heiau* (place of worship, temple) present in Kona near the archaeological survey area. *Heiau* and *koa* (fishing shrines) near the project vicinity are shown in Figure 4. These *heiau*, as well as additional *heiau* and *koa*, are listed in Table 3. Table 4 lists additional sites of major importance.

PRE-CONTACT HISTORY OF THE PROJECT AREA

The evidence for original colonization of the islands strongly supports a date of the late AD 700s (Masse and Tuggle 1998; Tuggle and Spriggs 2001). It is unlikely that there was any settlement along the leeward Kona coast for a long period following colonization. The early settlement was likely a small community dependent on local resources. It might have consisted of clusters of fishermen and their families who lived along the coast and exploited the excellent fishing grounds in Kailua Bay (Handy and Handy 1991:273). Agriculture, in the form of an upland field system, occurred very late in the pre-Contact period, almost certainly in the mid to late 1600s at the earliest (Tuggle and Tomonari-Tuggle 2005:14).

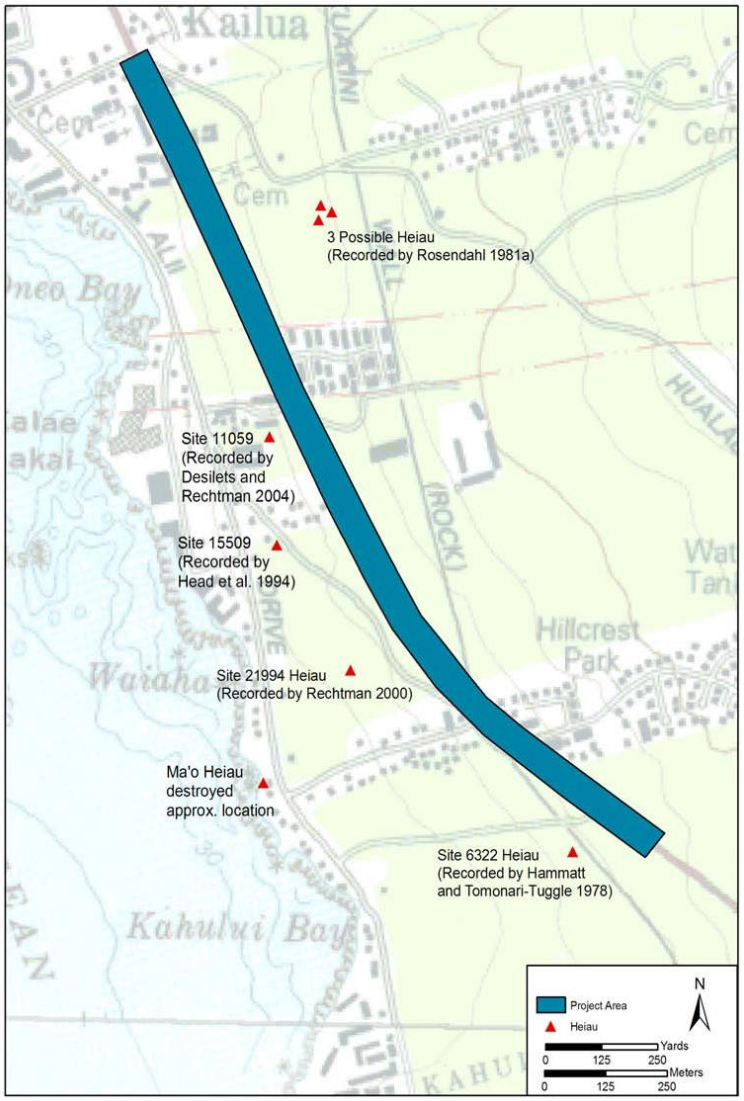

Figure 4. *Heiau* located near Kuakini Highway Improvements Project.

Table 3. *Heiau* and Shrines Located Near the Archaeological Survey for the Kuakini Highway Improvements Project.

Name of Heiau and Koa	Location	Location on Fig. 4	Details	Reference
Haleokolia Site 59	Kahului	no	Fishing *heiau* at Puʻu Kani, 50 ft from the sea, burial mounds nearby	Maly 1998: A-19; Reinecke n.d.:59-60
Hekelinui	Kahului	no	Fishing *heiau* consisting of a platform 105 x 40 ft and 4 ft high	Maly 1998: A-19; Reinecke n.d.:59-60
5608 Feat. A	ʻAuhaukeaʻē Ahupuaʻa	yes	Possible *heiau* consisting of a stepped platform	Rosendahl 1981a; Clark and Rechtman 2004
5608 Feat. K	ʻAuhaukeaʻē Ahupuaʻa	yes	Possible *heiau* consisting of a stepped platform	Rosendahl 1981a; Clark and Rechtman 2004
5608 Feat. L	ʻAuhaukeaʻē Ahupuaʻa	yes	Possible *heiau* consisting of a platform	Rosendahl 1981a; Clark and Rechtman 2004
6322	Kahului 1st	yes	Composite *heiau*; 29 x 21 m; no name or function found	Ching et al. 1973; Hammatt and Tomonari-Tuggle 1978; Hammatt and Meeker 1979; O'Hare and Wolforth 1998
11059 Feat. 7	Puaʻa 2nd Ahupuaʻa	yes	Possible shrine consisting of a high platform 4.5 x 3.1 m	Desilets and Rechtman 2004
15509	Near boundary of Puaʻa 3rd and Waiaha 1st	yes	Possible *koa* or fishing shrine consisting of a paved court and and waterworn upright	Head et al. 1994
21994	Waiʻaha 1st	yes	*Heiau* consists of an internally complex platform, disturbed with only 20 x 10 m platform remaining	Rechtman 2000
Haleokū	ʻAuhaukeaʻē; west of *hau* grove north of Kalopau Heiau	no	Said to have been built by Alapaʻi	Stokes 1991:50
Kalopau	Puaʻa Ahupuaʻa, 2 miles from the sea	no	Said to have been built by Alapaʻi	Stokes 1991:50
Kauakaiakaola	Puapuaʻa 1st, northern point of Puapuaʻa Bay 80 ft from the sea and 10 ft above mean tide	yes	150 x 70 ft; walled structure with interior platform features; said to have been built by Kamehameha I	

Table 3. *Heiau* and Shrines Located Near the Archaeological Survey for the Kuakini Highway Improvements Project (continued).

Name of Heiau and Koa	Location	Location on Fig. 4	Details	Reference
Keikipuʻipuʻi	Keōpū 3rd or Honuaʻula; on the south shore of Kailua Bay; precise location of site could not be determined	no	*Luakini* class *heiau*; probably built at the time of ʻUmi	Stokes 1991:49
Maʻo or Nalupoʻo Site 3834	Waiʻaha Ahupuaʻa, on the north shore of Kailua Bay on a sandy beach	yes; approx. location since now destroyed	A *heiau kālua ua* built to control rain; *maʻo* means green; said to have been built by Kiwalaʻo	Pukui et al. 1974; Thrum 1907:43; Stokes 1991:52; Walker et al. 1996; Rechtman 2000

Table 4. Sites of Major Importance Located Near the Archaeological Survey Area for the Kuakini Highway Improvements Project.

Site	Location	Details	Reference
Kuakini Wall, Site 6302	from Kahuluʻu to Keahuolu	Large wall, average height 8 ft	Ching et al. 1973; Clark and Rechtman 2003, 2004; Corbin and Rosendahl 2002; Donham and Kai 1990; Hammatt and Meeker 1979; Hammatt and Tomonari-Tuggle 1978; Haun and Henry 2004, 2005; Moore et al. 1997; Rechtman 2004; Rosendahl 1979a, 1979b, 1981a, 1981b, 1981c
Laniakea Cave, Site 7248	Entrances at Thurston House and Hale Halawai	Spacious cavern; sections of the cave have collapsed and the entrance was choked with debris and disturbed by squatters	DOT 1975; Ellis 1963:62; Soehren 1980 in Kelly and Barrére1980:16; Paikuli-Campbell pers. comm. 2005
ʻAuhaukeaʻē Platform, Site 2005	Puaʻa 1st	Traditional Hawaiian dwelling compound with ranching components	Rosendahl 1988
Oneo Landing		Prior to concrete barrier wall, the landing had a small sandy beach	Hammatt and Borthwick 1987; Allen 1986:6
Kahopuka Beach	Puaʻa	Famous surf bathing resort in Kamehamehama's time	Welch 1988

In order to provide a chronological and cultural framework for Kona, the traditions of Kona can be examined (Tomonari-Tuggle and Tuggle 2004; Tuggle and Tomonari-Tuggle 2005). In the chronological succession of the kings in the lineage of La'au and Pili, it was during the reign of either Kuaiwa or Kahoukapu (9th or 10th generation) that a junior son of Kuaiwa named 'Ehu became the chief of Kona and possibly Kohala. This event also probably marks the beginning of Kona as a significant economic, political, and religious domain. This may be due to a major population increase, development of the Kona Field System, establishment of major temples, and creation of the fishponds in Kona. Within four to five generations, by the early to mid-1500s, economic, political, and religious importance had grown to the point that allowed 'Umi-a-Liloa to take the remarkable step of moving the royal court from Waipio to Kona. From that time on, Kona became the ruling center for chiefs of the island. The bay at Kailua and its surrounding area was one of the royal centers where the island ruler periodically resided; other Kona centers were at Kealakekua, Hōlualoa, Kahalu'u and Hōnaunau (Cordy 1995:13; Tomonari-Tuggle 2005:15). Archaeologically, these centers are typified by a concentration of elaborate habitation complexes (*kauhale*) indicative of high-ranking residents, temples (*heiau*; see Table 3), and structures related to chiefly activities (e.g., *hōlua* slides).

It is likely that sites located within the archaeological survey corridor will relate to the following model regarding *kauhale.* The compounds forming *kauhale* had separate structures for different activities. These included *hale mua* or men's house where men ate, *hale aina* where women ate, *hale kua* where women performed domestic activities, *hale kuku* in which women beat tapa*, hale pea* or menstrual hut, *hale noa* where a man and his wife met freely, *hale-moe* where the man, his wife, and his children lived and worked together, and *heiau* where men worshipped (Malo 1976:28-29; Handy and Handy 1991:297).

Although there are different types of *heiau*, only a few are known (Valeri 1985:179; see also Thrum 1907 and Bennett 1970 for typological descriptions of Hawaiian *heiau*). The *hale mua* or men's house can also be described as a domestic temple and indicates the first house to be built in the complex, a place where guests were received, and where business was transacted (Valeri 1985:174). A private, raised alter (*tuahu* or *kuahu*) was located at the end of the *hale mua*, similar to the shrine located at the bow of the canoe. *Ko'a* or *ko'a kū'ula* are fishing *heiau.* Often they have an altar of coral and can be devoted to one or several fish. *Luakini heiau* were reserved for the high chiefs. Human sacrifices were made and principal royal rituals took place. Other *heiau*, such as *hale o Lono*, were intended to secure plentiful harvests, *heiau ho'oūluulu ua* were intended to insure rain, others were dedicated to the gods of war, *hula*, surfing, love, healing, and so on. When William Ellis (1963:73) toured Kailua in 1822 and 1823, he observed a "number of heiaus, and depositories for the dead… Some appeared very ancient, others had evidently been standing but a few years."

With the population increase in Kona, an extensive cultivated field system, known as the Kona Field System, was developed. Plants, such as taro, sweet potato, breadfruit, sugarcane, plantains, and paper mulberry were cultivated on the mountain slopes in elaborate terraces (Handy and Handy 1991:525-527). The field system spanned the upland slopes from Kailua to Kealakekua and was the agricultural foundation for the chiefdoms of Kona. "The field system consists of four basic zones that extend from the coast to about 1,200 m (4,000 ft) above sea level. Its spread can be seen as largely isomorphic with rainfall and elevation, with variations dependent on sediment and geologic base" (Tomonari-Tuggle 2005:17).

The Kona Field System is characterized in the higher elevations by long inland-seaward walls called *kuaiwi* and perpendicular walls, sometimes called "formal portion of the field system, or the formal-walled area" (Cordy 2000:248), that extend across the slope. They may have been built to stabilize the steep slopes and form semi-permanent garden plots (Allen 2001:144). At lower elevations, including the archaeological survey area, agricultural features are less formal and may consist of mounds, modified outcrops, residential platforms, and enclosures.

Schilt (1984) and Burtchard (1996) propose similar models for the evolution of the field system. Initial agricultural development began in the upper zones with higher rainfall between AD 1050 and 1400. Between AD 1400 and the mid-1600s, farming expanded into less optimal areas. Schilt suggests that it was during this period that use of the drier *kula* zone began, suggesting that erosion of soils from the upland fields into the *kula* zone facilitated this expansion. By the late AD 1600s and 1700s, the upland area and the inland portion of the *kula* zone were fully developed. By contact, the field system covered most of the leeward slopes of Hualālai and northwestern Mauna Loa.

Haun and Henry (2000:38) provide data to support the Schilt and Burtchard models,[1] although they suggest that agricultural development up to and during the AD 1300s was limited. They concur that inland fields were used extensively by the AD 1400s. Radiocarbon age determinations from 11 archaeological studies within the Kona Field System are summarized as follows (Haun and Henry 2000:7):

> The pattern indicates that most activity occurred after the early to mid-1400s. There is no clustering of age ranges from particular agricultural feature types or from dates from layers pre-dating surface features. Dates from features below 400 feet elevation and above 600 feet elevation span the entire range between the 1300s and 1800s. There are twelve dates from features situated between 400 and 600 feet elevations. Two of the ages post-date 1500 and the rest post-date the [sic] 1640 suggesting that the upper *kula* and lower *kalu'ulu* zones were the last areas to be brought into cultivation.

A firsthand account of the Kona Field System was recorded by Ellis when he toured the Kona region (1963:31-32):

> The environs were cultivated to a considerable extent; small gardens were seen among the barren rocks on which the houses are built, wherever soil could be found sufficient to nourish the sweet potato…and in many places these seemed to be growing literally in the fragments of lava, collected in small heaps around their roots… The path now lay through a beautiful part of the country, quite a garden compared with that through which they had passed on first leaving the town. It was generally divided into small fields, about fifteen rods square, fenced with low stone walls, built with fragments of

[1] A problem in Haun and Henry's approach, although it may not affect their conclusion, is the selection and/or use of age determinations from potentially questionable proveniences or from proveniences that do not reflect a specific event (e.g., charcoal from a soil deposit in the middle of an enclosure could be the result of any number of events, some of which may have nothing to do with the occupation of the enclosures). Further, Haun and Henry (2000:7) note that most of the age determinations were from "excavations [that] were conducted in features suspected to contain burials or in features of uncertain function."

> lava gathered from the surface of the enclosures. These fields were planted with bananas, sweet potatoes, mountain taro, paper mulberry plants, melons, and sugar-cane, which flourished luxuriantly in every direction.

POST-CONTACT HISTORY OF THE PROJECT AREA

During the 19th century, many changes occurred in Kona, most notably the introduction of foreign markets, foreign ideas, and a loss of population, due to disease, low birth rates, and out-migration. The following summary briefly describes these transformations.

King Kamehameha I, known for uniting the Hawaiian Islands, chose Kailua as the capital of Hawai‘i. One of his compounds was located near the north end of Kailua Bay. Kamehameha was involved in *heiau* construction. He ordered *kapu* (taboo) on the killing of imported cattle, exported sandalwood from the hillsides around Kailua, and traded with passing sailing ships.

When Kamehameha died at Kailua, his son, Liholiho and his widow, Ka‘ahumanu, abolished the *kapu* system. Liholiho also moved his court from Kailua to Honolulu and appointed Kuakini the governor of Hawai‘i Island in 1820. Kuakini was the son of Ke‘e-au-moku and Na-mahana. He was born in 1791 and given the name Ka-lua-i-konahale. After the death of his half brother Kuakini, he was also given the name Kuakini. His half sister was Ka‘ahumanu, wife of King Kamehameha. Kamakau described Kuakini as “a liquor-drinking, pleasure-loving chief, a hula dancer and patron of thieves” until he converted to Christianity (Kamakau 1992:390).

When the missionaries arrived, they found the “nation was without any religion, and in this respect at least prepared to receive the dispensation of the gospel” (Ellis 1963:21). In 1823, the Reverend Asa Thurston and his wife, Lucy, arrived in Kailua and were given land to build their house. The 5-acre site, located northeast of the archaeological survey corridor (north of Hualalai Road), was located on the boundary of Honua‘ula and Hienaloli 1st Ahupua‘a. The Thurstons constructed their residence adjacent to Laniakea Cave. This cave is a “spacious cavern” where “children and aged persons were placed for security during an assault or sally from the fort, and sometimes the wives of the warriors also, when they did not accompany their husbands to battle” (Ellis 1963:62). Ellis explored the

> celebrated cavern… called Raniakea. After entering it by a small aperture, they passed on in a direction nearly parallel with the surface; sometimes along a spacious arched way, not less then twenty-five feet high and twenty feet wide; at other times, by a passage so narrow, that they could with difficulty press through, till they had proceeded about 1200 feet; here their progress was arrested by a pool of water, wide, deep, and as salty as that found in the hollows of the lava within a few yard of the sea… More than thirty natives, most of them carrying torches, accompanied them in their descent; and on arriving at the water, simultaneously plunged in, extending their torches with one hand, and swimming about with the other… The mouth of the cave is about half a mile from the sea, and the perpendicular depth to the water probably not less than fifty or sixty feet” (Ellis 1963:30).

Similar accounts of Laniakea Cave were reported by the historian James Jarves, who explored the cave in 1840 (Jarves 1844:215-216 in Kelly and Barrére 1980:16), Chester Smith Lyman, who entered the cave in 1846 (Lyman 1924:130 in Kelly and Barrére1980:16), and Albert Baker in 1915 (Baker 1915 in Kelly and Barrére1980:16). In 1980, the archaeologist Lloyd Soehren noted that sections of the cave had collapsed and the entrance is choked with debris (Soehren 1980 in Kelly and Barrére1980:16). A wall once stood next to Laniakea Cave. It was part of “an old military fortification, formerly belonging to the makaainana (common people, as distinguished from the aristocracy, or reigning chiefs)” (Ellis 1963:62). Ellis described it as 18 or 20 ft high and 14 ft thick at the bottom. The stones were likely used for construction of the Thurston Residence (Kelly and Barrére1980:16).

As governor, Kuakini directed a number of large-scale building projects in Kailua, including a fort with massive walls and probably the expansion or rebuilding of an older wall east of the village to keep out wild cattle. The Hawaiian name of the wall is Pāpipi, clearly referring to a cattle wall. It is likely this is the same wall described in 1812 by John Papa ‘I‘i as “A stone wall to protect the food plots stretched back of the village from one end to the other and beyond” (‘I‘i 1995:111). Prior to 1855, the wall was consistently known as the Great Wall by surveyors (Kelly and Barrére1980:30). After 1855, the wall was called the Great Wall, the Great Wall of Kuakini, the *Pa Pipi*, Govenor Adam’s Wall, or Kuakini’s Wall (O’Hare and Wolforth 1998:2-6). In 1915, Albert Baker wrote in the *Hawaiian Almanac* that “Just a little above [the stone church at Kahalu‘u], and continuing all the way to Kailua, is the huge stone wall built in Kuakini’s time to keep pigs from the cultivated lands above” (Baker 1915:83-84 in Kelly and Barrére 1980:31).

When Ellis visited Kailua between 1822 and 1823, he recorded “3,000 inhabitants” living in the village of Kailua (Ellis 1963:ix). By the 1830s, a decline in population was observed in Kona:

> We have been sensible for some time that the number of inhabitants in this island is on the decrease. There is an almost constant moving of the people to the leeward islands, especially since the removal of the governor [Kuakini] to Oahu. Some leave by the order of the chiefs, and other go on their own responsibility. At a late census of this district [Kona] the number of inhabitants fell short of 13,000 (Thurston and Bishop 1833:236 in Hammatt and Chiogioji 1996:6).

In the mid-19th century land distribution called the Māhele, the king, chiefs, and the government divided all the lands among themselves, with each party relinquishing rights to the other parties’ claims. Commoners were given the opportunity to claim lands that they used, such as agricultural fields, garden plots, and associated homesteads. These land claim awards (LCAs) provide useful information about patterns of land use in the 18th century (see Appendix D).

With the diminishing Hawaiian population in Kona, land was available for ranching. In addition, the land around Kuakini Wall was often reserved for *ali‘i* and *konohiki* (headman of an *ahupua‘a*) who used it as pasture for their own cattle (Sahlins 1992:136, 148-149 in O’Hare and Wolforth 1998:1-9). Cattle were first brought to the Big Island in the 1790s to roam the natural pasturelands inland between Kawaihae and Waimea. These cattle were known to damage crops and “were the primary cause for the building of stone fences around kuleanas and cultivated areas… they were called *pa-aina*, and the same name applied to the area enclosed by such a fence” (*Polynesian* 1846 in Kuykendall 1965:318).

Hawaiian cowboys, known as *paniolo* (Hawaiian word for "Spanish"), were brought in to help with the herds. Small herds were maintained in the *kula* lands during the summer months. They were moved upland during the drier months. The land was generally used for "pasture land for cattle… cattle grazing on the *kula* began as early as the 1840s, and by the mid- to late 1800s, the transition from cultivation to ranching had been completed" (Kelly 1983:79 in Schilt 1984:14). One of the ranchers, Manuel Gomes, purchased grazing lands in the *ahupua'a* of Wai'aha and Kahului from the defunct Kona Sugar Company in 1927, as well as land from private individuals in Hienaloli (Maly 1998). The Gomes ranch also leased lands in Keahuolu, Hōlualoa, and Honua'ula, totaling about 7,000 acres of ranchland (Gomes pers. comm. in Maly 1998:A-36). The Greenwell Ranch was located in the northeastern portion of the project area in the *ahupua'a* of 'Auhaukea'ē and Hienaloli (Clark and Rechtman 2004). Rock structures were constructed for use as pens, gates, paddock walls, boundary walls, and shelters. Stones were often obtained from earlier Hawaiian structures or made by modifying previously existing features (Maly 1998:A-16).

Ranchers herded their cattle to Kailua Bay where they were shipped out. This process involved lassoing the cattle and pulling them into the bay, where they were lashed onto the gunwales of waiting whaleboats and delivered to waiting ships. The last cattle were shipped out in 1956, when the deep harbor at Kawaihae supplanted the Kailua Harbor (Kona Historical Society 2000:22-23). Cattle ranching in the Kona region continued until the 1970s.

Experimentation with export crops was conducted in the early 20th century. Coffee, sisal, sugarcane, Irish potatoes, oranges, and grapes were shipped to Honolulu markets and elsewhere.

Following World War II, building in Kona increased. This included construction of the Kona Airport located at the northwest edge of Kailua between 1948 and 1950. The airport was used until 1970 when it was replaced by Keāhole Airport and the site converted to a state park. In addition to the airport, plans were made for the "Kailua-Keauhou Road," designated Project No. S-229(1). The road, later renamed after Kuakini, connects the *mauka* (inland) government road to Palani Road and to the new airport road (Hammatt and Chiogioji 1996:14). The location of Kuakini Highway was surveyed in the 1950s (Kona Historical Society 1998:39). An aerial photograph shot before construction shows that Kuakini Highway does not follow an existing trail or roadway (Hammatt and Chiogioji 1996:14, Fig. 11). Two historic trails are recorded in the area: the *kaluula*, the trail of Kealakowaa, which is the trail on which canoes were dragged from the uplands; and the *ala loa*, which is the main trail near the coast (Maly 1998:A-10).

The plan for the Kailua portion of Kuakini Highway, dated August 5, 1949, shows "existing stonewall fences," none of which line the right-of-way, and notes, "All existing Stonewall Fences within thee [sic] Right-of-Way shall be removed and reconstructed at locations as indicated" (Hammatt and Chiogioji 1996:14). New "stonewall fences" and reconstructed fences are also indicated on both sides of the right-of-way for much of the corridor.

III. PREVIOUS ARCHAEOLOGICAL INVESTIGATIONS

Within the past 30 years, there have been 29 archaeological projects carried out that include portions of land within the Kuakini Highway Improvements Project and a number of projects on adjacent parcels (Table 5). The locations of previous archaeological projects are shown in Figure 5. Table 6 provides a brief description of the archaeological projects, along with locational information (TMK and *ahupua'a*) and the authors and dates of the corresponding reports. These projects indicate a high concentration of features located near Kailua and Oneo Bay, many of which may be high status residences, agricultural fields, and ranching features.

The earliest field survey in Kona occurred in 1970 when Kenneth Emory (1970) recorded prominent sites in the district of Kona. Four years later, the first archaeological investigation located within what is now the archaeological survey area for the Kuakini Highway Improvements Project was conducted (Connolly 1974). It consisted of a walk-through survey of a proposed road alignment, which intersects the western side of the archaeological survey area for the Kuakini Highway Improvements Project (TMK 7-5-009:25; see Fig. 5). Identified features included a partially destroyed platform, *'ili 'ili* (pebble) paving, and historic walls and enclosures.

The following section details archaeological projects that have occurred along the Kuakini Highway Improvements Project in the last 30 years. The project are organized roughly from north to south.

An archaeological survey project conducted on the northeast side of the Kuakini Highway Improvements Project (TMK 7-5-09:48) identified habitation sites, agricultural terraces, walls, and caves (Donham and Kai 1990). Unlike the sites to the south and west, "The findings of this survey indicate that the portion of Hienaloli 6 between 90 and 120 ft AMSL was utilized during the prehistoric and historic periods for relatively low-intensity agriculture and temporary habitation" (Donham and Kai 1990:20). Moore et al. (1997:9) conducted the data recovery project at the same location and attribute the "absence of permanent residential and ceremonial structures on the subject property… to destruction caused by modern development."

Formal platforms and burial features were discovered in a parcel (TMK 7-5-009–31) on the northwest side of Kuakini Highway, which intersects the current archaeological survey area for Kuakini Highway Improvements Project (Sinoto 1980; Allen 1986; Wickler 1989, 1990). Sinoto (1980:6) noted that the "utilization of coral pebbles in the fill of nearly all the structures" and the "proximity to Ahu'ena Heiau may indicate occupants of chiefly rank." During the inventory survey, "three petroglyphs and five *papamū*" or game boards were found, which "suggested that leisure activities had been important at one time, a finding consistent with Sinoto's (1980) suggestion that *ali'i* may have occupied the parcel during pre-modern times" (Allen 1986:59).

Table 5. Archaeological Projects Conducted Within and Near the Archaeological Survey Area for the Kuakini Highway Improvements Project, Organized from North to South.

Ahupua'a	TMK	Level of Survey	Comments	Report (author/date)
24 *ahupua'a*	—	inventory survey	134 sites comprising 455 features consisting of burials, cairns, caves, enclosures, platforms, gardens, modified outcrops, trails, stone piles, and historic features	Schilt 1980
26 *ahupua'a*	—	monitoring	monitoring for the Kuakini Highway Realignment Project for State of Hawai'i [note– different project corridor from the current project]; 4.83 km x 91.5 m; buried deposits— many relating to sites recorded during previous archaeology; 15 lava tubes found, one with a burial	Toenjes 1986
Keōpū	7-5-4	exhumation	Site 50-Ha-D8-30: removal of 355 individuals from traditional cemetery	Han et al. 1986
Lanihau, Moeauoa, Keōpū, Honua'ula	7-5-04:24, 28	archaeological and historical assessment, reconnaissance survey	2,800-foot corridor along Kuakini Highway with at least two traditional Hawaiian burials in TMK 7-5-07:28, and remnants of a *heiau* complex at TMK 7-5-04:24	Hammatt and Chiogioji 1996
Kona District	—	inventory survey	examined sites in the Kona District	Emory 1970
Honua'ula	7-5-07:2, 9, 10, 27, 28, 68	inventory survey	3 sites with 14 features, consisting of a historic burial crypt, an enclosed burial site, and a cluster of traditional and 20th century habitation features	Elmore and Kennedy 2000
Honua'ula	7-5-07:9	data recovery plan	research design for habitation Site 21740, a cluster of traditional and 20th century habitation features	Elmore and Kennedy 2003
Pua'a 1 and 'Auhaukea'ē 2	7-5-09:21, 23, 25, 37	reconnaissance survey	examined strip of land between two *ahupua'a*: 6 sites with 1 feature each; walls, enclosures, platforms, and coral concentrations	Connolly 1974
Pua'a 1	7-5-09:21, 22	reconnaissance survey	parcel 21: bulldozed remnants of probable house site belonging to Lot Kapuaiwa (Kamehameha V), numerous scattered marine shells and waterworn stones; parcel 22: well preserved house platform	Soehren 1979
Pu'a 1	7-5-09:23	reconnaissance survey	Site 2005, or 'Auhaukea'ē Platform, consisting of a habitation feature from the late prehistoric period to the early 20th century	M. Rosendahl 1988

Table 5. Archaeological Projects Conducted Within and Near the Archaeological Survey Area for the Kuakini Highway Improvements Project (continued).

Ahupua‘a	TMK	Level of Survey	Comments	Report (author/date)
Pu‘a 1	7-5-09:23	analysis of portable remains	artifacts indicate Site 2005 was occupied from the late prehistoric period until the early 1900s; fishing gear. lithics, and midden were recovered from the traditional component; glass, metal, and slate from the historic component	Rosendahl and Delimont 1988
Pua‘a 2	TMK 3-7-5-09:3, 38, 49, 60, 61, 62	reconnaissance survey	Site 5610, consisting of 52 features, most of which appear to be recent features; traditional features include an enclosure and a platform, which was found to cover multiple burials	Rosendahl 1978+
Pua‘a 2	7-5-09:03, 38, 49, 60, 61, 62	inventory survey	1 site with 52 features consisting of a pre-Contact cemetery, terraces, mounds pits, walls, and platforms; no map included in the report	Hommon 1979
Pua‘a 2	7-5-09:03	data recovery plan	Site 2005, a habitation site with an associated midden	Corbin 2004
‘Auhaukea‘ē	7-5-09:25, 28, 43	reconnaissance survey	small habitation sites; 3 historic house platforms surrounded by enclosing walls, probable burial, modified bluffs; area now developed	Hammatt and Borthwick 1987
‘Auhaukea‘ē	7-5-09:54, 55	survey (not submitted to SHPD)	large site (Site 5608) with 75 features, including 3 major structural features interpreted as possible *heiau*, 34 possible burials, 5 confirmed burials; 4 residential features, and other features such as retaining walls, a walled terrace, and a cairn	Rosendahl+ 1979a, 1979b, 1981a, 1981b, 1981c
‘Auhaukea‘ē	7-5-09:54 por.	inventory survey	portion of Site 5608, consisting of 15 features such as a burial, agricultural features, and an activity area; Site 6392-Kuakini’s Wall	Clark and Rechtman 2004
Hienaloli 1	7-5-08:12, 22	reconnaissance survey	historic house, grindstone, and possible burial cave covered with coral; no traditional sites found	Soehren 1978
Hienaloli 6	7-5-09:30, 59	reconnaissance survey	boundary walls and historic pineapple plantings	Allen-Wheeler 1981

Table 5. Archaeological Projects Conducted Within and Near the Archaeological Survey Area for the Kuakini Highway Improvements Project (continued).

Ahupua‘a	TMK	Level of Survey	Comments	Report (author/date)
Hienaloli 6, ‘Auhaukea‘ē	7-5-09:31	reconnaissance survey	platforms suggesting *ali‘i* may have occupied the site during pre-modern times	Sinoto 1980
Hienaloli 6, ‘Auhaukea‘ē	7-5-09:31	inventory Survey	11 platforms; historic house and traditional work and/or agriculture-related with traditional artifacts; *papamū*; petroglyphs; family cemetery	Athens 1981a
Hienaloli 6, ‘Auhaukea‘ē	7-5-09:31	burial disinterment; monitoring	archaeological excavation of 3 historic burials; traditional artifacts recovered from house platform	Athens 1981b
Hienaloli 6, ‘Auhaukea‘ē	7-5-09:31	inventory survey	Site 50-Ha-D8-64, habitation site probably occupied between ca. 1650 to 1935; consisting of 25 features such as stone walls, enclosures, platforms, cairn, modified outcrops, depressions, midden, *papamū*, and petroglyphs	Allen 1986
Hienaloli 6 & ‘Auhaukea‘ē 1	7-5-09:31	burial disinterment and monitoring	disinterment of 3 historic burials at Site 50-Ha-D8-64	Wickler 1989
Hienaloli 6, ‘Auhaukea‘ē 1	7-5-09:31	burial disinterment and monitoring	disinterment of 3 historic burials at Site 50-Ha-D8-64	Wickler 1990
Pua‘a 2	7-5-09:40	reconnaissance survey	Site 11059 containing 8 features such as boundary walls, platforms, cairn, lava bubble, and modified outcrop	Welch 1988
Pua‘a 2	7-5-09:40	burial disinterment	excavation and removal of two historic burials	Wickler 1991a
Pua‘a 2	7-5-09:40	burial disinterment	excavation and removal of two historic burials	Wickler 1991b
Pua‘a 2	7-5-09:40	inventory survey	Site 11059 containing 8 features such as boundary walls, platforms, cairn, lava bubble, and modified outcrop	Clark and Rechtman 2003
Pua‘a 2	7-5-09:40	data recovery plan	Site 11059 Fe 7- platform possibly utilized as a pre-Contact shrine	Desilets and Rechtman 2004
Hienaloli 6	7-5-09:48	inventory survey	13 sites and 17 feature components consisting of walls, terraces, caves, modified outcrops for habitation, agriculture, and boundaries	Donham and Kai 1990

Table 5. Archaeological Projects Conducted Within and Near the Archaeological Survey Area for the Kuakini Highway Improvements Project (continued).

Ahupua‘a	TMK	Level of Survey	Comments	Report (author/date)
Hienaloli 6	7-5-09:48	data recovery	11 of 13 sites underwent data recovery investigations, including examination of Kuakini Wall (Site 6302); radiocarbon date of A.D. 1471-1676 at agricultural site	Moore et al. 1997
‘Auhaukea‘ē 1	7-5-09:54	inventory survey	portions of two previously identified sites were recorded and tested— 1 human burial was uncovered; agricultural features and walls recorded	Clark and Rechtman 2004
Wai‘aha 1 and 2	7-5-17:6, 7; 7-5-18:73	assessment survey	28 sites consisting of 53 features such as boundary walls, habitation, possible ceremonial features, possible burials, agriculture, and ranching features	Corbin and Rosendahl 2002
Wai‘aha	7-5-10:85; 7-5-17:06	inventory survey	26 sites, including pre-Contact habitation sites consisting of a two-tiered platform, smaller platforms, enclosures, boundary walls, possible burials, agriculture, and ranching features	Clark and Rechtman 2003
Wai‘aha 1	7-5-10:85; 7-5-17:06	data recovery plan	plan for 10 sites- pre-Contact habitation sites and agriculture features	Rechtman 2004
Wai‘aha 1	7-5-18:07	inventory survey	27 sites consisting of 41 features such as walls, mounds, lava tube caves, platforms, modified outcrops, shrine, pavement, and *papamū*	Corbin and Gothar 2001+
Wa‘aha 1	7-5-18:08	inventory survey	29 sites consisting of burials, religious, habitation, ranching, and agricultural features	Rechtman 2000
Wai‘aha 1	7-5-18:07	reconnaissance	parcel has been extensively bulldozed and no surface archaeological remains present	Barrera 1991
Wai‘aha 1	7-5-18:07	data recovery plan	plan for 7 sites, consisting of 2 lava tubes with possible burials, habitation platform, and 4 complexes	Haun and Henry 2001
Pua‘a 2 and 3, Waiaha 1 and 2	7-5-18:07, 08	inventory survey	20 sites consisting of 38+ features, such as modified outcrops, terraces, mounds, walls, lava tubes, paved areas, enclosures, and a trail; radiocarbon dates suggest some features may predate AD 1000.	Head et al. 1994

Table 5. Archaeological Projects Conducted Within and Near the Archaeological Survey Area for the Kuakini Highway Improvements Project (continued).

Ahupua‘a	TMK	Level of Survey	Comments	Report (author/date)
Pua‘a 2, 3, Wai‘aha 1, 2	7-5-18:07, 8	data recovery	3 sites: 15507- burial, modified outcrops; 15511- small cave with cultural material; 15526- platform	Walker et al. 1996
Kahului 2	7-5-19:01	reconnaissance	21 features recently disturbed by bulldozing,- habitation, burials, and ranching	Soehren 1976
Kahului 1	7-5-19:05, 38, 40	inventory survey	7 sites consisting of habitation platforms, burial platform for an high status individual, and a *heiau*	Hammatt and Tomonari-Tuggle 1978
Kahului 1	7-5-19:05, 38, 40	data recovery excavations and *heiau* stabilization	platforms suggesting high status individuals, likely associated with nearby *heiau*; high status burial, and concentration of volcanic glass artifacts	Hammatt and Meeker 1979
Kahului 1st	7-5-19:05, 38, 40	inventory survey	inventory survey performed to update survey conducted in 1978; residential complexes, *heiau*, walls, burials	O’Hare and Wolforth 1998
Kahului 1	7-5-19:46	inventory survey	paved areas on pahoehoe, boundary walls, and historic house	Barrera 1991
Kahului 1 & 2	7-5-19:05, 7, 8, 9	inventory survey	2 boundary walls and a permanent habitation terrace	Rechtman and Henry 1999
Kahului 2	7-5-19:01	reconnaissance survey	area west of Kuakini Wall; appeared recently bulldozed; platforms, burials, enclosures, and *papamū*	Soehren 1976
Kahului 2	7-5-19:01	inventory survey	17 sites consisting of 103 features, such as platforms (4 with burials), enclosures, cairn, walls, terraces, mounds, and modified outcrops	Ching et al. 1973; Haun and Henry 2004+, Rechtman and Henry 1999; Soehren 1976
Kahului 2	7-5-19:01	data recovery plan	5 sites	Ching et al. 1973; Haun and Henry 2005+

+ These archaeological reports are referenced in other reports, but were not available at SHPD.

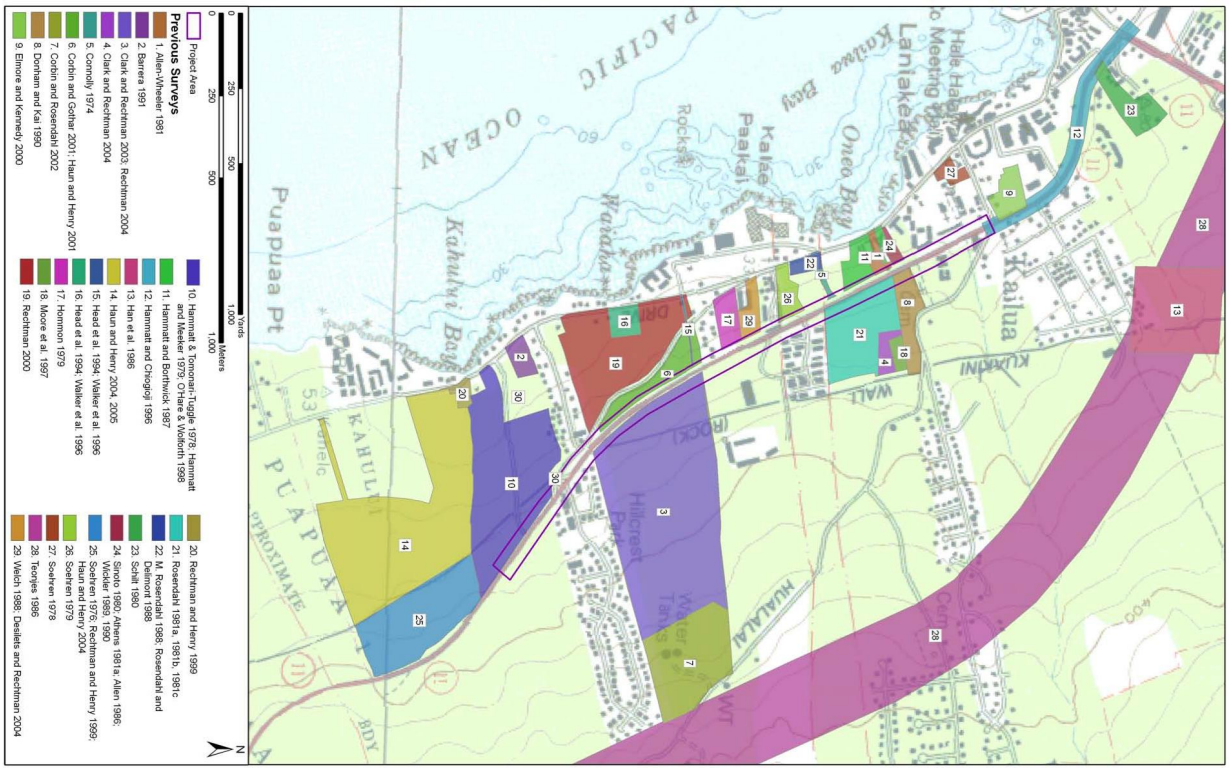
Project Area
Previous Surveys
1. Allen-Wheeler 1981
2. Barrera 1991
3. Clark and Rechtman 2003; Rechtman 2004
4. Clark and Rechtman 2004
5. Connolly 1974
6. Corbin and Gothar 2001; Haun and Henry 2001
7. Corbin and Rosendahl 2002
8. Dorham and Kai 1980
9. Elmore and Kennedy 2000
10. Hammatt & Tomonari-Tuggle 1978; Hammatt and Meeker 1979; O'Hare & Wolforth 1998
11. Hammatt and Borthwick 1987
12. Hammatt and Chiogioji 1996
13. Han et al. 1986
14. Haun and Henry 2004, 2005
15. Head et al. 1994; Walker et al. 1996
16. Head et al. 1994; Walker et al. 1996
17. Hommon 1979
18. Moore et al. 1997
19. Rechtman 2000
20. Rechtman and Henry 1999
21. Rosendahl 1981a, 1981b, 1981c
22. M. Rosendahl 1988; Rosendahl and Delimont 1988
23. Schilt 1980
24. Sinoto 1980; Athens 1981a; Allen 1986; Widler 1989, 1990
25. Schilt 1980; Rechtman and Henry 1999; Haun and Henry 2004
26. Soehren 1979
27. Soehren 1978
28. Teorges 1986
29. Welch 1988; Desilets and Rechtman 2004
Yards
Meters
Kuakini Hwy
Puapuaa Pt
Kahului Bay
Kalae Paakai
Kaiwa Bay
Oneo Bay
Lanlakea
Kalua
Hillcrest Park
Water Tank
Hale Hanai
Meeting Hall
PACIFIC
OCEAN
PUAPUAA
KAHULUI
HUALALAI
ROCKY
WALL
KUAKINI
Rocky
Kaiwa
Puaa
Kahului
Kalua
Lanlakea
Oneo
Kalae
Paakai
Hillcrest
Park
Water
Tank
Hale
Hanai
Meeting
Hall
Kuakini
Hwy
Puapuaa
Pt
Kahului
Bay
Kaiwa
Bay
Oneo
Bay
Kalua
Lanlakea

Table 6. Archaeological Sites Previously Recorded In and Near the Archaeological Survey Area for the Kuakini Highway Improvements Project (continued).

Site Number^	Feature	Description	Inferred Function	Documentation	Identified Within Survey Area	Identified Within Proposed Limits of Construction	Current Status	NRHP Eligibility Criteria*/ Recommendations from Prior Reports
5608	FFF	platform	probable burial feature	Rosendahl 1979a, 1979b, 1981a, 1981b, 1981c- in Clark and Rechtman 2004	No	No	not located; possibly outside project area or destroyed	Preservation***
5608	WWW	occupation area	unknown	Rosendahl 1979a, 1979b, 1981a, 1981b, 1981c- in Clark and Rechtman 2004	Yes	No	ID uncertain; Feature appears disturbed	D; Preservation***
6300	—	faced, core-filled wall along north *ahupua'a* boundary of Kahului, parallel to Kuakini Highway, and parallel to Ali'i Drive; 1.2 to 1.7 m wide and 0.7 to 1.6 m high; wall morphology documented	boundary wall probably constructed during historic ranching—breaches in wall appear to have occurred during construction of Kuakini Highway	O'Hare and Wolforth 1998	Yes	Yes	wall located and mapped; Kuakini Highway currently abuts the wall, and there are breaches in several places	D; NFA

Table 6. Archaeological Sites Previously Recorded In and Near the Archaeological Survey Area for the Kuakini Highway Improvements Project (continued).

Site Number^	Feature	Description	Inferred Function	Documentation	Identified Within Survey Area	Identified Within Proposed Limits of Construction	Current Status	NRHP Eligibility Criteria*/ Recommendations from Prior Reports
6302	—	large wall, ca. 5.6 miles long from Kahulu'u to Keahuolu; average height 8 ft (note: wall extends beyond the mapped portion shown in Fig. 6)	Kuakini Wall	Ching et al. 1973; Clark and Rechtman 2003, 2004; Corbin and Rosendahl 2002; Donham and Kai 1990; Hammatt and Meeker 1979; Hammatt and Tomonari-Tuggle 1978; Haun and Henry 2004, 2005; Moore et al. 1997; Rechtman 2004; Rosendahl 1979a, 1979b, 1981a, 1981b, 1981c	Yes	No	wall breached by Kuakini Highway, otherwise appears in excellent condition	B, C, D; Preservation
7248	—	historic house ruins with opening to lava tube cave that lead to the ocean at Hale Halawai	Laniakea Cave at the Thurston House	DOT 1975; Ellis 1963:62; Soehren 1980 in Kelly and Barrére1980:16; Paikuli-Campbell pers. comm. 2005	No	No	cave openings out of survey area; cave may extend below Kuakini Highway; no map	D; Preservation
11059	4	rock mound	cairn or cleaning pile	Welch 1988	Yes	No	excellent condition, slight tumbling of rocks apparent	D; NFA

Table 6. Archaeological Sites Previously Recorded In and Near the Archaeological Survey Area for the Kuakini Highway Improvements Project (continued).

Site Number^	Feature	Description	Inferred Function	Documentation	Identified Within Survey Area	Identified Within Proposed Limits of Construction	Current Status	NRHP Eligibility Criteria*/ Recommendations from Prior Reports
11059	8	rock wall	boundary marker	Welch 1988	No	Yes	excellent condition	D; NFA
15508	—	rock wall	ranching wall	Corbin and Gothar 2001; Haun and Henry 2001; Head et al. 1994	Yes	Yes	excellent condition	D; NFA
15514	—	rock wall	ranching wall	Corbin and Gothar 2001; Haun and Henry 2001; Head et al. 1994	Yes	No	good to excellent condition-wall appears previously truncated	D; NFA
22045++	IARII Temp 8	modified outcrop located at the location of Site 22045	clearing	Corbin and Gothar 2001; Haun and Henry 2001	Yes	No	–	D; NFA
22053++	PHRI 2086 T15	L-shaped wall located at the location of Site 22053	portion of cattle pen	Corbin and Gothar 2001; Haun and Henry 2001	Yes	No	good to excellent; appears previously truncated	D; NFA
22054++	IARII Temp 7	rock wall located at the location of Site 22054	boundary marker	Corbin and Gothar 2001; Haun and Henry 2001	No	No	poor condition; scatter rock with few remnants of facing and interior cobble fill	D; NFA

Table 6. Archaeological Sites Previously Recorded In and Near the Archaeological Survey Area for the Kuakini Highway Improvements Project (continued).

Site Number^	Feature	Description	Inferred Function	Documentation	Identified Within Survey Area	Identified Within Proposed Limits of Construction	Current Status	NRHP Eligibility Criteria*/ Recommendations from Prior Reports
22057	—	rock wall on west side of Kuakini Highway	boundary	Corbin and Gothar 2001; Haun and Henry 2001; Head et al. 1994	Yes	Yes	poor condition-wall segments remain in southern portion	D; NFA
23662	PHRI Fe 2235-20	walled enclosure	ranching	Clark and Rechtman 2003, Corbin and Rosendahl 2002; Rechtman 2004	Yes	Yes	excellent condition	D; NFA
23665	—	wall; extends east/west	boundary	Clark and Rechtman 2003, Corbin and Rosendahl 2002; Rechtman 2004	Yes	Yes	no integrity; wall dismantled and rebuilt	D; NFA
23666	PHRI Fe 2235-28	wall on the east side of Kuakini Highway, parallel to the highway	boundary, possible ranching	Clark and Rechtman 2003, Corbin and Rosendahl 2002; Rechtman 2004	Yes	Yes	excellent condition; a few sections breached for roads, condomin-iums, etc.	Preservation recommended for modern feature (does not meet NRHP criterion for significance; preservation therefore not necessary)
23686	187	mound; 3.0 x 1.7 m and 0.8 m high; tested—1 waterworn coral fragment	agriculture	Clark and Rechtman 2003, Corbin and Rosendahl 2002; Rechtman 2004	Yes	No	good to excellent condition	D; NFA

Table 6. Archaeological Sites Previously Recorded In and Near the Archaeological Survey Area for the Kuakini Highway Improvements Project (continued).

Site Number^	Feature	Description	Inferred Function	Documentation	Identified Within Survey Area	Identified Within Proposed Limits of Construction	Current Status	NRHP Eligibility Criteria*/ Recommendations from Prior Reports
23686	188	modified outcrop; 3.5 x 2.7 m and 1.0 m high	agriculture	Clark and Rechtman 2003, Corbin and Rosendahl 2002; Rechtman 2004	Yes	No	good to excellent condition	D; NFA
23686	189	mound; 2.4 x 2.3 m and 0.7 m high; waterworn coral; tested-no cultural	agriculture	Clark and Rechtman 2003, Corbin and Rosendahl 2002; Rechtman 2004	No	No	good to excellent condition	D; NFA
23686	190	modified outcrop; 3.9 x 2.3 m and 0.9 m high	agriculture	Clark and Rechtman 2003, Corbin and Rosendahl 2002; Rechtman 2004	Yes	No	not located	D; NFA
23686	191	modified outcrop; 4.4 x 2.1 m and 0.8 m high	agriculture	Clark and Rechtman 2003, Corbin and Rosendahl 2002; Rechtman 2004	Yes	No	not located	D; NFA
23686	197	mound; 6.0 x 2.3 m and 1.1 m high	agriculture	Clark and Rechtman 2003, Corbin and Rosendahl 2002; Rechtman 2004	No	No	good condition	D; NFA
21189	—	human remains marked by a modern memorial	inadvertent discovery of human remains	Barrera 1998; Hibbard 1998; Smith 1998	Yes	Yes	–	E; Preservation

Table Footnotes

^ Site numbers are listed as either State Site Numbers, which are the official designations by the State Historic Preservation Division (SHPD), or Bishop Museum numbers if State Site Numbers do not appear to have been assigned. State Site Numbers are preceded by "50-10-28" indicating the State of Hawai'i, island of Hawai'i, and USGS topographic quadrangle. Bishop Museum numbers within the table are preceded by "BPBM 50-Ha-D8" indicating the State of Hawai'i, island of Hawai'i, District of North Kona, and the number assigned to the *ahupua'a*

* NRHP: National Register of Historic Places

** NFA: No Further Archaeological Work Recommended

*** Preservation *en mass* (Kona Hale Alii Rezoning Application in RC-0205; County of Hawai'i State of Hawai'i Bill No. 367 Ordinance No. 05 74)

++ Sites found at the location of previously recorded locations, however no detailed maps were available to substantiate that the identified sites are the same as those previously recorded.

B: Site is associated with the lives of persons important in our past.

C: That 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.

D: Have yielded, or is likely to yield, information important for research on prehistory or history.

E: Site has important historical cultural value to an ethnic group of the State (this is a State of Hawai'i criterion).

Hammatt and Borthwick (1987) conducted a reconnaissance survey of a parcel south of the previous parcel (TMK 7-5-009–31) that intersects what is now the western side of the archaeological survey area for the Kuakini Highway Improvements Project (TMK 7-5-009:25, 28, 43). Habitation features and burials were recorded on the parcel, which was described as:

> undoubtedly inhabited by persons of high socio-political rank, especially during the late pre-historic and early historic times… The importance of the makai portion of ‘Auhaukea‘e as a residential area of ranking individuals is substantiated by land claims made during the Great Mahele” (Hammatt and Borthwick 1987:4).

The presence of an old canoe landing, Oneo Landing, on the ocean-side of this parcel adds further significance to the area. Although there is no sand at the landing now, sand was present prior to construction of the sea wall that fronts Kailua Bay (Hammatt and Borthwick 1987; Allen 1986:6).

Similar features are located on the east side (TMK 7-5-009:54 and 55) of Kuakini Highway, and suggest the highway has artificially divided the sites, all of which appear to have been features of high-ranking individuals. Although the area has been surveyed, the archaeological reports have not been submitted to the State Historic Preservation Division (Mary Anne Maigret pers. comm. 2005). The survey identified a large site, designated Site 5608, which contains 75 features, including three major structural features interpreted as possible *heiau* (Rosendahl 1979a, 1979b, 1981a, 1981b, 1981c in Clark and Rechtman 2004).

Remnants of habitation features were identified during a walk-through survey (TMK 7-5-009:25) in what is now the mid-west side of the Kuakini Highway Improvements Project (Soehren 1979). Lot Kapuaiwa (Kamehameha V) once owned the parcel. Bulldozing conducted prior to 1979 disturbed features that once may have been platforms.

Additional features from high status residences were recorded in the west side of Pua‘a Ahupua‘a (TMK 7-5-009:40), in the mid-west portion of the archaeological survey area for the Kuakini Highway Improvements Project. These include habitation platforms, modified outcrops, and boundary walls (Welch 1988; Desilets and Rechtman 2004). Historical documentation also reveals that the *ahupua‘a* of Pua‘a was royal land (Welch 1988:3). The “famous surf bathing resort in Kamehameha’s time,” called Kahopuka, is located at the seaward end of Pua‘a Ahupua‘a (Emerson 1883). The area along the shoreline, about 200 m inland, “was used primarily for permanent habitation and other non-agricultural activities, such as canoe storage, ceremonial and burial practices, recreation, and fishing-related activities” (Desilets and Rechtman 2004:4).

Archaeological investigations near the southwest portion of the Kuakini Highway Improvements Project (see Fig. 5) have recorded complexes of small platforms, which date to the late pre-Contact/early historic period, two *heiau*, burials, boundary walls, and agricultural features; other features include historic house sites and ranching features (Soehren 1976; Hammatt and Tomonari-Tuggle 1978; Hammatt and Meeker 1979; Head et al. 1994; Walker et al. 1996; Rechtman 2000; Corbin and Gothar 2001; O’Hare and Wolforth 1998).

Archaeological investigations intersecting the southeast portion of the Kuakini Highway Improvements Project (TMK 7-5-10:85; 7-5-17:06; see Fig. 5) have documented habitation sites, ceremonial features, clearing mounds, agricultural features, ranching features, and possible

graves (Clark and Rechtman 2003; Corbin and Rosendahl 2002; Rechtman 2004). This area is also within the Kona Field System and likely was used historically for agriculture, as is reflected by the LCAs awarded in the area (Corbin and Rosendahl 2002:10). Between the 1920s and 1970s, the Gomes family conducted ranching on the parcel. They constructed a number of cattle walls, pens, and other features, often using the stones from previously existing features.

The Kuakini Wall (Site 6302) is a significant site that roughly parallels the Kona coast. This large wall is about 8 ft high and extends from Kahulu‘u to Keahuolu, a distance of ca. 5.6 miles. It has been extensively recorded near the project area (Ching et al. 1973; Clark and Rechtman 2003, 2004; Corbin and Rosendahl 2002; Donham and Kai 1990; Hammatt and Meeker 1979; Hammatt and Tomonari-Tuggle 1978; Haun and Henry 2004, 2005; Moore et al. 1997; Rechtman 2004; Rosendahl 1979a, 1979b, 1981a, 1981b, 1981c). The wall once crossed the project area at the intersection of Kuakini Highway and Walua Road. As mentioned earlier, this wall is likely an expansion or rebuilding of an older wall by Governor Kuakini to keep wild cattle out of gardens and residential areas. Examination of a portion of the wall in the *ahupua‘a* of Hienaloli 6 indicates that wall construction took the form of “three parallel rows of stacked vertical slabs… This may be an original design or may relate to successive construction episodes” (Moore et al. 1997:19).

Results of the previous archaeological investigations that have been conducted along the archaeological survey area for the Kuakini Highway Improvements Project indicate that this area was intensely occupied by high status individuals, probably from the time ‘Umi-a-Liloa moved his court to Kona in the early to mid-1500s. It is expected that features in this area may relate to the *kauhale* (compounds) of these high status individuals and include platforms, religious features, gardens, and burials.

IV. INVENTORY SURVEY RESULTS

Twenty archaeological sites, consisting of 25 features, were identified during the inventory survey within the archaeological survey area for the Kuakini Highway Improvements Project. Sixteen of these sites were recorded during earlier surveys (Fig. 6; see Table 6). The present survey collected data about each of the features for comparison and management purposes. Sites 5606 (Features (BBB, CCC, DDD, and WWW), 6300, 6302, 7248, 11059 (Feature 8), 15508, 22057, 23662, 23665, 23666, 26100, 26101, 26102, and the Memorial, designated Site 21189, are located within the APE. Those located outside the APE include Feature 4 of Site 11059 and Sites 15514, 22045, 22054, 23686 (Features 187, 188, 189, 190, 191, and 197), and 26099.

SITE INVENTORY AND DISTRIBUTION

Although "site" identification is necessary for management purposes, most of the project area is best characterized as part of an archaeological landscape with concentrations of structures along the coast. "This means that there is some archaeological evidence or indication of past activity over extensive areas" (Tuggle and Tomonari-Tuggle 2005:27).

Site recording in Kailua-Kona varies from project to project rather than reflecting the archaeological landscape. Archaeologists have used different methods of site recording, often constrained without permission to examine the sites in neighboring parcels. Sites may be defined as entire complexes with the structures identified as features; sites may also be defined as individual structures; and finally, sites may be defined by function as well as period (e.g., historic ranching features provided one site number whereas Hawaiian features within the same area were assigned different numbers). It is important, therefore, to look at sites and features identified within the survey corridor as components of the larger archaeological landscape.

INVESTIGATION PROCEDURES

The inventory survey consisted of walking transects within the project corridor parallel to Kuakini Highway. Locations of all features encountered during the survey were recorded using a Trimble Pro-XR Global Positioning System (GPS) based on real time differential corrections using the Universal Trans Mercator (UTM) coordinate system with the North American Datum of 1983 (NAD-83). The GPS points are included in Appendix A.

Tape and compass maps were drawn of all the features except walls, the shapes and locations of which were recorded using the GPS and plotted onto the USGS map. Photographs, notes, and measurements were recorded on site forms.

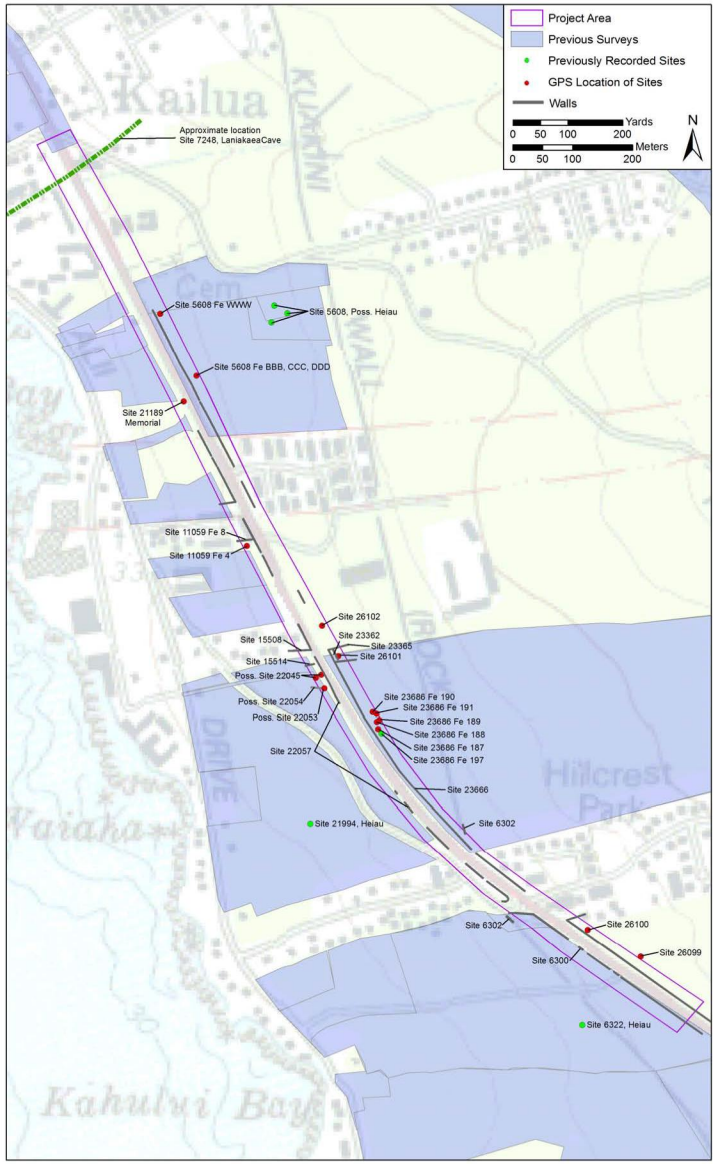

Figure 6. Archaeological sites recorded in the archaeological survey area for the Kuakini Highway Improvements Project, including nearby significant sites.

SITE DESCRIPTIONS

This section provides summary descriptions of all sites recorded in the present project. Table 7 lists the archaeological sites identified during the archaeological survey for the Kuakini Highway Improvements Project as well as the inadvertently discovered human remains below Kuakini Highway. Sites identified during previous archaeological projects are listed in Table 6, in the previous section. GPS data is included in Appendix A. Select photographs of the archaeological features are presented in Appendix B, and feature maps in Appendix C.

Site numbers are listed as either State Inventory of Historic Places (SIHP) number, which are the official designations by the State Historic Preservation Division (SHPD), or Bishop Museum numbers if State Site Numbers do not appear to have been assigned. State Site Numbers are preceded by "50-10-28" indicating the State of Hawai'i, island of Hawai'i, and USGS topographic quadrangle. They will generally be referred to within this report without their prefix. Bishop Museum numbers are preceded by "50-Ha-D8" indicating the State of Hawai'i, island of Hawai'i, District of North Kona, and the number assigned to the *ahupua'a*. Their entire site number will be included within the report so as not to confuse them with designated State Site Numbers.

Table 7. Archaeological Sites Identified during the Kuakini Highway Improvements Project Inventory Survey or not included in Previous Archaeological Reports.

Site Number	Description	Inferred Function	Within Proposed APE*	Within Proposed Limits of Construction	Current Status
26099	mound; 3.1 x 2.7 m and 0.45 m high	clearing, agriculture	No	No	excellent condition
26100	C-shaped wall; 2 x 1 m and 0.5 m high	temp. habitation	Yes	No	excellent condition
26101	modified outcrop; 5.5 x 3.0 m and 1.9 m high, marine shell and possible remnant paving to the north	clearing, ranching	Yes	No	poor condition
26102	collapsed lava bubble with small amount of marine shell	temp. habitation	Yes	No	poor condition; impacted by bulldozing
Not assigned	inadvertent discovery of human remains	human remains	Yes	Yes	unknown

* APE = Area of Potential Effect

SITE 5608

Site 5608, consisting of 75 features, is located on the north east side of Kuakini Highway (TMK 7-5-09:54 and 55) in the *ahupua'a* of 'Auhaukea'ē. Although Rosendahl (1979a, 1979b, 1981a, 1981b, and 1981c) recorded the site, an archaeological report has not been submitted to SHPD. Clark and Rechtman (2004:ii) summarize Rosendahl's findings.

> The site includes three major structural features… that were interpreted as "possible *heiau*" (Rosendahl 1981c). Of the remaining seventy-two features recorded on the two parcels, twenty-nine are listed as possible burials, five are confirmed burials, and three others are considered probable burials (Rosendahl 1981b). Also, four of the recorded features were interpreted as possible residential, eight as retaining walls, one as a possible cairn, one as a bedrock activity area, one as a possible walled terrace, one as a storage feature, one as a modern construction, and sixteen were of unknown or undetermined functions.

During the current survey, six features previously identified within Site 5608 were possibly located and recorded. Only brief descriptions of the features and a site map are available (Rosendahl 1979a, 1979b, 1981a, 1981b, 1981c; Clark and Rechtman 2004).

Much of this site area is being re-zoned from A-1a to Open District by the County of Hawai'i with a "prohibition of any development or improvement of that area in such a way as to interfere with or negatively affect the archaeological and historic features of such area, as determined by the State Historic Preservation Officer" (Kona Hale Alii Rezoning Application in RC-0205; County of Hawai'i State of Hawai'i Bill No. 367 Ordinance No. 05 74 2005:5-6). At this time, however, no archaeological inventory survey or preservation plan has been submitted to SHPD (Mary Anne Maigret, pers. comm. 2005).

Feature Q

Feature Q, a cultural deposit, is shown on Rosendahl's site location maps on the east side of Kuakini Highway across from Coconut Grove Market Place (Rosendahl 1979a, 1979b, 1981a, 1981b, 1981c; Clark and Rechtman 2004). Although the feature is described as being located below the boundary wall, later designated as Site 23666, it was not observed during the archaeological survey or GIS mapping of Site 23666 for the Kuakini Highway Improvements Project. This area was covered in high grass, which may have obscured the feature; alternatively, the feature may have been destroyed. A feature description indicates that the feature is:

> an occupation area situated between the pavement of Kuakini Highway and the stone boundary wall along the seaward boundary… it was observed that a portion of the cultural deposit probably extended several meters further inland– beneath the boundary wall [Site 23666]…
>
> The eroding exposed face of the deposit– cut during the road construction– indicated the presence of a cultural deposit estimated to be possibly as much as 30 cm. thick…
>
> The surface of the ground immediately to the north of a large pahoehoe bedrock outcrop was littered with abundant midden remains– principally marine mollusc [sic] shell and sea urchin spines and fragments, and numerous coral and waterworn basalt pebbles and small cobbles. A cursory inspection of the pahoehoe outcrop on the south side of Feature Q noted three shallow depressions and a small mortar or cup (Rosendahl 1981a:9, brackets added).

Features BBB, CCC, and DDD

Features BBB, CCC, and DDD are located on the east side of Kuakini Highway across from the Coconut Grove Marketplace. Each feature was described as a platform and identified as a probable burial by Rosendahl (Rosendahl 1979a, 1979b, 1981a, 1981b, 1981c; Clark and Rechtman 2004:8). The site map drawn by Rosendahl and shown in his reports indicates these features are clustered together just east of Kuakini Highway across from what is now the Coconut Grove Marketplace.

During the current survey, a platform (Photo 1) with adjacent terraces was discovered in the same area. This feature may be one or all of the three features recorded by Rosendahl. It is also possible that additional features are located beyond the archaeological survey area and not observed.

The platform recorded during the survey is rectangular in shape, 6.5 by 21 m, and 0.25 to 0.4 m high (two to three courses). The feature exhibits interior divisions. The northeast corner is slightly raised and contains numerous pieces of branch coral. An upright basalt boulder sized rock is located at the northeast corner. The southwest corner of the feature is a cleared area defined by a single course of rocks along the north and west edges. Numerous pieces of coral are also present in this area. The southeast portion of the platform is wider than the upper portion, giving the appearance of an L-shaped notch.

Stone is concentrated on the west side of the feature along the natural slope, which may be the remnants of a lower terrace feature, 12 by 7 m and 0.4 m high. Two small L-shaped terraces (2 x 2 m) are adjacent to the platform: one on the southwest side of the platform and one on the southeast side. In addition, a single course of rocks is present on the eastern side of the feature, forming a scalloped pattern; interior divisions are visible. Stones arranged in a rectangular (ca. 1.5 x 1.0 m) enclosure north of the feature appear to have been constructed by squatters. This area appears to be currently occupied by squatters, it was not examined in detail.

Photo 1. Site 5608, platform Features BBB, CCC, and DDD, view to southeast. Rectangular platform is 6.5 by 21 m and ca. 25 to 40 cm height.

Features FFF and WWW

On the Rosendahl site map (Rosendahl 1979a, 1979b, 1981a, 1981b, 1981c; Clark and Rechtman 2004:6), Features FFF and WWW are shown at the northwest end of the Rosendahl project area, which is now across from the Coconut Grove Marketplace. Feature FFF is described as a platform and Feature WWW as an occupation area (Rosendahl 1981a:14-15).

During the current survey, a disturbed scatter of coral and marine shell was found in this same location. The scatter is spread out in a ca. 10 m diameter on a pahoehoe outcrop. It appears to have been disturbed by bulldozing. The pahoehoe is stepped, forming natural ledges. On one ledge, a small lava blister is present. It is 80 cm wide, 51 cm high, and 2 m deep. No cultural material was present within the blister.

Although the Feature FFF platform, was not relocated, it may be situated outside of the archaeological survey area or was destroyed, possibly when the car dealership to the north was constructed. Feature WWW is likely the coral and marine shell scatter recorded.

SITE 6300

Site 6300 is described as a historic boundary wall on the west side of Kuakini Highway (O'Hare and Wolforth 1998). The wall marks the northern boundary of Kahului Ahupuaʻa. At its northeast end it turns south and parallels Kuakini Highway. The west side of the wall parallels Aliʻi Drive. Mrs. Makuakāne, a resident descended from several family lines from this area, confirmed that these were boundary walls, which had to be rebuilt to keep the cattle out of the house lots and backyard gardens (Makuakāne in O'Hare and Wolforth 1998:I-9). Details of the wall morphology, recorded during an inventory survey by O'Hare and Wolforth (1998), indicate that the wall is faced and core-filled, about 1.2 to 1.7 m wide and 0.7 to 1.6 m high. The section of the wall adjacent to Kuakini Highway "has several large breaches. These cuts into the wall are usually associated with drainage culverts, which were probably placed during construction of the highway. It has also suffered from natural erosion, because in many places it is built at the top of a steep gully" (O'Hare and Wolforth 1998:2-1). The walls were "probably constructed after the Great Mahele, when the area was first divided into separate lots" (O'Hare and Wolforth 1998:2-1).

The east section and eastern end of the north section of this wall were located and mapped with GPS within the archaeological survey area for the Kuakini Highway Improvements Project. This wall is constructed of stacked, faced aa clinkers. Both the Kuakini Highway and Walua Road abut the wall, indicating the roads were constructed after the wall. As also noted by O'Hare and Wolforth (1998), portions of the wall were observed to have collapsed naturally, have been bulldozed, or covered with trash and debris.

SITE 6302

Site 6302, also known as the Kuakini Wall, is a large wall that extends from Kahuluʻu to Keahuolu. Since this wall is long, it crosses through a number of parcels and thus has been

recorded by numerous archaeologists (Ching et al. 1973; Clark and Rechtman 2003, 2004; Corbin and Rosendahl 2002; Donham and Kai 1990; Hammatt and Meeker 1979; Hammatt and Tomonari-Tuggle 1978; Haun and Henry 2004, 2005; Moore et al. 1997; Rechtman 2004; Rosendahl 1979a, 1979b, 1981a, 1981b, 1981c). The wall averages 8 ft in height and is core filled and faced on both sides. Moore et al. (1997) noted two possible construction phases, which would support the idea that Kuakini modified a pre-existing wall.

A small section of Kuakini Wall is present within the archaeological survey area for the Kuakini Highway Improvements Project. It is located on the east side of the highway, north of Walua Road and it is 1.1 to 1.5 m high on the west (downhill) side and about 0.8 m high on the east (inland) side, due to build-up of the sediment against the wall. The width varies from 1.1 to 1.3 m. The base of the wall is constructed of large, tabular pieces of subangular, vesicular basalt boulders. Rocks, consisting of both aa clinkers and subangular vesicular basalt cobbles and boulders, have been stacked generally six high to form the exterior facing. The fill is composed of aa and vesicular basalt pebbles and small cobbles. The wall extends north, beyond the archaeological survey area. The southern terminus of this wall section abuts an old, wooden post and wire fence. Kuakini Highway has breached the wall to the south. The wall begins again just west of archaeological survey area and continues in a southeast direction. Sample portions of the wall were recorded by GPS.

SITE 7248

Site 7248 is assigned to the Thurston House ruins and its associated features. Thurston House is outside the APE. It located ca. 250 m east of the north end of the archaeological survey area for the Kuakini Highway Improvements Project and west of Kuakini Wall. One of the features associated with Thurston House is Laniakea Cave, which extends from the ruins to Hale Halawai in Kailua and thus passes underneath Kuakini Highway (approximate location of the cave is shown on Fig. 6).

Ellis explored the cave in the early 19th century and described it as a "spacious cavern" where women, children, and elderly persons could be hidden during an assault (Ellis 1963:62). In 1980, sections of the cave had collapsed and the entrance was choked with debris (Soehren 1980 in Kelly and Barrére1980:16). When archaeologist Tyler Paikuli-Campbell entered the cave, he found that the entrance near the Thurston House was disturbed by squatters (pers. comm. 2005). While he was inside the cave, he observed a small opening covered by a grate. Paikuli-Campbell postulated that the grate may be the same one located southeast of the intersection of Hualalai Road and Kuakini Highway. Waste products and debris have been dumped into the cave via this opening, causing an accumulation of sediment and muck within the cave at this point. No cultural materials were observed in the cave around this area; however, cultural materials could be concealed below the sediment. The western entrance to the cave near Hale Halawai is blocked. Paikuli-Campbell also described large concrete pillars that may be in place within the cave to support Kuakini Highway.

A Section 106 Compliance Letter issued by SHPD, indicates that a field inspection conducted by Marc Smith, SHPD staff archaeologist, and Thomas Pack, County of Hawaii Department of Public Works, noted that "It appears to us that the roof of the cave (a lava tube) is

far enough below surface that the proposed work will have "no effect" on this significant historic site" (Wilson 1998). The cave was not entered or mapped during the archaeological survey for the Kuakini Highway Improvements Project, because the entrances are located outside of the archaeological survey area for the current project.

SITE 11059

Site 11059 is located in the *ahupua'a* of Pua'a which was awarded as LCA 7715 to Lot Kapuaiwa, who became known as Kamehameha V. The LCA listing indicates Kapuaiwa had a house on the parcel. Following his death in 1872, part of the land was sold and the other part was returned to the government (Welch 1988).

During the reconnaissance survey conducted by Welch (1988), eight features were identified within Site 11059. Two of these (Features 4 and 8) are located within the archaeological survey area for the Kuakini Highway Improvements Project.

Feature 4

Feature 4 is described as "a small oval mound of stacked basalt cobbles and small boulders, approximately 3.2 by 2.3 m and 80 cm high, is located about 12 m *makai* of the *mauka* wall near the north boundary. It does not appear to be faced and is probably a clearing pile" (Welch 1988:9).

During the current project, a mound was found in roughly the same location. The measurements differ slightly, possibly due to disturbances since the reconnaissance survey. The roughly oval-shaped mound, constructed on a pahoehoe outcrop, is 3.7 by 1.9 m and 0.58 m high. The underlying pahoehoe continues towards both the east and west. Filled crevices were apparent, which may indicate remnants of a trail or other activity.

Feature 8

Feature 8 consists of rock walls that surround most of the property. The walls are "built of basalt boulders and cobbles stacked from 50 to 120 cm high. These are most likely historic walls since they follow historically defined boundaries. Both the west and east walls were probably segments of long, continuous walls that formerly ran along Alii Drive and Kuakini Highways" (Welch 1988:9).

Feature 8 was recorded within the archaeological survey area for the Kuakini Highway Improvements Project. It is located along the northern boundary of TMK 7-5-09:40, and parallel to Kuakini Highway. The northern boundary wall is located 14 m north of Feature 4. The wall in this location is core filled and faced on both sides. It is 1.5 m high on the north side (7 courses) and 0.95 m high on the south side (5 courses), and 0.75 m wide. The height difference may be due to landscaping on the condominium grounds located immediately north of the wall.

SITE 15508

Site 15508 is a ranching wall recorded by Head et al. (1994), Corbin and Gothar (2001), and Haun and Henry (2001). It is described as a "probable late historic/historic animal husbandry (cattle control) or boundary [wall]. It extends *mauka-makai* for approximately 220.0+ m between Ali'i Drive and Kuakini Highway, and probably originally extended farther, in both directions… Based on location, the wall may demarcate the boundary between Pua'a 2-3 and Waiaha 1-2" (Head et al. 1994:19). The presence of agricultural features nearby suggests the walls may have also functioned to keep cattle out.

The wall is located within the archaeological survey area for the Kuakini Highway Improvements Project. GPS locations of the feature were recorded and are presented in Appendix A. Notes regarding wall dimensions are also provided.

SITE 15514

Site 15514 is a ranching wall recorded by Head et al. (1994), Corbin and Gothar (2001), and Haun and Henry (2001). It is described as a "late historic/historic wall that was used for the control of domestic animals (cattle, swine, horses, etc.)" (Head et al. 1994:20).

The wall, Site 15514, is located within the archaeological survey area for the Kuakini Highway Improvements Project. GPS locations of the feature were recorded and are presented in Appendix A. Notes regarding wall dimensions are also provided.

SITE 21189 (MEMORIAL)

Site 21189 consists of human remains inadvertently discovered during grubbing activities associated with development of the Coconut Grove Marketplace. The remains were uncovered on 29 January 1998, below a house platform located within the county right-of-way (Smith 1998:1). A stone and concrete memorial on the sidewalk adjacent to the Coconut Grove Marketplace currently mark their location. Another set of human remains was found within the same platform about 7 m away on private property.

The human remains within the county right-of-way were approximately 70 cm below surface, in a matrix of fine silt containing cultural midden. Although the burial appeared to have been articulated, portions were disturbed and severely weathered. The remains are believed to be from one individual, over 50 years of age, and of Native Hawaiian ancestry (Hibbard 1998:1).

The human remains are not directly associated with an individual or family, although Ruby McDonald notes they could represent a relative of Keōpūolani (Ruby McDonald in Prasad 2006:19). They may also belong to the Kamaka family (Auntie Josephine in Prasad 2006:20), but McDonald thought the Kamaka family lived farther away from the location where the remains were found.

The memorial was erected above the human remains which were left in place about 8 feet below the sidewalk along the west side of Kuakini Highway (Cisco 2001:1).

SITE 22045 (POSSIBLE)

Two modified outcrop were observed in the area designated as Site 22045, as indicated on the Haun and Henry (2001:4) site map. Although the report shows the site location, it does not discuss it and no reference is made regarding form or function; therefore the word "possible" follows the site number. This likely is presented in the Corbin and Gothar (2001) report, which was not available at the SHPD library.

One modified outcrop consists of a stone pile along the base and top of an outcrop, 2.8 by 5.0 m and 30 cm high. It may be a clearing mound or a remnant of a disturbed feature. Although it resembles a paving, it lacks distinct morphology.

The other modified outcrop, located east, adjacent to Site 22057 (wall), is a stone concentration 5 by 1.4 m in size and 0.2 to 0.5 m high. The feature may be a clearing pile or a stockpile of stone for wall building.

SITE 22053 (POSSIBLE)

An L-shaped historic wall was discovered in the same area as Site 22053, as indicated on the Haun and Henry (2001:4) site map. Although the report shows the site, it does not discuss it and no reference is made regarding form or function; therefore the word "possible" follows the site number. This likely is presented in the Corbin and Gothar (2001) report, which was not available at the SHPD library.

The L-shaped wall is a faced, cobble-filled wall adjacent to the western wall along Kuakini Highway (Site 22057). It is about 0.7 to 1.02 m high and 1.2 to 1.4 m wide. It is constructed of five courses of vesicular basalt boulders and large cobbles. Although the wall does not abut Site 22057, scattered rock suggests it may have at one time. The east-west portion of the wall is 13 m long and the north-south portion is 17 m long.

Another wall segment, designated as possible Site 22054, extends west from possible Site 22053.

SITE 22054 (POSSIBLE)

Remnants of a wall feature were observed in the area designated as Site 22054, as indicated on the Haun and Henry (2001:4) site map. Although the report shows the site, it does not discuss it and no reference is made regarding form or function; therefore the word "possible" follows the site number. This likely is presented in the Corbin and Gothar (2001) report, which was not available at the SHPD library.

The wall remnant consists of what appears to be the base portion of a wall. Parallel alignments of large cobbles and boulders are present with smaller pebbles and cobbles between them. The wall remnant continues for ca. 23 m, and then becomes scattered stone. It is oriented at 95 degrees true north. It is about 2 m wide and varies between 20 and 40 cm high.

SITE 22057

Site 22057 is the faced, cobble-filled wall that parallels Kuakini Highway along its west side, within the *ahupua'a* of Wai'aha 1. It is shown as a continuous feature on the site location map in Haun and Henry (2001:4).

The wall, Site 22057, was located during the survey within the archaeological survey area for the Kuakini Highway Improvements Project. It was likely constructed as both a boundary wall and a cattle wall to keep the livestock from wandering onto Kuakini Highway and into gardens and houselots. It is probable that it was constructed in the 1950s when the Kuakini Highway was built. Much of the wall has been removed; only portions of it remain in the southern end. Bougainvillea has been planted around these portions. GPS locations of the wall fragments were recorded and are presented in Appendix A. Notes regarding wall dimensions are also provided.

SITE 23662

Site 23662 is a walled enclosure constructed for ranching purposes (Clark and Rechtman 2003; Corbin and Rosendahl 2002; Rechtman 2004). This feature functioned as a "cattle loading corral" (Corbin and Rosendahl 2002:14). The map of the feature indicates that cattle were herded from the pasture located west into the corral, where they were then guided into smaller chambers within the corral that led into vehicles (Rechtman 2004:4).

The portion of Site 23662 adjacent to Kuakini Highway was mapped using a tape and compass and its positions recorded with the GPS. The interior wall, oriented at 150 degrees true north, is 21 m long, 0.8 m wide, and 1.2 m high. It terminates at the northwest end at a reconstructed boundary wall designated as Site 23665 (Rechtman pers. comm. 2005). A gate was once present at the southeast end, as indicated by wooden posts. There is a gap of 3.5 m at this point and another wall (second wall), oriented at 88 degrees true north, extends beyond the gap. A third wall (Site 23666) parallels Kuakini Highway and intersects with the second wall to form the corral. A cattle ramp, constructed of basalt cobbles and boulders, is present at the northwest corner of the corral. The ramp is a rectangle, 3.8 by 4.4 m, extending up from ground level in the east to 1 m in height on the west side. The feature may have been in use until the 1970s, when cattle ranching in the area ended.

SITE 23665

Site 23665 is a boundary wall located between the *ahupua'a* of Wai'aha 1st and Pua'a 3rd (Clark and Rechtman 2003; Corbin and Rosendahl 2002; Rechtman 2004). Since the site was

originally recorded, it has been dismantled and rebuilt with concrete (Rechtman pers. comm. 2005).

The reconstructed wall was located during the archaeological survey of the Kuakini Highway Improvements Project. The GPS positions were recorded and are presented in Appendix A.

SITE 23666

Site 23666 is the wall east of Kuakini Highway. This feature extends in a north-south direction parallel to Kuakini Highway along the length of the Kuakini Highway Improvements Project (Clark and Rechtman 2003; Corbin and Rosendahl 2002; Rechtman 2004). It is described as a modern stone wall and property boundary (Corbin and Rosendahl 2002:15; Haun and Henry 2001:4). Rosendahl's site map for Site 5608 also shows this wall, however it does not provide a site or feature number for it (Rosendahl 1979a, 1979b, 1981a, 1981b, 1981c; Clark and Rechtman 2004), simply describing it as a boundary wall along Kuakini Highway.

Site 23666 was located during the archaeological survey for the Kuakini Highway Improvements Project. The wall appears to once have been a continuous feature on the east side of Kuakini Highway; however, there are numerous breaks now due to the impacts of driveways and development projects. It was likely constructed as both a boundary wall and a cattle wall to keep the livestock from wandering onto the highway. It is probable that it was constructed in the 1950s when the Kuakini Highway was built. The GPS positions were recorded and are presented in Appendix A.

SITE 23686

Site 23686 is described as "the entire archaeological agricultural landscape" within TMKs 3-7-5-10:85 and 3-7-5-17:06 (Rechtman 2004:30). The site consists of 297 agricultural features that are likely part of the Kona Field System (Site 6601). Although the features extend over two parcels, they are concentrated in the southeast portion of the parcels, possibly due to less historic disturbance in this area.

Six features (Features 187 through 191 and 197) within Site 23686 are also within the archaeological survey area for the Kuakini Highway Improvements Project. These features are described below.

Feature 187

Feature 187 is described as a rectangular mound, 3.0 by 1.7 m and 0.8 m high (Rechtman 2004:35). The mound rests on bedrock and the edges are generally stacked, although portions have collapsed. A test unit excavated at this feature uncovered a waterworn coral fragment (Rechtman 2004:35).

A small rock mound was discovered in the same location during the archaeological survey area for the Kuakini Highway Improvements Project. An orange flag, observed at the feature, indicates it is Temp. Site 11, Feature C. The feature consists of piled stone, 3.0 by 2.7 m and 0.85 m high. A trail appears to recently have been cleared through the middle of the feature, and the stones have been tossed to the side. The trail extends in a 286-degree true north direction.

Feature 188

Feature 188 is described as a modified outcrop 3.5 by 2.7 m and 1.0 m high (Rechtman 2004:35). A rectangular, stacked cobble and boulder mound was discovered in approximately the same location within the archaeological survey area for the Kuakini Highway Improvements Project. An orange flag was observed at the feature, indicating it is Temp. Site 11, Feature B. The mound is 2.1 by 1.1 m and 0.85 m high. Although the mound resembles the one mapped and photographed in Rechtman (2004:40-41), it varies in size and shape. It is possible that the mound was reconstructed following testing, and is thus the same feature recorded by Rechtman. No cultural material was observed during excavation.

Feature 189

Feature 189 is described as an irregular mound, 2.4 by 2.3 m and 0.7 m high. "The mound rests on exposed bedrock and may have been formerly stacked around its edges, but is now largely collapsed. A small rounded piece of coral was found resting on the feature's southwest corner" (Rechtman 2004:35).

A feature found at about the same location during the archaeological survey area for the Kuakini Highway Improvements Project consists of a stone terrace constructed against a pahoehoe outcrop. An orange flag was observed at the feature, indicating it is Temp. Site 11, Feature E. The mound, 2.3 by 2.2 m and 0.5 m high, is constructed of vesicular basalt cobbles and boulders stacked and piled against the west edge of the outcrop. It is raised on three sides, creating a small terrace. A small section of the west edge appears intact with three courses and a vertical face. The remaining edges are less distinct and tumbled. Although the surface is not level, a few slab-like basalt rocks suggest that it was at one time. The interior appears to be filled with smaller cobbles. Feature 191 is located ca. 8 m to the southwest.

A modified outcrop was observed southeast of Feature 189 during the archaeological survey area for the Kuakini Highway Improvements Project. This feature does not appear to have been previously recorded. Since it is associated with Feature 189, no new feature number was assigned. It is a poorly defined feature located on a pahoehoe outcrop, and it appears that a possible alignment was present along the northwest side and two possible circular arrangements of rocks are located in the northern section. The area of modified stone is ca. 10 m in diameter.

Feature 190

Feature 190 is described as a linear modified outcrop, 3.9 by 2.3 m and 0.9 m high (Rechtman 2004:35).

Feature 190 was not located during the archaeological survey area for the Kuakini Highway Improvements Project. It was likely hidden by the grass or located outside the project corridor.

Feature 191

Feature 191 is described as a linear modified outcrop, 4.4 by 2.1 m and 0.8 m high (Rechtman 2004:35).

Feature 191 was not observed during the archaeological survey area for the Kuakini Highway Improvements Project. It was likely hidden by the grass or located outside the project corridor.

Feature 197

Feature 197 is described as a rectangular mound, 6.0 by 2.3 m and 1.1 m high. When the archaeological survey area for the Kuakini Highway Improvements Project is overlaid onto the map in Rechtman (2004:31), this feature is shown as being located along the east boundary of the project area.

An elongated mound was discovered in this same location during the archaeological survey for the Kuakini Highway Improvements Project. The elongated mound, 7.5 by 1.0 m in size and 2.5 m high, is truncated by the presence of a recently cleared trail. The section of the feature northeast of the trail consists of dispersed rock. Although differences between the two features suggest they may not be the same feature, it is possible Rechtman (2004) focused on the southwestern portion of the feature that is better preserved. Examination of the feature suggests that it may be a wall remnant, possibly a *kuaiwi.*

SITE 26099

Site 26099 is located in the southeast portion of the project area, designated TMK 7-5-17:5, about 20 m east of Kuakini Highway at the edge of the survey corridor. No archaeological reports are on file at SHPD for this area, nor were any archaeological surveys known to have been conducted in this parcel.

Site 26099 is a stacked rock mound, 3.1 by 2.7 m and 0.45 m high. The rock mound may be a clearing mound or an agricultural feature. Although no other features were present in the area, concentrations of rocks were apparent in the high grass. Inspection of these rocks

revealed the presence of bedrock outcrops. High grass in this section of the project area may have hidden additional features.

SITE 26100

Site 26100 is located in the southeast portion of the project area, designated TMK 7-5-17:2, about 5 m east of the wall on the east side of Kuakini Highway (Photo 2). No archaeological reports are on file at SHPD for this area, nor were any archaeological surveys known to have been conducted in this parcel.

Site 26100 is a C-shaped structure constructed of stacked pebble and cobble sized aa clinkers. The feature is built on the edge of an aa lava flow and opens up to the southwest, or down slope. The feature is 2.0 by 1.0 m in size and 0.2 to 0.5 m high. The interior appears artificially leveled and paved with small aa clinkers. This feature may have functioned as a temporary habitation site. No other features were observed in the area, however, the vegetation, consisting of high grass, introduced succulents, and *koa haole*, was very thick, which obscured visibility.

Photo 2. Site 26100, C-shape constructed of aa clinkers. Tape measure indicates 1 m, view to southeast.

SITE 26101

Site 26101 consists of a modified outcrop at Site 23362 (cattle pen). The outcrop is 5.5 by 3.0 m and 1.9 m high, and consists of a natural, raised pahoehoe hill that appears to have been quarried for stone, possibly to make the adjacent walls (Sites 23362, 23365, and 23666). A light scatter of marine shells and waterworn coral pebbles is located north of the raised pahoehoe outcrop. East of the marine shells is a concentration of waterworn stones. If the marine shell scatter and possible paving remnant are features from a traditional Hawaiian site, they have been very disturbed, most likely from cattle.

SITE 26102

Site 26102 is a collapsed lava blister, located east of Kona Mansions, with a small amount of marine shells present. The surrounding area has been graded and leveled for construction. This portion of the site is the only remaining original ground. Tracks from a bulldozer are apparent over the collapsed lava blister.

The collapsed area is 4.1 by 1.9 m. A small amount of coral and cowrie shells are present within the collapse. It is not apparent whether the collapse conceals a buried lava tube chamber.

INADVERTENT DISCOVERY OF HUMAN REMAINS

Human remains were discovered along Kuakini Highway in February 2006 during construction activities for the Kuakini Highway 16-Inch Waterline Improvements Project, following the archaeological survey for the current project. The remains were discovered below the existing Kuakini Highway roadbed near the northeast corner of TMK 7-5-009:21 within the existing Kuakini Highway right-of-way. Analysis of the remains is currently being undertaken by Rechtman Consulting to determine if the remains were part of an in situ burial feature or in a secondary context within road construction fill (Mary Anne Maigret pers. comm. March 2006).

V. EVALUATION AND RECOMMENDATIONS

This section discusses the significance of archaeological sites within the proposed APE (Area of Potential Effect) for the Kuakini Highway Improvements Project and presents recommendations for previously identified sites and preliminary recommendations for features identified during the survey for this project. Figures 7a to 7c show the location of the proposed APE along Kuakini Highway.

The proposed APE for the Kuakini Highway Improvements Project is a narrow wedge of land that passes through nine traditional *ahupua'a* in Kailua-Kona providing a glimpse of the archaeological landscape. The coastal portion was settled by high status Hawaiians. Their homes consisted of complexes of habitation features, activity areas, and gardens. Other Hawaiians also lived in the area, often as farmers working in the Kona Field System, as fishermen, or as support for the *ali'i*. As Kona entered the 19th century, the way of life for Hawaiians changed. The traditional home with its compounds became a single structure, and boundary walls were constructed to delineate house lots and keep livestock out. With the increase in cattle, ranching became a productive enterprise. Ranchers constructed more walls and pens to contain their animals.

ASSESSMENT OF POTENTIAL EFFECTS AND RECOMMENDATIONS

Based on previous significance evaluations, fieldwork, archival research, and analysis of survey data, IARII has prepared recommendations regarding the eligibility of each of the sites within the proposed APE to the National Register of Historic Places (NRHP) based on the criteria of the federal government and to the State Register of Historic Places based on the State of Hawai'i historic preservation rules and regulations. Table 6 lists all sites in the proposed APE for the Kuakini Highway Improvements Project, with proposed significance evaluations and recommended mitigation actions.

Historic property is defined in the NHPA as "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in the National Register of Historic Places." Eligibility to the NRHP is based on the following categories of significance (spelled out in 36 CFR Part 60:4):

> The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, and association and:
>
> A. That are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> B. That are associated with the lives of persons significant in our past; or

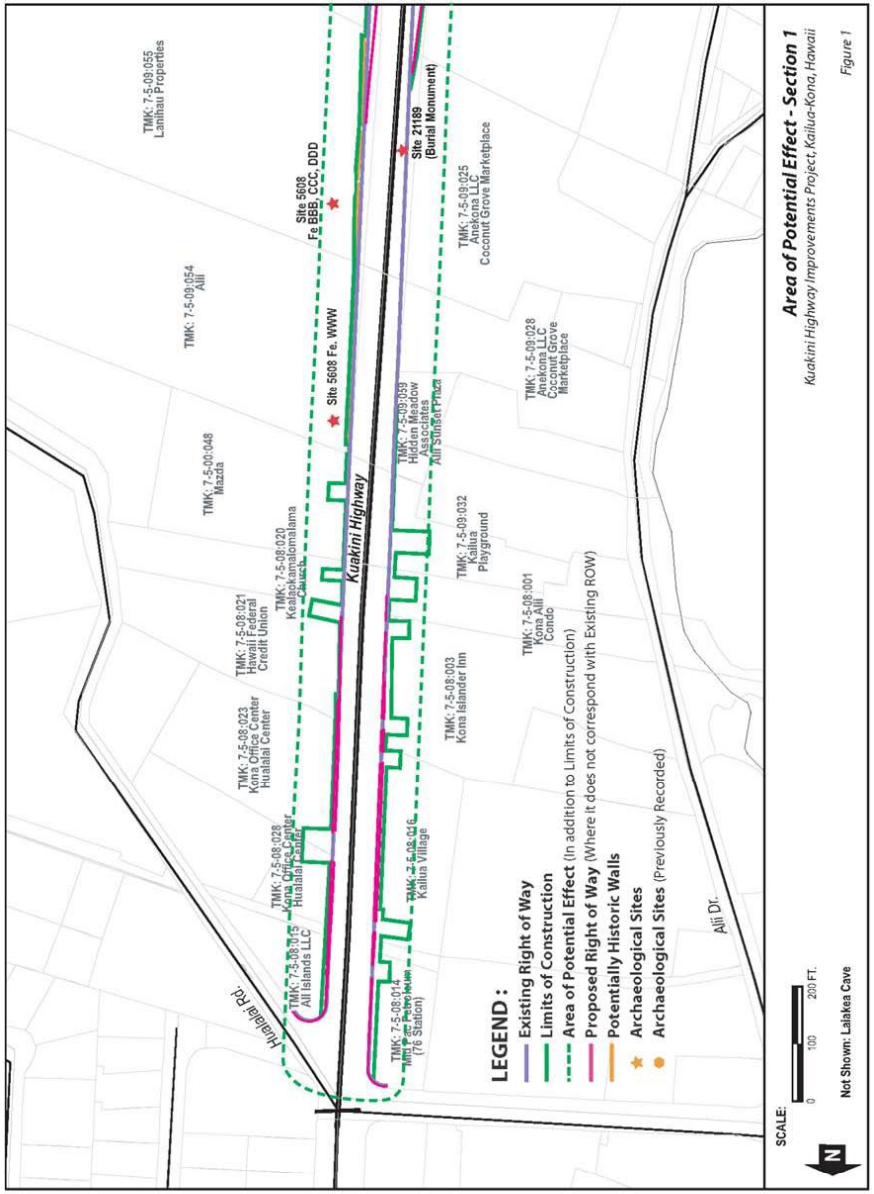

Figure 7a. North end of the Kuakini Highway Improvements Project, Phase 2, showing limits of construction and archaeological sites. (Map courtesy of Parsons Brinckerhoff Quade & Douglas, Inc.)

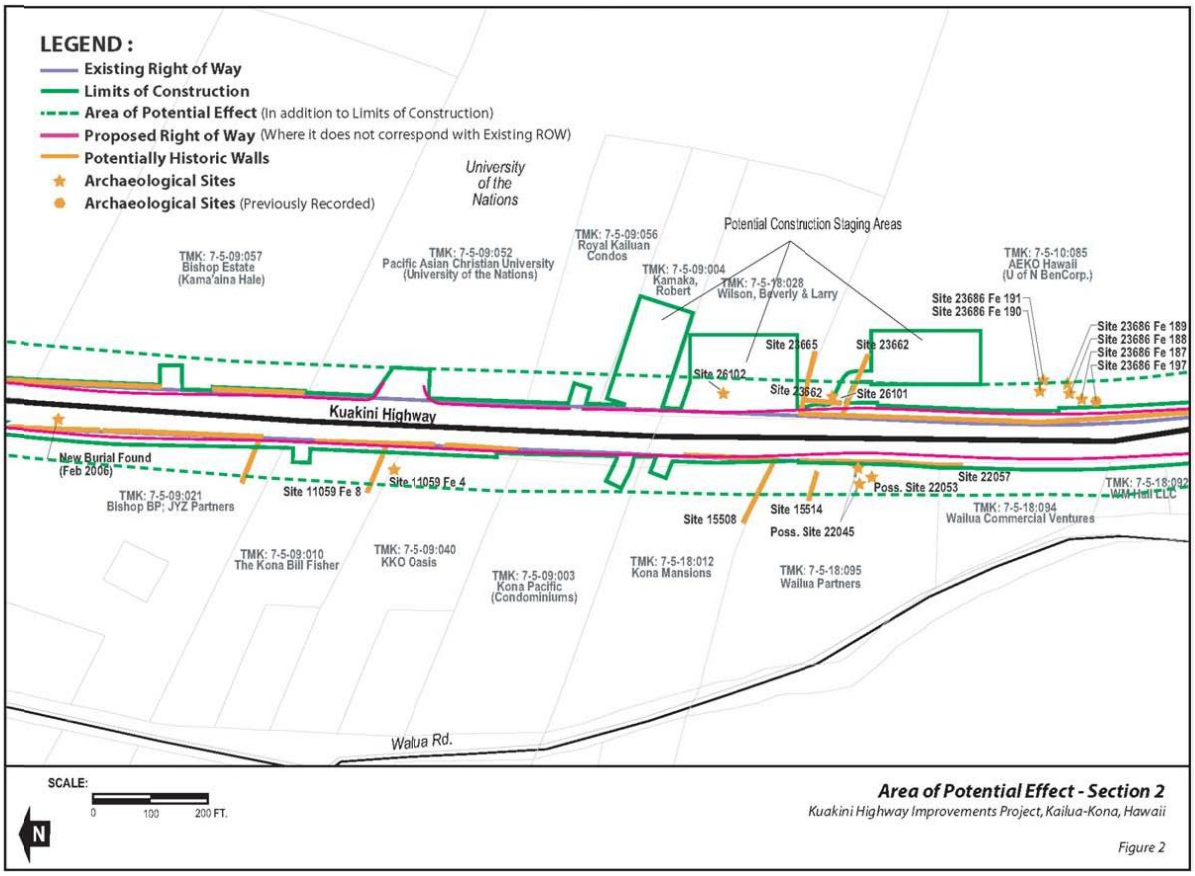

Figure 7b. Middle Portion of the Kuakini Highway Improvements Project, Phase 2, showing limits of construction and archaeological sites. (Map courtesy of Parsons Brinckerhoff Quade & Douglas, Inc.)

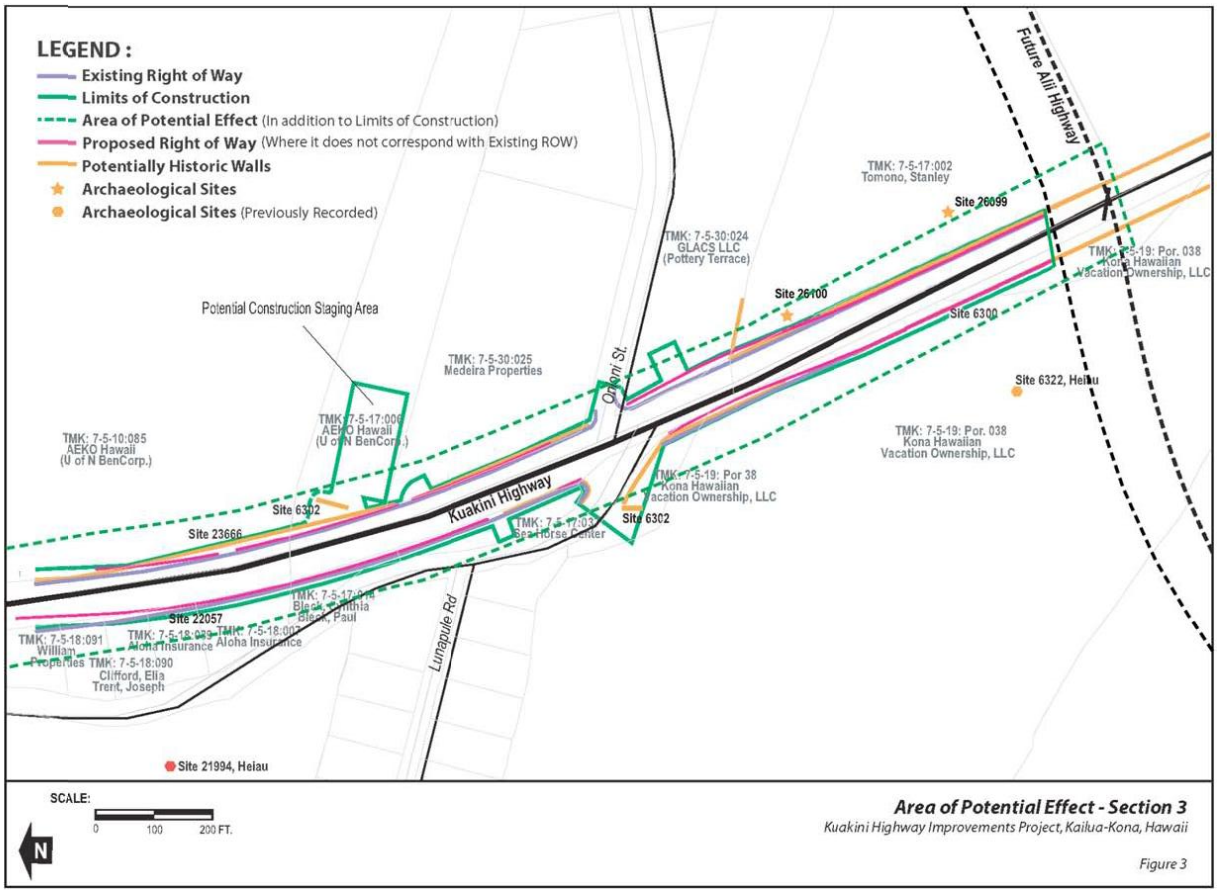

Figure 7c. South Portion of the Kuakini Highway Improvements Project, Phase 2, showing limits of construction and archaeological sites. (Map courtesy of Parsons Brinckerhoff Quade & Douglas, Inc.)

C. That 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; or

D. That have yielded, or may be likely to yield, information important in prehistory or history.

Section 6 of Chapter 13-275, Hawaii Administrative Rules (entitled "Rules Governing Procedures for Historic Preservation Review for Governmental Projects Covered Under Sections 6E-7 and 6E-8, HRS)" adds another criterion for evaluating significance:

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.

Under Criterion E, consultation with ethnic organizations or members of the ethnic group should be sought prior to submission of significance evaluations for properties other than architectural properties. A cultural impact assessment study (Prasad 2006), undertaken concurrently with this project, covers these concerns.

SITE RECOMMENDATIONS

Based on the most recent available conceptual design for the Kuakini Highway Improvements Project, Phase 2, 14 sites are located within the proposed APE (Area of Potential Effect). These include Sites 5608 (Features BBB, CCC, DDD, WWW), 6300, 6302, 7248, 11059 (Feature 8), 15508, 21189, 22057, 23662, 23665, 23666, 26100, 26101, and 26102 (Table 8).

Site 7248, the Laniakea Cave, may pass below the project area; however, the entrances to the cave are located outside the archaeological survey area and its underground route has yet to be mapped in detail. Parsons Brinckerhoff Quade & Douglas plans to investigate the cave in more detail at a later date.

Although Site 5608 is outside the currently planned limits of construction, Features BBB, CCC, DDD, and WWW are within the APE because of the potential for indirect impacts. This site is eligible for listing in the National Register under Criterion D and State Criterion E for significance. It is also designated for preservation as a condition of rezoning, which forbids any adverse impacts to any archaeological or historical sites. However, no archaeological reports or plans have been submitted to SHPD regarding this site. Features BBB, CCC, and DDD of Site 5608 should be regarded as particularly sensitive due to the likelihood that these are traditional Hawaiian community features that may contain burials; preservation is recommended. A particular concern for this site is the dismantling of the modern rock wall that lines the east side of the current highway, which would remove the protection for this site. Buffers (of 30 feet from each feature or some other appropriate distance) should be established between the road and the features, and protective actions should be undertaken to prevent encroachment during construction and limit access to the sites following construction. Such actions might consist of installing protective fencing or rebuilding the rock walls, if they are damaged or dismantled.

Sites 26100 and 26102 are located within the proposed APE. These sites are significant under National Register Significance Category D. They should be avoided during construction activities. If avoidance is not possible, mitigation measures, such as further testing and recording should be undertaken.

Table 8. Recommendations for Archaeological Sites within the proposed APE for the Kuakini Highway Improvements Project, Phase 2.

Site No. 50-10-28-	Feature	Description	Inferred Function	Time Period	Integrity Retained	Condition	State of Hawai'i Significance Category	NRHP Eligibility Significance Category	Recommended Action
5608	BBB	platform	habitation; probable burial feature	probable pre-contact	Yes	Excellent	E	D	Preservation; provide protection and limit access after construction required by zoning
5608	CCC	platform	habitation; probable burial feature	probable pre-contact	Yes	Excellent	E	D	Preservation; provide protection and limit access after construction required by zoning; provide protection and limit access after construction
5608	DDD	platform	habitation; probable burial feature	probable pre-contact	Yes	Excellent	E	D	Preservation ; provide protection and limit access after construction required by zoning
5608	WWW	occupation area	unknown	probable pre-contact	Yes	Poor	None	D	Preservation ; provide protection and limit access after construction required by zoning
6300	—	wall	ranching; boundary	Historic	Yes	Excellent to Good	None	D	None
6302	—	wall	Kuakini's Wall; boundary	Historic	Yes	Excellent	E	B, C, D	Preservation
7248	—	cave adjacent to historic house	Laniakea Cave- may have been used for refuge	pre-contact to historic	Unknown	Unknown	E	D	Preservation; located beneath the project area but no entrance within the APE
11059	8	rock wall	boundary marker	Historic	Yes	Excellent	None	D	None
15508	—	rock wall	boundary	Historic	Yes	Excellent	None	D	None
21189		inadvertent discovery of human remains marked by a modern memorial	human remains	Historic	Unknown	poor	E	None	Preservation
22057	—	rock wall	boundary	Modern	No	Good to Excellent	None	None	None
23662	—	walled enclosure	ranching	Historic	Yes	Excellent	None	D	None
23665	—	wall	boundary	Historic	No	None (rebuilt)	None	None	None
23666		wall	boundary	Modern	No	Good to Excellent	None	None	None

Table 8. Recommendations for Archaeological Sites within the proposed APE for the Kuakini Highway Improvements Project, Phase 2 (continued).

Site No. 50-10-28-	Feature	Description	Inferred Function	Time Period	Integrity Retained	Condition	State of Hawai'i Significance Category	NRHP Eligibility Significance Category	Recommended Action
26100	—	C-shaped wall	temporary habitation	probable pre-contact	Yes	Excellent	None	D	Avoidance; mitigation measures necessary if avoidance not possible
26101	—	modified outcrop	clearing, ranching	Historic		Poor	None	None	None
26102	—	collapsed lava bubble with midden	temporary habitation	probable pre-contact	Yes	Poor	None	D	Avoidance; mitigation measures necessary if avoidance not possible
Undetermined	—	human remains	possible burial or secondary deposit	probable pre-contact or historic	Unknown	Unknown	E	unknown	Unknown

Table Footnotes

B: Site is associated with the lives of persons important in our past.
C: Site embodies 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.
D: Site has yielded, or is likely to yield, information important for research on prehistory or history.
E: Site has important historical cultural value to an ethnic group of the State (this is a State of Hawai'i criterion).

Site 21189, the human remains below the Memorial located in the sidewalk next to Coconut Grove Market Place, are eligible under Hawai'i State Criterion E. Preservation is recommended for this site. Protective measures should be undertaken during construction activities to avoid disturbances to the remains. If preservation is not possible, then determination of the appropriate disposition of these remains will require further consultation with the SHPD, the HIBC (Hawai'i Island Burial Council), and possible lineal descendants.

The human remains discovered below Kuakini Highway during construction activities for the Kuakini Highway 16-Inch Waterline Project are located within the proposed APE for the Kuakini Highway Improvements Project, Phase 2. The archaeologists for the waterline improvements project, in conjunction with the SHPD and HIBC, are in the process of making determinations regarding the remains (Mary Anne Maigret pers. comm. February 2006). The effect of the proposed project on the human remains will be dependent on the outcome of those determinations.[2]

Sites 6300, 11059 (Feature 8), 15508, and 23662 located within the proposed APE are evaluated to be significant under National Register Criterion D. These sites are historic period walls that were likely used to demarcate boundaries or for control of livestock. Data gathered by this and previous surveys document construction characteristics and alignment patterns that can be useful in large scale studies of ranch practices (which falls outside the scope of the present, corridor-oriented study). These sites have been fully documented and no further work is necessary.

Site 6302, located within the proposed APE, is significant under National Register Criteria B, C, and D, and State of Hawai'i Significance Criterion E. Although the existing Kuakini Highway has breached this site, the remaining wall portions are in excellent condition east and west of the highway and preservation is recommended. Interim protection measures, such as protective orange fencing, should be established in areas that may be impacted during construction activities.

Sites 22057, 23666[3], and 26101 are located within the proposed APE. Sites 22057 and 23666 are boundary walls built along Kuakini Highway, apparently in the 1950s. Site 26101 is a modified outcrop. These modern sites, which are fully documented, do not meet the criteria for eligibility to the National Register. No further archaeological work is therefore necessary.

Site 23665 is a boundary wall located within the proposed APE. This feature has been dismantled and reconstructed and has no integrity. It therefore does not meet National Register criteria for eligibility to the National Register. No further archaeological work is necessary.

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2 Subsequent to completion of the draft report of the present project in 2006, the remains were relocated to a location outside of the APE (letter from the Hawaii Division, Federal Highway Administration to SHPD, dated April 3, 2007).

3 Preservation was previously recommended for Site 23666, the modern wall on the east side of Kuakini Highway, probably constructed as a cattle barrier along Kuakini Highway sometime around 1950 (Corbin and Rosendahl 2002:15). This modern site does not appear to meet any of the NRHP criteria of significance and is not recommended for preservation.

The remaining archaeological sites identified by the present study are not located within the proposed APE. These sites which are primarily agricultural walls, rock mounds, and modified outcrops, have been fully documented and no further archaeological work is necessary. They include Sites 23686 (all features), 11059 (Feature 4), 15514, 22045, 22053, 22054, and 26099. These sites are described in the previous section but are not discussed in the present section because they will not be affected by highway improvements.

Monitoring is recommended during construction of the Kuakini Highway Improvements Project, due to the probability of encountering human remains, as demonstrated from previous archaeological projects in the area. Buried cultural deposits and caves may also be encountered. A monitoring plan will need to be prepared and submitted to SHPD for approval.

An additional archaeological inventory survey is recommended for the portions of the construction staging area that have not been surveyed. Four potential construction staging areas have been identified in TMKs 7:5-09:004, 7-5-18:028, 7-5-10:085, and 7-5-17:006 (see Figs, 7a through 7c). The portions of the construction staging areas more than 100 feet from the existing street centerline were not surveyed during this archaeological survey since they were not included in the scope of work. It is anticipated that archaeological sites similar to those nearby may be present, including rock walls, rock mounds, and platforms.

APPENDIX A

GPS DATA

EASTING*	NORTHING*	ELEVATION	SITE	FEATURE	RGL**	COMMENT	POINT ID	DATE
816031.1	2173515.2	50.767	22057	south end of *makai* wall	south end of wall that is parallel to Kuakini Highway	Core-filled construction, 1.25 m high, 85 cm wide at top, 115 cm wide at base	1	Oct. 25
816017.2	2173542.1	50.055	22057	near center of *makai* wall	standing adjacent to wall on *mauka* side	Wall parallel to Kuakini Hwy between Kona Pacific + condo to north. 1 m high, 70 cm wide. good integrity.	2	Oct. 25
816013.2	2173549.2	47.761	22057	north end of south section of *makai* wall	standing north of wall adjacent to end	Collapsed on end, wooden phone pole on northeast side adjacent to wall	3	Oct. 25
816010.3	2173554.3	47.593	22057	south end of north section of *makai* wall	standing next to south end of wall	Wall sloping to south, coconut ca.10m to north in area with tall grasses, bougainvillea	4	Oct. 25
815986.5	2173564.6	47.527	11059 Fe. 4	rock mound	standing on center of mound	Small boulders + large cobbles on natural outcrop	5	Oct. 25
815997.5	2173575.8	47.505	11059 Fe. 8	north section of *makai* wall at intersect	on center of wall where *makai* wall joins roughly perpendicular wall	Walls are approx. same width, perpendicular wall slightly higher. Same construction technique. At corner of condo property.	6	Oct. 25
815990.7	2173574.7	48.221	11059 Fe. 8	on wall west of *makai* wall	on top of wall approx. 6m west of intersection w/*makai* wall	Wall runs along south border of condo, continues to w. 75 cm wide at top, 95-150 cm tall- lower ground on north	7	Oct. 25
815978	2173609.6	48.149	22057	end of wall near driveway	at end of wall that tapers off to ground. next to water tank	5 m south of driveway into parking lot of condo north of Kona Pacific	1	Oct. 26
815964.5	2173638.3	40.56	22057	south corner of *makai* wall	standing adjacent to corner of wall, north of condo	Corner of roughly perpendicular walls, perpendicular wall 90 cm high,75 cm wide. *makai* wall 110 cm high, 80 cm wd	2	Oct. 26
815952.8	2173634.9	48.346	11059 Fe. 8	wall running *mauka-makai*	standing adjacent to south side of wall in condo property.	Core-filled construction with isolated waterworn coral fragments.	3	Oct. 26
815957.7	2173649.9	47.904	22057	along edge of *makai* wall	standing adjacent to east side of wall in tall grasses, bougainvillea north of condo		4	Oct. 26
815931.8	2173694.8	44.686	22057	north end of segment of *makai* wall	standing north of wall at sewer line cleared area	Wall continues to north, appears to have been dismantled for sewer line	5	Oct. 26
815930.9	2173696.9	44.005	22057	south end of *makai* wall north of sewer line	standing next to wall	Collapsed on end, cobble fill visible	6	Oct. 26
815923.5	2173711.4	44.619	22057	*makai* wall at south end of gate entrance	standing just north of gate entrance	Appears to be original gate	7	Oct. 26
815921.8	2173714.1	44.666	22057	*makai* wall; south end of wall at north end of gate	standing adjacent to wall		8	Oct. 26
815897.9	2173756.1	42.223	22057	north end of *makai* wall	standing north of collapsed end of wall	Just south of coconut grove marketplace entrance	9	Oct. 26
815928.3	2173659.6	44.166	–	natural cupboard in outcrop	standing on top of outcrop directly above entrance	Extends back 3 m, 30 cm high. small animal bones inside - mongoose? sediment at least 10 cm thick; no cultural	10	Oct. 26

EASTING*	NORTHING*	ELEVATION	SITE	FEATURE	RGL**	COMMENT	POINT ID	DATE
815872.7	2173804.5	42.273	Memorial, Site 21189	1.2 m by 1.25 m by .75m stone	northwest corner of memorial marking human remains under sidewalk	Cemented stone with plaque "E hoʻomaha me ka maluhia"	11	Oct. 26
815814.5	2173957.6	35.619	23666	north end of *mauka* wall	standing on end of wall running parallel to Kuakini Hwy on *mauka* side	Wall is 1m high one side, flush with ground surface on west side	12	Oct. 26
815828.6	2173952.1	37.817	5608 Fe. WWW	cupboard with coral	standing next to north edge of cupboard	Small cupboard in natural outcrop, 2.3 m deep, 1.2 m wide, 15 cm high. small pieces of waterworn coral	13	Oct. 26
815829.8	2173951.2	37.733	5608 Fe. WWW	south end of outcrop with cupboard	at edge of southern-most rock of cupboard		14	Oct. 26
815839.7	2173912	37.399	23666	along north segment of *mauka* wall	adjacent to wall on west side	Across from north end of marketplace, wall is about 1m high, 80cm thick	15	Oct. 26
815860.7	2173872.4	39.587	23666	homeless trail entrance in *mauka* wall	adjacent to west side of wall where 1m has been dismantled and leads to trail to shanty	Across from marketplace, next to north end of guardrail over drainage. wall continues to south into drainage	16	Oct. 26
815893.2	2173853	39.603	5608 Fe. BBB	platform	west of upright on northeast corner of feature	Possible religious feature with large amount of branch coral on northeast portion of platform	17	Oct. 26
815893.2	2173843.7	36.521	5608 Fe. BBB	southwest corner of upper platform	standing directly over corner	Raised platform with faced edge, concentration of coral ca. 1.2 m east of west wall, .5 m north of south wall	22	Oct. 26
815896.9	2173851.1	40.838	5608 Fe. BBB	east corner of notch	standing directly over corner	Point taken at the north end of the wall that connects to south wall	23	Oct. 26
815885.3	2173831.6	38.821	23666	break in *mauka* wall	standing in the center of collapsed area ca. 3m south of guardrail	2 m segment of wall that has been dismantled, directly adjacent to tarmac of Kuakini Hwy	1	Oct. 27
815899.1	2173805.8	40.692	23666	break in *mauka* wall	standing at center of 2.5m long break in wall across from modern monument marking human remains	Probable trailhead to homeless area, 3 m east of sewer marked 42, lots of rubbish on *mauka* side of wall	2	Oct. 27
815917.3	2173772.6	43.378	23666	nail and survey stake in *mauka* wall	standing directly over spray-painted nail in wall directly across from south entrance to coconut marketplace.	Wooden survey stake with orange and red flags in top of wall, wall is ca. 1.5m high	3	Oct. 27
815959.3	2173697.1	45.897	23666	south end of *mauka* wall	standing next to wall	At entrance to apartment complex	4	Oct. 27
815972.8	2173672.2	46.376	23666	north point of *mauka* wall	standing next to wall where *mauka* wall meets modern wall, modern wall extends 15m to north, cement mortar	In front of apartments, sewer marked 47 3 m west. under plumeria tree	5	Oct. 27
815996.4	2173629.4	47.481	23666	south end of *mauka* wall	standing 50cm south of fence of university of the nations property	Wall destroyed, paved sidewalk to south, natural outcrop on east continues	6	Oct. 27
816084.8	2173470.8	51.939	23666	south end of *mauka* wall	standing next to southwest corner of wall	Wall end not collapsed, continues north to meet cement mortared portion of wall at Royal Kailuan.	7	Oct. 27
816073.3	2173491.2	51.788	23666	north point of *mauka* wall	standing next to wall on *makai* side where unmod. wall connects to cement topped portion	Cement top portion cont. 2.5 m north and abuts sign at entrance to Royal Kailuan	8	Oct. 27
815921.4	2173771.1	44.723	23666	collapsed lava bubble- squatters home	southeast corner of basalt around opening	Bubble continues 60 cm under *mauka* wall, modified alignment 1.5m northeast of bubble	9	Oct. 27

EASTING*	NORTHING*	ELEVATION	SITE	FEATURE	RGL**	COMMENT	POINT ID	DATE
816116.4	2173434.3	53.837	26102	lava bubble	on northwest edge of bubble opening	In cleared parcel, evidence of bulldozer scraping, possibility of archaeological deposit; few marine shells	10	Oct. 27
816076.7	2173435.8	51.078	15508	north end of *makai* wall	standing on wall in Kona Mansions V property	Landscaped area - wall probably used to continue to north - roughly perpendicular wall to west intersects	11	Oct. 27
816100.1	2173391.8	50.767	15508 and 22057	intersection w/perpendicular wall and *makai* wall	standing on wall at center point of intersection	Intersecting wall between Kona Mansions V and sewer access route-5 m wide cleared area w/lg boulders	12	Oct. 27
816085	2173390.6	50.27	15508	along wall west of *makai* wall	standing next to wall on south side	Wall is 1.5 m high, pool on north side, sewer access route on south side. West of small plumeria tree	13	Oct. 27
816118.1	2173351	49.894	22045	rock concentration	standing on center of pile on west end of feature	There was a blue flag on feature. no site tag identified	14	Oct. 27
816096.4	2173366.1	48.557	15514	wall running *mauka-makai*	standing next to wall on south side	Wall is 1m high, 62 cm wide at top. Extends 10 m *mauka* and unknown distance *makai*. Outcrop on south side	15	Oct. 27
816090.7	2173364.4	52.434	15514	along *mauka-makai* wall	standing adjacent to wall on south side	Point taken to get direction/bearing of wall. Wall is 70 cm wide at top and 102 cm high. core-filled	16	Oct. 27
816125.7	2173325.9	49.57	22053	L-shaped wall	standing next to outer edge of wall 40cm south of northwest corner	Area 20 m to south cleared and under construction. Feature mapped in detail by TR; PHRI 2086 T15 43206	17	Oct. 27
816128.9	2173317.2	50.496	22053	L-shaped wall	standing at end of south wall - outer (southwest) corner	High grasses then cleared area to south, bulldozed piles of stone to southwest. Wall has core-filled const.; PHRI 2086 T15	18	Oct. 27
816130.3	2173324.7	50.431	22053	L-shaped wall	standing next to east end of wall on interior (south) side	PHRI 2086 T15	19	Oct. 27
816130.4	2173335.4	53.036	22057	along *makai* wall ca. 5 m north of L-shape	standing adjacent to wall on *makai* (west) side		20	Oct. 27
816124	2173327.9	50.301	22053	wall remnant	standing over northeast corner of alignment	GPS point 4 for this site. Ca. 3 m north of corner of L-shaped wall; PHRI 2086	21	Oct. 27
816110.8	2173328.4	49.613	22053	alignment	standing on outcrop at west end of cleared area	GPS point 5 for this site; PHRI 2086	23	Oct. 27
816094.8	2173334.9	50.228	22054	modified outcrop on pahoehoe	in center just east of aluminum site tag	Sketched by CR. 2 by 3 m, small boulders on top; PHRI 2086 T18	24	Oct. 27
816109	2173345.1	50.21	22054	modified outcrop	standing in center	2.8m by 4m, notes taken by TR	25	Oct. 27
816485.2	2172958.1	59.374	22057	north end of *makai* wall at Walua Road	standing next to stop sign - wall truncated ca. 2 m south	Wall flush with ground surface on *mauka* (e) side near Kuakini Hwy. dense bougainvillea near wall end	26	Oct. 27
816455.1	2172958.7	57.673	6300	east end of wall	standing 40 cm south of wall where wall meets broken concrete slabs	Wall made of small to medium a‘a boulders	28	Oct. 27
816444.5	2172958.3	57.386	6300	along wall	standing adjacent to wall on south side	Wall continues *makai* (west)	29	Oct. 27
816439.9	2172951.9	55.857	6302	wall	at north end directly above rebar	Documented by Hammatt and Tomonari-Tuggle 1978. volcanic glass core 2 m east of wall. Site 6484 2 m west	30	Oct. 27

EASTING*	NORTHING*	ELEVATION	SITE	FEATURE	RGL**	COMMENT	POINT ID	DATE
816543.4	2172918.6	57.621	22057	south end of *makai* wall	standing on wall 30 cm north of south end	Wall ends at rusted metal pole, outcrop on steep hill slope down to south - ravine? H&TT Site 6300	31	Oct. 27
816615.3	2172870	63.205	22057	south end of *makai* wall	standing adjacent to wall on south end	Ends at new construction fence, area to west cleared and under construction	32	Oct. 27
816577.7	2172894.9	60.671	22057	north end *makai* of wall	standing on northwest corner	Wall ends at intersection of cement-mortared wall south of ravine	33	Oct. 27
816565	2172902	59.798	22057	possible wall remnant	on south side on bedrock portion	Modified outcrop/possible. wall remnant with wooden posts on top, 10 m long to northwest	34	Oct. 27
816622	2172866.3	64.323	22057	north end of *makai* wall	standing just north of wall on *mauka* (east) side at gate post		35	Oct. 27
816632.5	2172858.7	64.56	22057	break in *makai* wall - 5m long	standing in center of break		36	Oct. 27
816679.4	2172827.9	67.542	22057	along *makai* wall	standing adjacent to wall on *mauka* (east) side	Construction activities on other side of the wall. core-filled aa	37	Oct. 27
816773	2172765.9	71.26	22057	south end of *makai* wall at const. break	standing on *mauka* (east) side of wall		38	Oct. 27
816787.9	2172785.1	73.064	22057	along *mauka* wall south of project area b	standing adjacent to *makai* (west) side of wall	Wall continues parallel to wall to south	39	Oct. 27
816405.6	2173011.1	58.484	22057	north end of *makai* section of wall	standing over northeast corner of wall	Wall extends south around property at corner of Walua Road,. stops at driveway to green commercial bldg.	41	Oct. 27
816399	2173016.1	58.336	22057	south end of *makai* wall	standing over southeast corner of wall	Driveway to south	42	Oct. 27
816370.9	2173040.8	56.897	22057	near north end of *makai* wall section	2 m east of wall - dense bougainvillea	Wall continues up to 20 m to north - destroyed by construction	43	Oct. 27
816339.5	2173064.4	56.322	22057	south end of *makai* section of wall	standing south of wall end	Leveled area, construction activities on *makai* side	44	Oct. 27
816302.6	2173099.2	57.654	22057	north end of *makai* section of wall	standing next to northeast corner of wall	At south extent of parking lot for aloha insurance services, inc. building	45	Oct. 27
816277.9	2173123.6	57.343	22057	south end of *makai* section of wall	standing at southwest corner of wall	In middle of property for aloha insurance	46	Oct. 27
816264	2173140.1	56.404	22057	north end of *makai* section of wall	standing next to northeast corner		47	Oct. 27
816251.2	2173153.9	56.158	22057	south end of *makai* section of wall	next to wall on south side	Wall extends 6 m north in same direction as section to south	48	Oct. 27

* Trimble Pro-XR Global Positioning System (GPS) based on real time differential corrections using the Universal Trans Mercator (UTM) coordinate system with the North American Datum (NAD) 83.

** Receiver ground location. The physical location where the GPS reading was taken.

APPENDIX B

SITE PHOTOGRAPHS

004_11059F4_toW.JPG

009_11059F8_toN.JPG

012_11059F8_toE.JPG

089_23665_E.JPG

094_22053_E.JPG

097_22053_E.JPG

019_5608FeFFF.JPG

036_5608FeBBBCCCDDD_E.JPG

051_5608FeBBBCCCDDD_S.JPG

103_22045_temp8_E.JPG

107_clinkerwall_6300.JPG

119_Temp1_S.JPG

054_5608FeBBBCCCDDD_NS....

058_5608FeBBBCCCDDD_N.JPG

059_5608FeBBBCCCDDD_N.JPG

122_Temp2_SE.JPG

124_6302_N.JPG

131_23686_Fe197_N.JPG

062_5608FeBBBCCCDDD_S.JPG

066_T4overview_S.JPG

067_T4detail_S.JPG

133_23686_Fe188_E.JPG

135_23686_Fe187_E.JPG

136_23686_Fe188_E.JPG

069_22054_N.JPG

072_memorial_NE.JPG

074_memorial_E.JPG

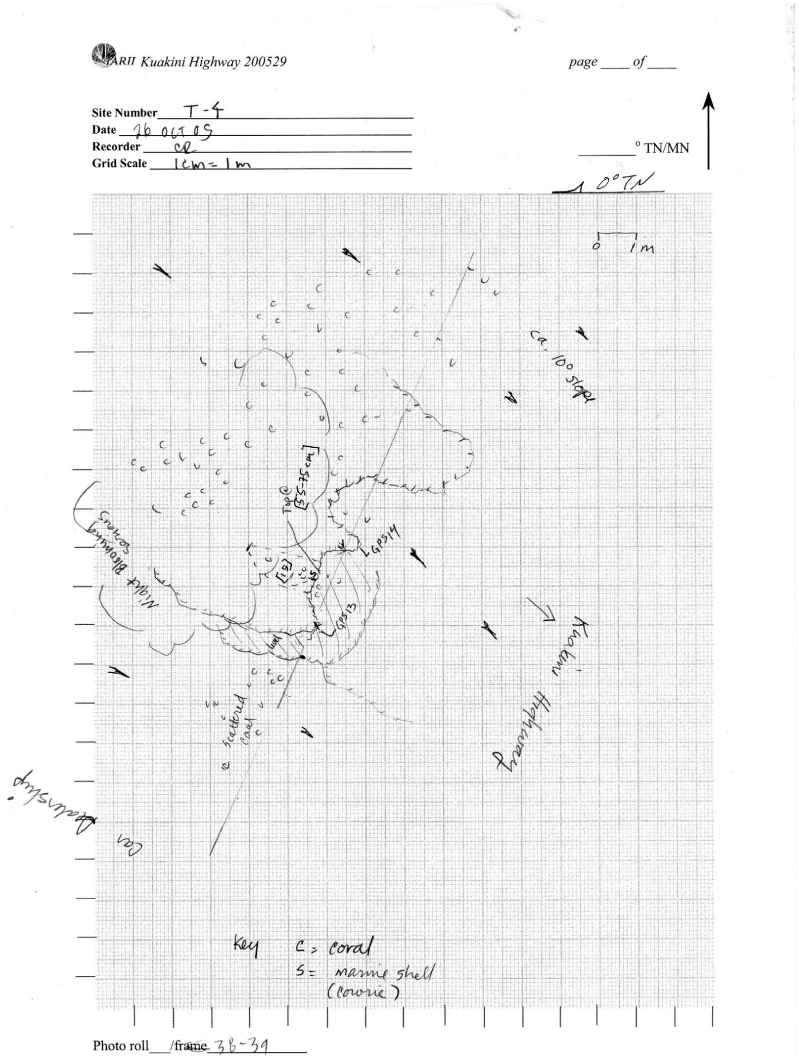
137_23686_Fe189_NE.JPG

138_23363_SE.JPG

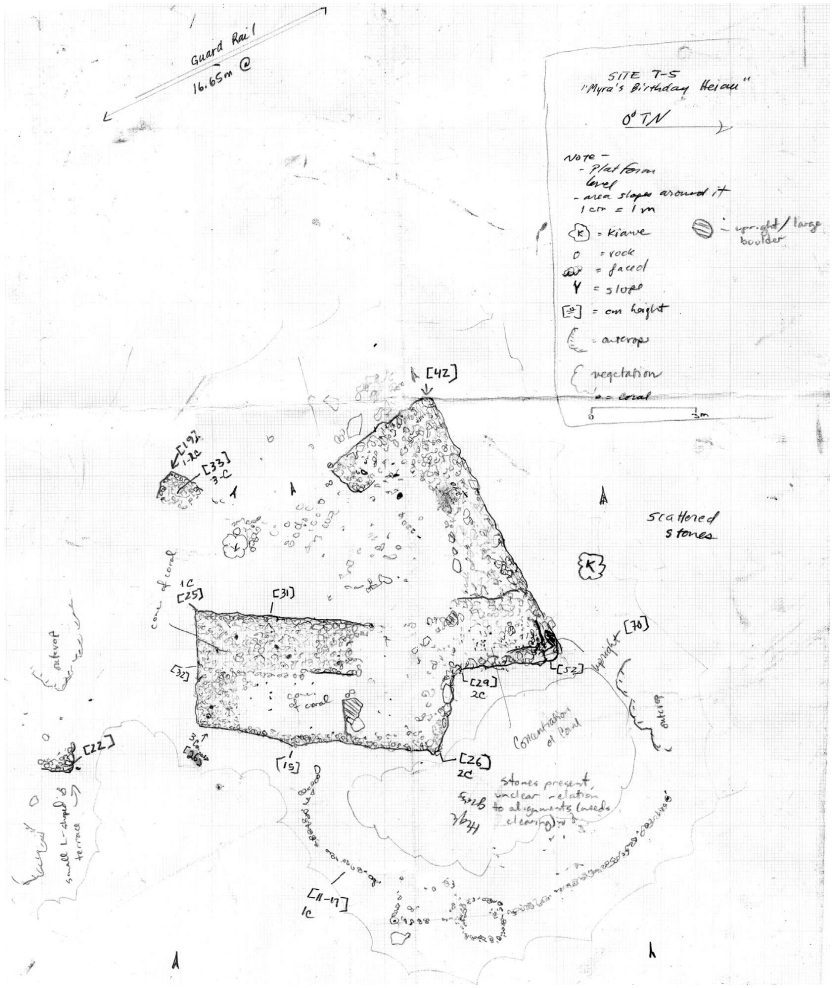
139_temp3_SW.JPG

APPENDIX C

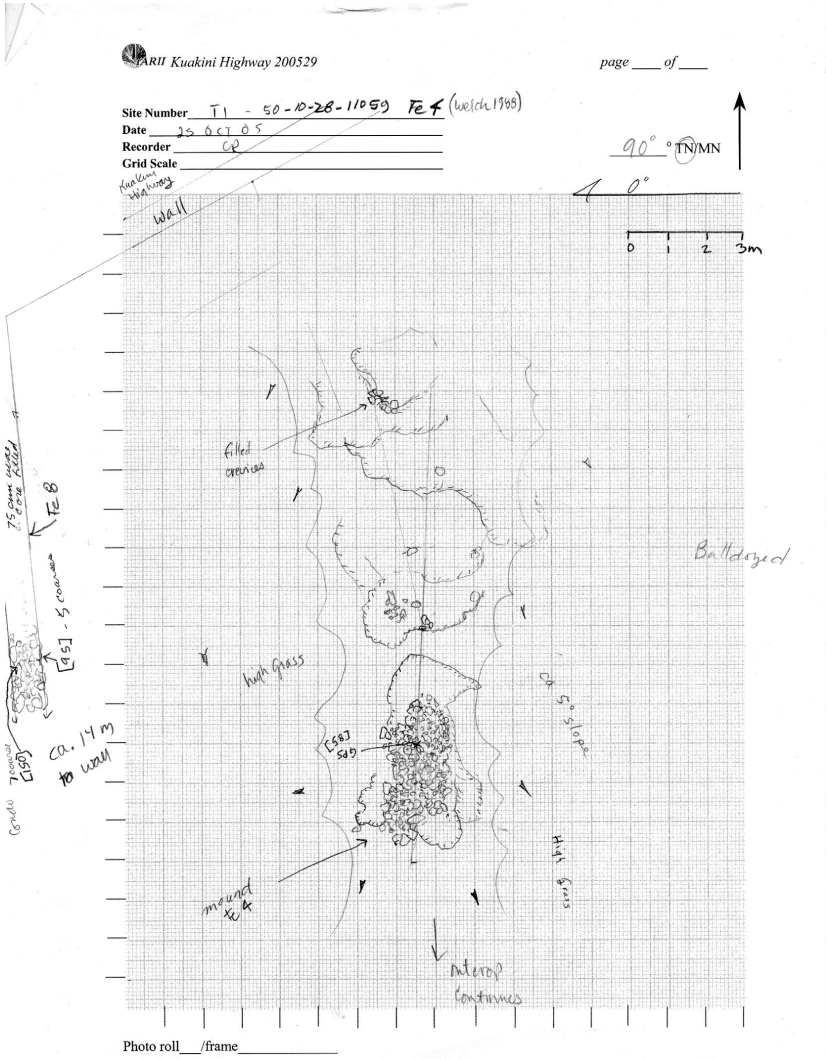
FIELD DRAWINGS



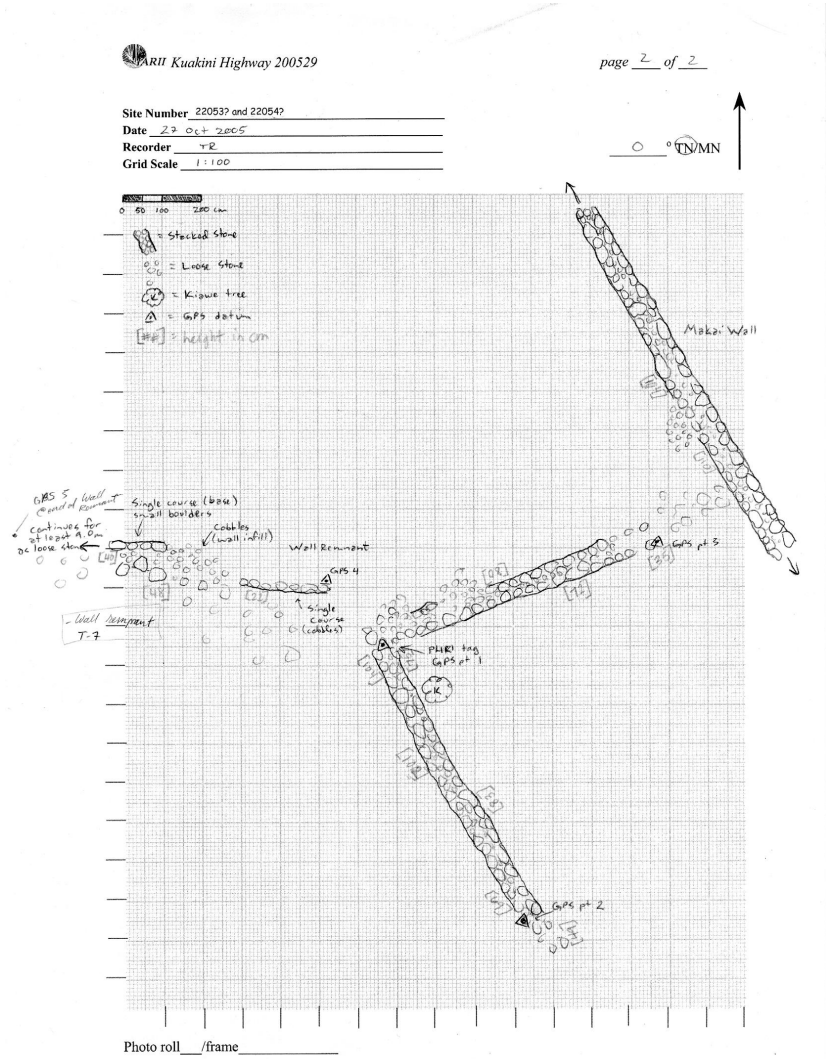
Possible Site 6508, Feature FFF, coral and marine shell catter.



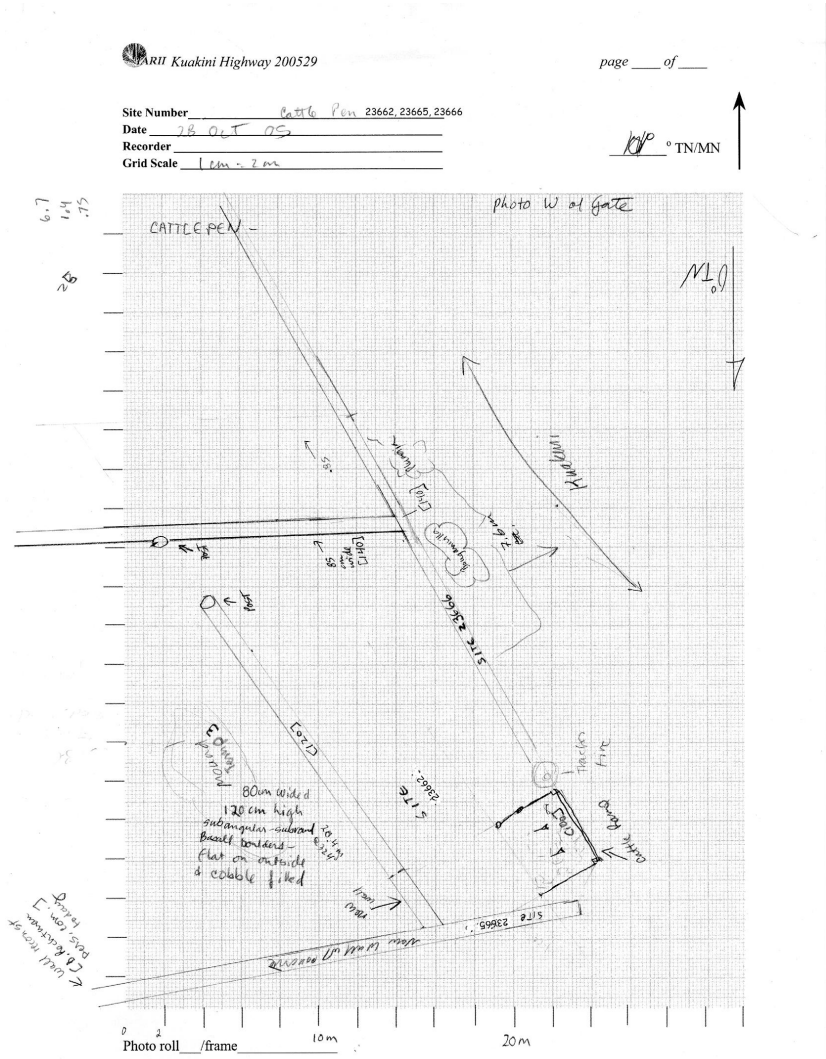
Site 5608, Platform Features BBB, CCC, and DDD.



Site 11059, Features 4 (mound) and 8 (wall).

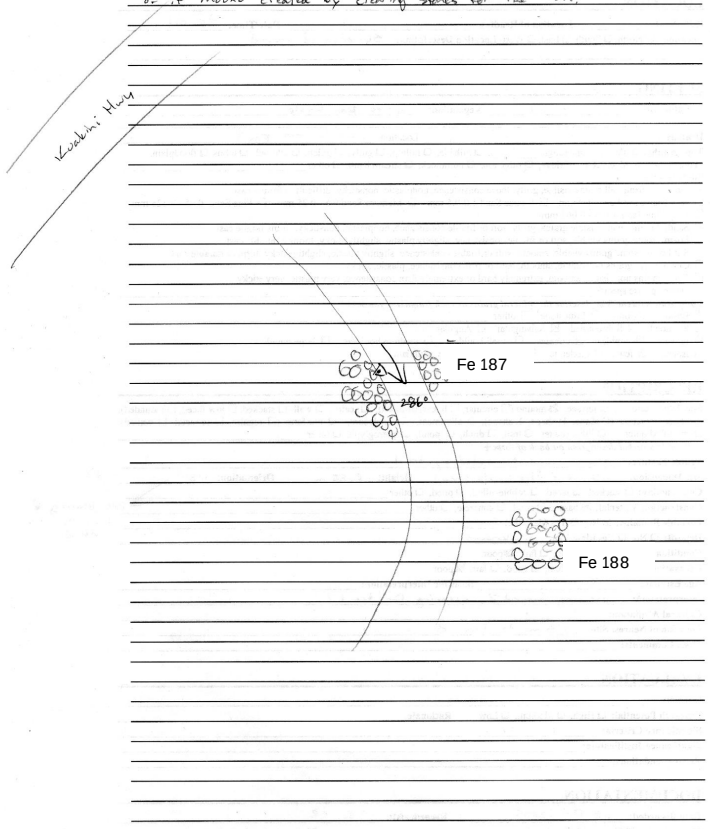


Possible Sites 22053, L-shaped wall, and 22054, wall segment.

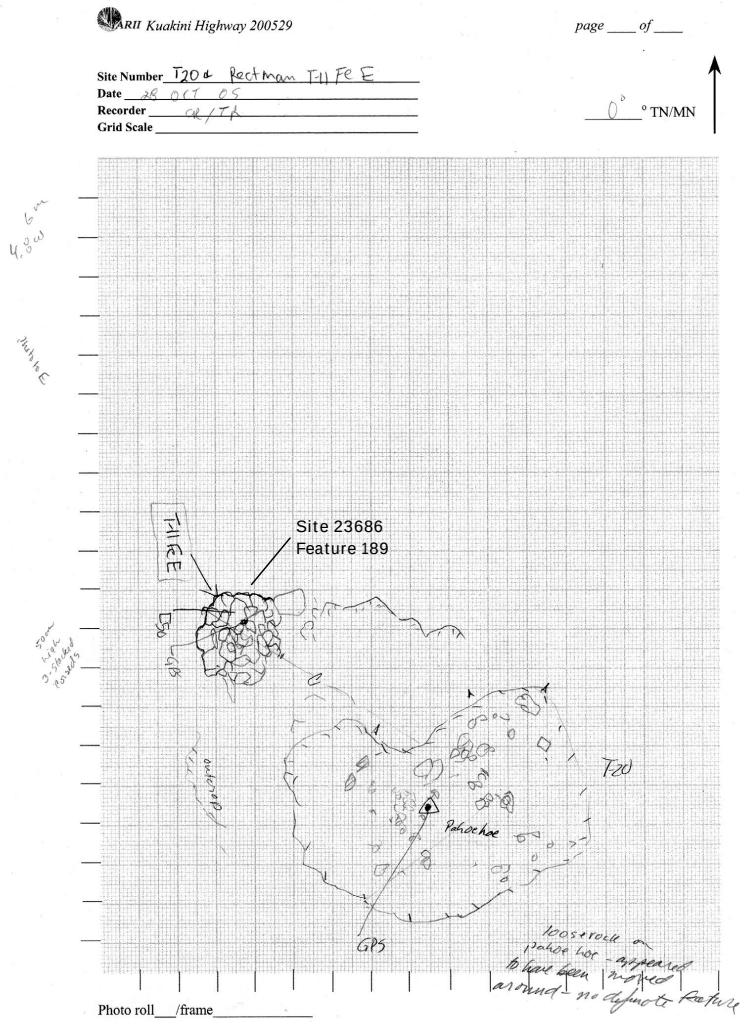


Sites 23662 (cattle pen), 23665 (reconstructed boundary wall), and 23666 (wall east of Kuakini Highway).

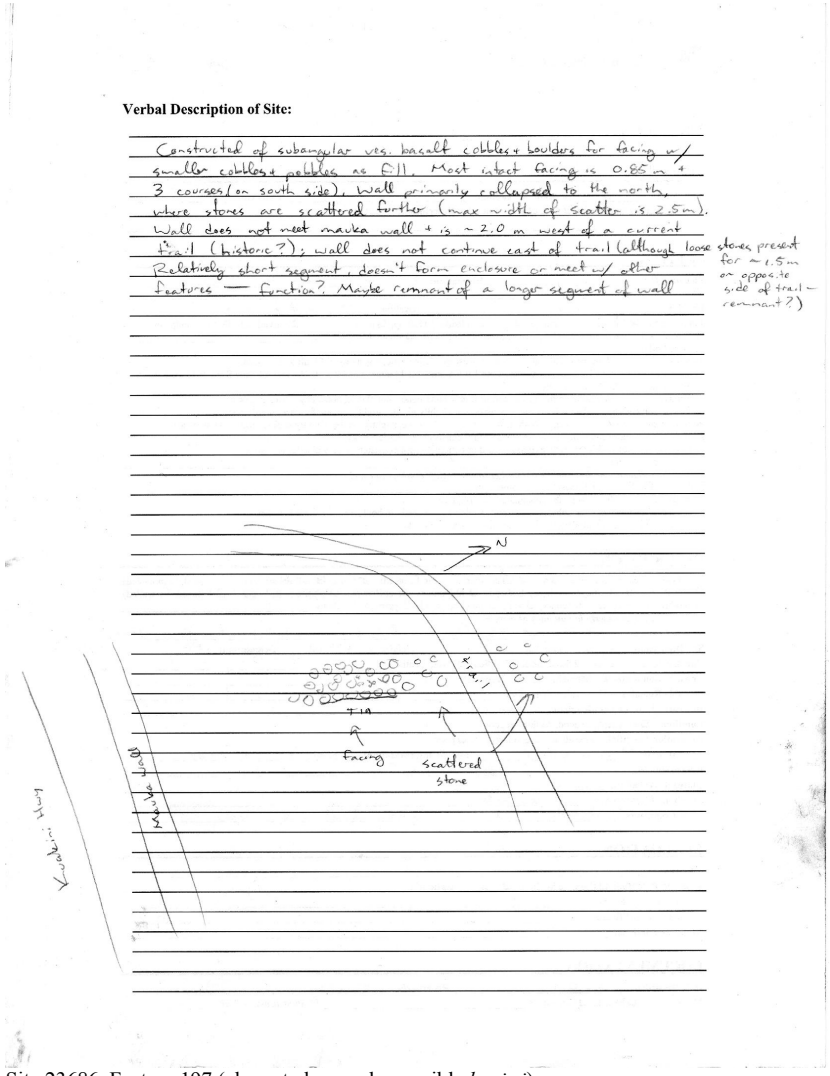
Verbal Description of Site:
Subangular ves. basalt pebbles, cobbles, + small boulders mounded on either side of the trail. Unclear if trail cut thru existing mound or if mound created by clearing stones for the trail.



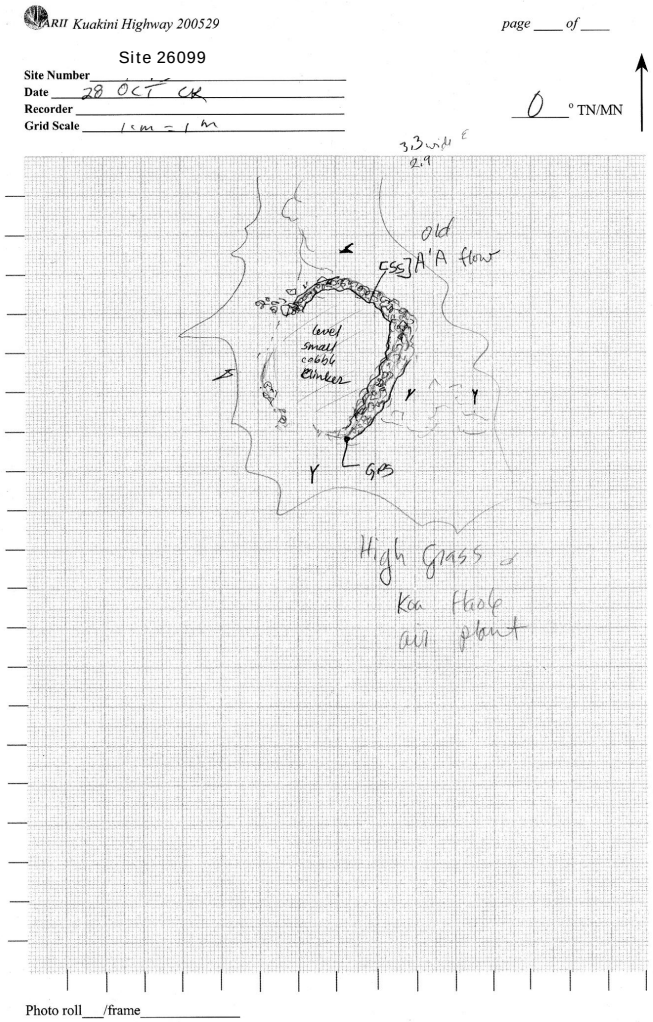
Site 23686, Features 187 and 188 (rock mounds).



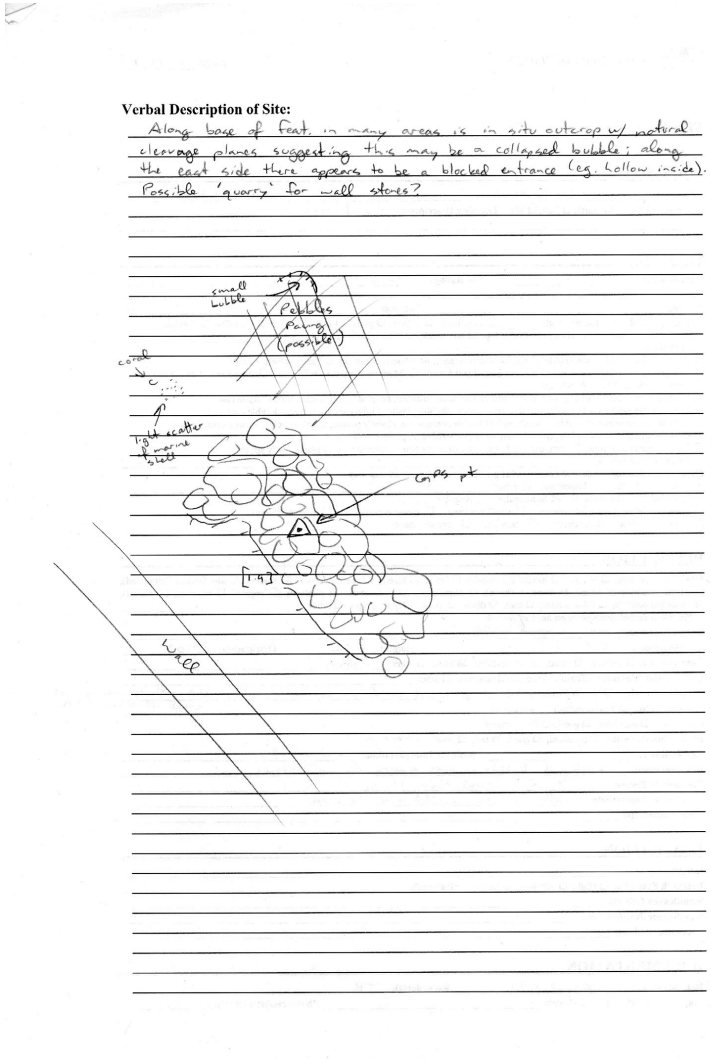
Site 23686, Feature 189 (stone terrace) with adjacent modified outcrop.



Site 23686, Feature 197 (elongated mound- possible *kuaiwi*).

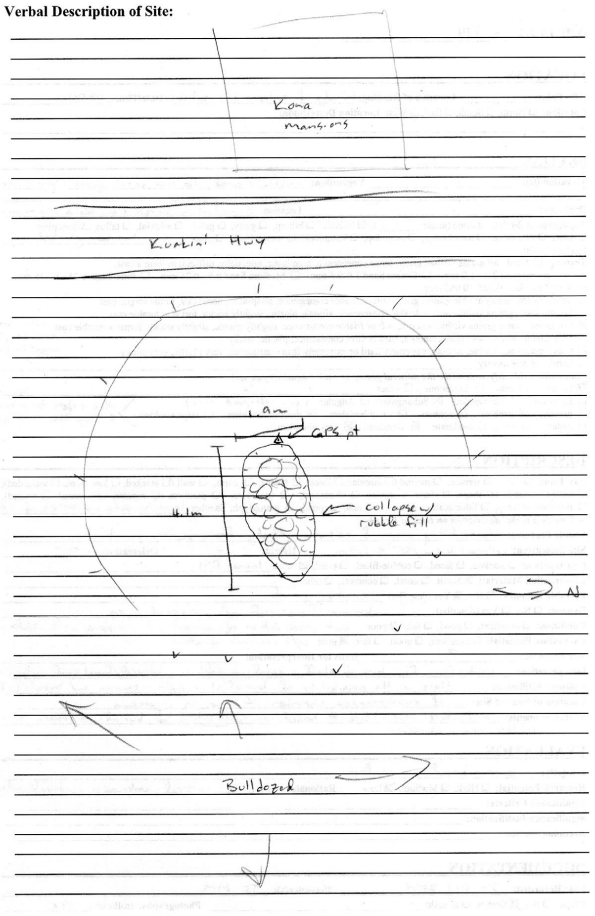


Site 26099, C-shaped structure.



Site 26101, modified outcrop and marine shell and waterworn coral concentration.

Verbal Description of Site:



Site 26102, collapsed lava bubble with small amount of marine shell.

APPENDIX D

LAND COMMISSION AWARDS NEAR THE ARCHAEOLOGICAL SURVEY AREA FOR THE KUAKINI HIGHWAY IMPROVEMENTS PROJECT

Land Commission Awards near the archaeological survey area for the Kuakini Highway Improvements Project.

Ahupua‘a	Pre-Māhele History	LCA No.	Royal Patent Number	Awardee	Post-Māhele History	Land Use	Citation
‘Auhaukea‘ē	owned by William Pitt Leleiohoku, son of Kalaniomoku and adopted son of Kuakini; heirs turned it over to government	11216		M. Kekauonohi	inherited by second husband, Levi Haalelea in 1851	eventually became part of Greenwell Ranch	Rosendahl 1981a:A-27; Clark and Rechtman 2004
‘Auhaukea‘ē 1	received the land from the chiefess Kaikainali‘i and her husband Kealoha (a.k.a. Ulualoha) in 1838	7073		Kapae	P.J Mioi and Paulo Mioi aquired lot and sold to A‘olona in 1986	used as house lot; 1925 land transferred to Jo Ho‘omana; in 1838 transferred to Anita Muler	Allen 1986
Hienaloli 1, 2, 6		designated government property					Moore et al. 1997
Hienaloli 6	Kaiamakini's parents lived on the lot since the time of Kamehameha and enclosed the lot with a stone wall	7075:2		Kaiamakini	sold *makai* section to A‘alona in 1980; *mauka* portion sold to Maewa in 1852, Kawelo in 1854, Kapalahu in 1854, Kepio in 1855, and Waahila in 1893	*makai* section used for house lot; *mauka* section probably for agriculture	Allen 1986; Wong-Smith 1990
Hienaloli 6		10404		Namimi- 25 kihapais partially cultivated and no home	sold to Maewa in 1852, Kawelo in 1854, Kapalahu in 1854, Kepio in 1855, and Waahila in 1893	probably good agricultural land	Native Testimony Vol. 4:556; Wong-Smith 1990
Hienaloli 6			1752	Kawelo			Wong-Smith 1990
Kahului 1				retained as Government Land			O'Hare and Wolforth 1998
Kahului 1		7350		Kialoa- for an agricultural plot- not awarded			NT Vol. 4:557; O'Hare and Wolforth 1998; Maly 1998

Land Commission Awards near the archaeological survey area for the Kuakini Highway Improvements Project.

Ahupua‘a	Pre-Māhele History	LCA No.	Royal Patent Number	Awardee	Post-Māhele History	Land Use	Citation
Kahului 1		7086		Kalawa	great-great granddaughter, Mrs. Makuakāne-Tripp, still lives on the land		NT Vol. 4:557; O'Hare and Wolforth 1998; Maly 1998
Kahului 1				Ka‘upena granted 97.5 acres in 1855		became part of Manuel Gomes Ranch in the 1920s; total ranch was 8,500 acres either leased or purchased	O'Hare and Wolforth 1998
Kahului 1		9944		Nalima- 2 land parcels			NT Vol. 4:517; Maly 1998
Kahului 1		10252		Maliu- house lot and gardens			NT Vol. 4:538; Maly 1998
Kahului 1	received from ancestors in the time of Kiwalao (ca. 1782)	9126		Kaiakaloa- several pieces of land with coffee, taro, *‘uala*, and a house			NT Vol. 8:677; Maly 1998
Kahului 1		7496-B		Keaweehu- cultivated lands			NT Vol. 4:515; Maly 1998
Kahului 1		7083		Kaulua- house lot			NT Vol. 4:513; Maly 1998
Kahului 1 and 2	received land from his older brother, Maliu, who received the land in the time of Kamehameha II	10374:1		Nalawaia- contained a house lot and grave (Site 6481)		1800s to early 1970s, used as cattle pasture	NT Vol. 4:529; Hammatt and Tomonari-Tuggle 1978:6; O'Hare and Wolforth 1998; Maly 1998

Land Commission Awards near the archaeological survey area for the Kuakini Highway Improvements Project.

Ahupua‘a	Pre-Māhele History	LCA No.	Royal Patent Number	Awardee	Post-Māhele History	Land Use	Citation
Kahului 2		8516-B:3-ahupua‘a		Grace Kama‘iku‘i, daughter of Ka‘ōana‘eha (royal lineage) and John Young Sr.			O'Hare and Wolforth 1998
Kahului 2		10373		Niniha- house and cultivated land			NT Vol. 4:533; Maly 1998
Kahului 2	land from his wife's parents, in the time of Kamehameha I	7336:1		Kuapuu- house lot and cultivated land			NT Vol. 4:500; Maly 1998
Kahului 2		7073:8		Kapae- house and cultivated land			NT Vol. 4:501; Maly 1998
Kahului 2	land received in the time of Kamehameha I	7690		Kulou			NT Vol. 4:516; NR Vol. 8:445; Maly 1998
Kahului 2		7914		Kekipi			NT Vol. 4:560; Maly 1998
Kahului 2		7335		Kaanaana			NR Vol. 8:423; Maly 1998
Kahului 2		11073		Aikane			NT Vol. 8:651; Maly 1998
Pua‘a 1		7715		Lot Kapuaiwa (Kamehameha V); house	after his death in 1872, part of the land was sold and part returned to the government; Waahila wanted to buy the land from the ocean to Kuakini Wall (only lot 1 granted)		Soehren 1979; Welch 1988
Pua‘a 1		7074		Kanewaahilani; house			Soehren 1979

Land Commission Awards near the archaeological survey area for the Kuakini Highway Improvements Project.

Ahupua‘a	Pre-Māhele History	LCA No.	Royal Patent Number	Awardee	Post-Māhele History	Land Use	Citation
Pua‘a 1		10267		Malowaole; house surrounded by a low stone wall			Soehren 1979
Pua‘a 2			7419	lot 1 was purchased by Waahila- between the ocean and Kuakini Wall			Welch 1988
Pua‘a 2			41002	lot 2 was purchased by Papa in 1897- between the ocean and Kuakini Wall			Welch 1988
Pua‘a 2			4037	lot 3 was purchased by Kaaeamoku in 1897- between the ocean and Kuakini Wall			Welch 1988
Wai‘aha		387		American Board of Commissioners for Foreign Missions	Joseph Gomes and Thomas Duarte	ranching	Board of Commissioners 1929, *Indices of Awards*; Corbin and Rosendahl 2002
Wai‘aha		8481	3682	Kalae			Corbin and Rosendahl 2002
Wai‘aha		7241-B	6672	Kalama			Corbin and Rosendahl 2002
Wai‘aha		6699		Lumaawe			Corbin and Rosendahl 2002

NR Information from Native Register.

NT Information from Native Testimony.

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APPENDIX F BOTANICAL SURVEY REPORT

KUAKINI HIGHWAY IMPROVEMENTS PROJECT, PHASE 2, KAILUA-KONA BOTANICAL REPORT

Prepared by Layne Yoshida, Botanical Consultant
Submitted Jan. 4, 2006

This botanical report was prepared for the *Kuakini Highway Improvements Project, Phase 2,* between Hualalai Road and the future Alii Highway intersection.

The fieldwork for this survey was conducted on Feb. 19, 2005; March 16, 2005; July 6, 2005 and Oct. 8, 2005. During the Feb. 19, March 16 and July 6 site visits; the areas along the side of the highway and public areas such as parking lots were surveyed. On Oct. 8 after a permission to enter property form was received I entered and surveyed the obviously private property and vacant lots in the study area.

METHODOLOGY:

The area within the study site was surveyed by foot and much of the area was viewed several times in an attempt to locate and identify all of the plants growing in the area. Approximately 90 to 95% of the study area was viewed.

A species list was developed and is included as an addendum to this report. Since there were no Rare, Endangered or Remarkable plants identified during the study, the plants on the species list are identified as being Alien or Indigenous. The common name and growth form of each plant is also recorded in the plant list.

GENERAL DESCRIPTION:

The study area for this project extends from the intersection of Hualalai Road and Kuakini Highway on the north side to a dry gulch approximately 100 yards to the south of the "Pottery Terrace". This dry gulch can further be described as being located approximately 250 yards south of the intersection of Oni Oni Street and the Kuakini Highway. The width of the study area extends 100 feet to both sides of the centerline of the Kuakini Highway. (Refer to Exhibit #1 for a map of the study area.)

On the mauka (mountain) side of the highway proceeding from the dry gulch at the south end to the Hualalai Road / Kuakini Highway intersection on the north end much of the area along the Kuakini Highway has been developed and landscaped, in the landscaped areas the flora was observed and recorded.

There are three parcels of undeveloped land on the mauka side of the Kuakini Highway within the study area, in these areas notes were also made concerning the vegetative communities. The first vacant plot on the mauka side of the Kuakini Highway is from the dry gulch to the Pottery Terrace.

The second undeveloped area is located between Oni Oni Street and the "Royal Kailuan", a condominium, this undeveloped parcel can be devided into three distinct areas. The first area starts at Oni Oni St and extends to a driveway approximately 80 yards to the north. The second area is a former pasture that is currently unused, this area is bounded

on both the north and south side by stone walls. The final area is a vacant lot that has been cleared but has not yet been developed, along this lot the shoulder of the highway is being used for parking.

The third area of undeveloped land starts at Kama'aina Hale and ends at a car dealership. From the vegetation, the stone walls and the debris scattered throughout these areas it is clear that these lots were at one time used as a cattle pasture.

The dominant vegetative community on the undeveloped land is a Haole Koa (*Luceana leucocephala*) dominated scrub with an understory of guinea grass (*Panicum maximum*). Other tree species noted in the area are Kiawe (*Prosopis pallida*) and autograph tree *(Clusia rosea*). All of the dominant vegetation noted in the area are introduced weedy species. Exhibit #2 is a photo showing the general vegetation type in the vacant lots.

On the makai (ocean) side of the Kuakini Highway there are again three areas of undeveloped land along the side of the Kuakini Highway. The first undeveloped area is a short strip of land from the dry gulch on the south to the intersection of Oni Oni St and the Kuakini Highway on the North. The second is a lot between a building under construction at the time of the survey and a condominium. The norther boarder of the third undeveloped parcel ends at parking lot of the "Coconut Grove" shopping complex.

The vegetation in the undeveloped areas on the makai side of the Kuakini Highway is again dominated by weedy introduced species such as Haole Koa, Fountain Grass and Guinea Grass.

During the site survey in October 2005 it was noted that the vegetation along the side of Kuakini Highway had been poisoned and consequently many of the weedy species that had been noted in previous visits were not observed. The poisoning of the vegetation on the shoulder of the Kuakini Highway prior to the October 2005 site survey did not effect the final results of the study since the vegetation had been observed and recorded on prior visits.

Due in part to the urbanized nature of the study area even the indigenous (native) species noted are widespread in distribution and common so the removal of any plants both native and non-native should have a minimal biological effect. The indigenous plants observed in the study area are for the most part associated with areas that have been cleared or greatly disturbed such as the shoulders of the highway or fringes of parking lots or property lines.

The indigenous plants such as *Waltheria indica, Ipomoea indica* and *Sida rhombifolia* are common vegetation along the side of many roads and trails on the western side of the island of Hawaii. The two native ferns located in the study area, *Nephrolepis exaltata* and *Pteris cretica,* are growing on the shoulder or next to the shoulder of the highway.

No Endangered Plant Species or Proposed Endangered Plant Species were seen in the study area. The State of Hawaii noted in a letter dated July 3, 1996 that two potentially Endangered Species, *Prtichardia affinis* (Loulu Palm) and *Cappris sandwicensis* (Pua Pilo) may be located in the general vicinity of the previous phase of the Kuakini Highway widening between Palani and Hualalai Road. Neither species was seen during the site survey.

WETLAND CONSIDERATIONS:

In the study area there were two areas that required consideration as possible wetland sites. These two areas are clearly delineated dry gulches and both have culverts that cross under Kuakini Highway. Both areas do not fall into the category of wetlands as defined for ecological consideration due to the following factors. Most importantly the culvert area within the study site has been altered by clearing and excavating the area next to and under the highway. Also the slope in the culvert is steep enough that water is not able to pool so that the area would not sustain pools of standing water for any length of time. Further the substrate in the culverts contain very little or no organic material and is composed mostly of loose gravel and sand. Finally the flora recorded from the culverts are not facultative or obligate hydrophytes. Exhibit #3 is a photo of the culvert at the South end of the study area and shows the loose gravel within the culvert.

(Kuades0101=not for report just a note as to filename)

KUAKINI HIGHWAY IMPROVEMENTS PROJECT PHASE 2

SPECIES LIST

Name	Family	Common Name	Form	Status
Abutilon grandifolium	Malvaceae	Hairy Abutilon	Herb	A
Allamanda cathartica	Apocynaceae	Allamanda	Vine	A
Aloe vera	Aloeaceae	Aloe	Herb	A
Alpinia sp.	Zingiberaceae	Flowering Ginger	Herb	A
Alternanthera sessilis	Amaranthaceae	Joyweed	Herb	A
Asystasia gangetica	Acanthaceae	Chinese violet	Vine	A
Bidens alba	Asteraceae	Bidens	Herb	A
Bidens cynapiifolia	Asteraceae	Bidens	Herb	A
Bidens pilosa	Asteraceae	Beggar's tick	Herb	A
Boerhavia coccinea	Nyctaginaceae	Boerhavia	Herb	A
Boerhavia glabrata	Nyctaginaceae	Nena	Herb	I
Bougainvillea sp.	Nyctaginaceae	Bougainvillea	Vine	A
Capsicum annuum	Solanaceae	Chili Pepper	Shrub	A
Carica papaya	Caricaceae	Papaya	Tree	A
Carissa macrocarpa	Apocynaceae	Natal-plum	Vine	A
Cassia sp.	Fabaceae	Shower Tree	Tree	A
Catharanthus roseus	Apocynaceae	Madagascar periwinkle	Herb	A
Cenchrus echinatus	Poaceae	Common sandbur	Herb	A
Chamaecrista nictitans	Fabaceae	Partridge pea	Herb	A
Chamaesyce hirta	Euphorbiaceae	Hairy Spruge	Herb	A
Chamaesyce hypericifolia	Euphorbiaceae	Graceful Spurge	Herb	A
Chamaesyce prostrata	Euphorbiaceae	Prostrate Spruge	Herb	A
Chloris barbata	Poaceae	Swollen Fingergrass	Herb	A
Citrus reticulata	Rutaceae	Tangerine	Tree	A
Cleome gynandra	Capparaceae	Spider Wisp	Herb	A
Clusia rosea	Clusiaceae	Autograph Tree	Tree	A
Coccinia grandis	Cucurbitaceae	Ivy Gourd	Vine	A
Cocos nucifera	Arecaceae	Niu	Tree	A
Codiaeum sp.	Euphorbiaceae	Croton	Shrub	A
Commelina benghalensis	Commelinaceae	Hairy honohono	Herb	A
Commelina diffusa	Commelinaceae	Honohono	Herb	A
Cordyline fruticoa	Agavaceae	Ki	Shrub	A
Crinum sp.	Liliaceae	Crinum	Herb	A
Cynodon dactylon	Poaceae	Bermuda Grass	Herb	A
Delonix regia	Fabaceae	Royal Poinciana	Tree	A
Desmanthus virgatus	Fabaceae	Slender mimosa	Shrub	A
Desmodium tortuosum	Fabaceae	Beggarweed	Herb	A
Digitaria setigera	Poaceae	Crabgrass	Herb	I?
Digitaria insularis	Poaceae	Sourgrass	Herb	A
Dracaena sp.	Agavaceae	Money Tree	Shrub	A
Eleusine indica	Poaceae	Wiregrass	Herb	A
Emilia sonchifolia	Asteraceae	Flora's paintbrush	Herb	A
Eragrostis tenella	Poaceae	Lovegrass	Herb	A
Erythrina sp.	Fabaceae	Erythrina	Tree	A
Euphorbia af. lactea	Euphorbiaceae	Euphorbia	Shrub	A
Fagraea berteroana	Loganiaceae	Pua Kenikeni	Shrub	A
Ficus lyrata	Moraceae	Fiddle-leaf Fig	Tree	A
Ficus microcarpa	Moraceae	Chinese Banyan	Tree	A
Ficus sp.	Moraceae	Banyan	Shrub	A
Filicium decipiens	Sapindaceae	Fern Tree	Tree	A
Hibiscus sp.	Malvaceae	Hibiscus	Shrub	A
Hylocereus sp.	Cactaceae	Night-Blooming Cereus	Vine	A
Hyptis pectinata	Lamiaceae	Hyptis	Vine	A
Ipomoea indica	Convolvulaceae	Koali 'awa	Vine	I
Ipomoea obscura	Convolvulaceae	Morning Glory	Vine	A
Ixora sp.	Rubiaceae	Ixora	Herb	A
Jatropha curcas	Euphorbiaceae	Physic nut	Tree	A
Kalanchoe pinnata	Crassulaceae	Air Plant	Herb	A
Kyllinga brevifolia	Cyperaceae	Kyllinga	Herb	A
Lantana camara	Verbenaceae	Lantana	Shrub	A
Leonotis nepetifolia	Lamiaceae	Lion's ear	Herb	A
Leucaena leucocephala	Fabaceae	Haole Koa	Shrub	A
Livistona chinensis	Arecaceae	Fan Palm	Tree	A
Malvastrum coromandelianum	Malvaceae	Cheese Wheel	Herb	A
Malvastrum sp.	Malvaceae	???	Herb	A
Mangifera indica	Anacardiaceae	Mango	Tree	A
Melaleuca sp.	Myrtaceae	Paperbark	Tree	A
Microsorium scolopendria	Polypodiaceae	Maile Scented Fern	Herb	A
Mirabilis jalapa	Nyctaginaceae	Four-o-clock	Herb	A
Momordica charantia	Cucurbitaceae	Balsam Pear	Vine	A
Morinda citrifolia	Rubiaceae	Noni	Shrub	A
Murraya paniculata	Rutaceae	Mock Orange	Shrub	A
Nephrolepis exaltata	Nephrolepidaceae	Sword Fern	Herb	I
Nerium oleander	Apocynaceae	Oleander	Shrub	A
Opuntia sp.	Cactaceae	Prickly Pear Cactus	Shrub	A
Oxalis corniculata	Oxalidaceae	Wood Sorrel	Herb	A
Panicum maximum	Poaceae	Guinea Grass	Herb	A
Passiflora edulis	Passifloraceae	Passion Fruit	Vine	A
Pennisetum setaceum	Poaceae	Fountain Grass	Herb	A
Phoenix roebelenii	Arecaceae	Pygmy Date Palm	Shrub	A
Phyllanthus sp.	Euphorbiaceae	Phyllanthus	Herb	A
Pithecellobium dulce	Fabaceae	Dulce	Tree	A

Pluchea symphytifolia	Asteraceae	Sourbush	Shrub	A
Plumeria sp.	Apocynaceae	Plumeria	Shrub	A
Podocarpus sp.	Podocarpaceae	Podocarpus	Tree	A
Polygala paniculata	Polygalaceae	Bubblegum Plant	Herb	A
Portulaca oleracea	Portulacaceae	Pigweed	Herb	A
Prosopis pallida	Fabaceae	Kiawe	Tree	A
Pseuderanthemum reticulatum	Acanthaceae	Eldorado	Shrub	A
Pteris cretica	Pteridaceae	Cretan Brake	Herb	I
Rhynchelytrum repens	Poaceae	Natal Redtop	Herb	A
Ricinus communis	Euphorbiaceae	Castor Bean	Shrub	A
Rivina humilis	Phytolaccaceae	Coral Berry	Herb	A
Samanea saman	Fabaceae	Monkeypod	Tree	A
Schefflera actinophylla	Araliacae	Octopus Tree	Tree	A
Senna occidentalis	Fabaceae	Coffee senna	Herb	A
Sida fallax	Malvaceae	Ilima	Herb	I
Sida rhombifolia	Malvaceae	Sida	Herb	I?
Sida spinosa	Malvaceae	Prickly sida	Herb	A
Spathodea campanulata	Bignoniaceae	African Tulip	Tree	A
Sporobolus diander	Poaceae	Indian Dropseed	Herb	A
Sporobolus indicus	Poaceae	Smutgrass	Herb	A
Synedrella nodiflora	Asteraceae	Nodeweed	Herb	A
Talinum triangulare	Portulacaceae	Talinum	Herb	A
Thevetia peruviana	Apocynaceae	Be-Still Tree	Shrub	A
Tradescantia spathacea	Commelinaceae	Oyster Plant	Herb	A
Tridax procumbens	Asteraceae	Coat Buttons	Herb	A
Triumfetta sp.	Tiliaceae	Bur Bush	Shrub	A
Waltheria indica	Sterculiaceae	Uhaloa	Herb	I
Wedelia trilobata	Asteraceae	Wedelia	Herb	A

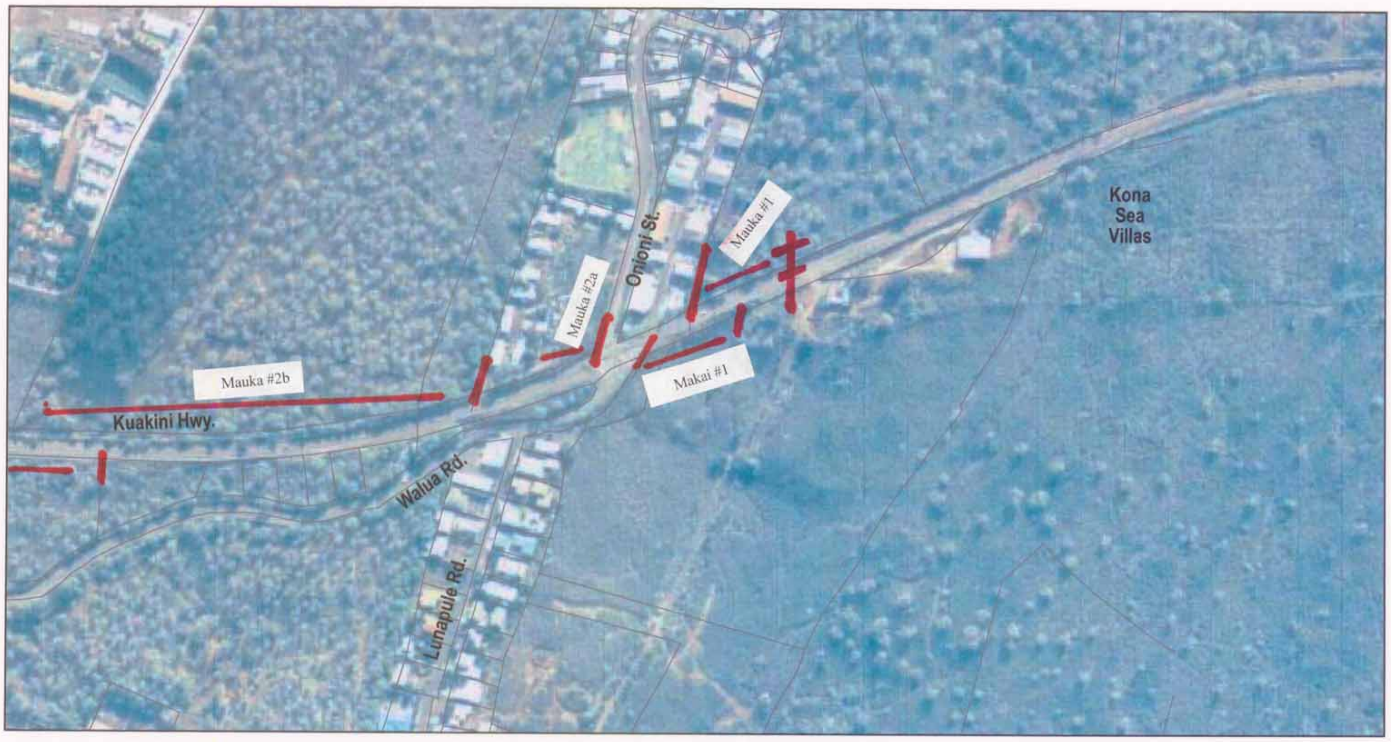
A= Alien

I= Indigenous

Photo of typical vegetation on undeveloped land in study site.

Bottom of culvert on South boarder of study site.

Field Map
Kuakini Highway Improvements Projects, Phase 2; Kailua-Kona, Hawaii
Page 1 of 2



Field Map
Kuakini Highway Improvements Projects, Phase 2; Kailua-Kona, Hawaii
Page 2 of 2

Legend for the aerial photograph of the study site:

Mauka #1) Is the undeveloped plot from the culvert to the Pottery Terrace.

Mauka #2a) Is the short undeveloped area from Oni Oni St. to the first driveway to the north of Oni Oni St. This area has been cleared and weedy species typical of the side of the Kuakini Hwy. shoulder were starting to grow on the parcel.

Mauka #2b) Is the longest undeveloped plot in the study area.

Mauka #2c) Is a cleared lot that is being overgrown with weeds typical of the side of the Kuakini Hwy.

Mauka #3) Is an undeveloped parcel that is botanically similar to Mauka #2b.

Makai #1) The short undeveloped parcel between the South end of the study site and Walua St.

Makai #2) The undeveloped parcel next to a condominium.

Makai #3) The undeveloped parcel to the south of the parking area for the Coconut Grove Marketplace.

APPENDIX G TRAFFIC NOISE IMPACT TECHNICAL REPORT

DRAFT
Traffic Noise Impact Technical Report
Kuakini Highway Improvement Project, Phase II
Hualalai Road to Ali'i Highway
Kailua-Kona, Hawai'i County, Hawai'i

Prepared for:

State of Hawai'i Department of Transportation

Prepared by:

Parsons Brinckerhoff Quade & Douglas, Inc.

December 2006

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EXECUTIVE SUMMARY

The purpose of this report is to analyze the traffic noise impacts of the proposed improvements to Kuakini Highway between Hualalai Road and the future intersection with Alii Highway in Kailua Village, North Kona on the island of Hawaii.

The County of Hawaii Department of Public Works (DPW) and the Federal Highway Administration (FHWA) are proposing improvements to Kuakini Highway between Hualalai Road and the future intersection with Alii Highway in Kailua Village, North Kona on the island of Hawaii (Figure 2-1). The proposed improvements would include increasing the vehicle capacity of Kuakini Highway within the project limits. The proposed project is included in the current Statewide Transportation Improvement Program (STIP) and the Hawaii Long Range Land Transportation Plan

The DPW has recently completed the widening and improvement of an adjacent stretch of Kuakini Highway, from Palani Road to Hualalai Road. That project, now called "Phase 1" of the Kuakini Highway widening, is separate from the action currently under consideration. The current action, widening from Hualalai Road to Alii Highway, has been designated as Phase 2.

In addition to the proposed action (Build Alternative), a No Build Alternative was also studied in this report. The following is a description of the two alternatives considered in this report:

> No-Build Alternative – The No-Build Alternative assumes that the widening of Kuakini Highway would not be accomplished by future year 2020. The existing two-lane cross-section would remain.
>
> Build Alternative – The Build Alternative primarily involves widening Kuakini Highway to a four-lane configuration from Hualalai Road and the future intersection with Alii Highway. Additional improvements include auxiliary lanes, bike lanes, and concrete sidewalks on both sides, curb and gutter, utilities, drainage system, highway lighting, and intersection improvements (Figure 2-2).

Land uses closest to the project area include residential, commercial, open space and undeveloped land.

Five short-term (15 to 30-minute) and two long-term (24-hour) measurements were taken at noise sensitive locations along the proposed alignment. Six additional residential sites were

modeled to supplement the measured sites or replace monitored sites that would be within the right-of-way of the proposed alignment.

Existing modeled worst-hour traffic noise levels for residential areas range from 53 dBA to 66 dBA (Table 3-3). The existing worst-hour traffic noise levels approach or exceed the NAC of Leq = 67 dBA at three of the 13 modeled sites.

FHWA Traffic Noise Model (TNM) was used to model the noise levels at 13 sites for the No Build Alternative along Kaukini Highway. Three of the modeling sites used in the No Build Alternative will be within the proposed right-of-way of the Build Alternative, so only 10 sites are modeled for the Build Alternative. Noise levels were calculated for the Year 2020 traffic.

The No Build Alternative has one site, Site B that approach or exceed the NAC (Table 4-3). The No Build Alternative is used as the baseline of future traffic noise levels. Noise abatement was not modeled for this alternative.

The Build Alternative has three sites, Site B, Site B-M-1 and Site B-M-2 that approach or exceed the NAC (Table 4-4). There is no increase over the No Build Alternative for Site B. Under the Build Alternative, this site does have a noise impact, so noise abatement was modeled for Site B, Site B-M-1 and Site B-M-2.

A 10 to 14-foot high 235-foot long noise barrier was found to be feasible and reasonable, with a 8 foot high barrier recommended for the Kama'aina Hale Condos, Site B. A 8 to 12-foot high 225-foot long noise barrier was found to be feasible and reasonable, with a 10 foot high barrier recommended for the Kama'aina Hale Condos, Sites B-M-1, and B-M-2. The noise barrier would be located at the edge of shoulder and would benefit a total of 24 residences along the eastbound side of Kaukini Highway at the area just north of the University of Nations.

CHAPTER 1
INTRODUCTION

The purpose of this report is to analyze the traffic noise impacts of the proposed improvements to Kuakini Highway between Hualalai Road and the future intersection with Alii Highway in Kailua Village, North Kona on the island of Hawaii (Figure 2-1). The improvements of the Proposed Action would include increasing the vehicle capacity of Kuakini Highway within the project limits. This study was prepared in accordance with Federal Highway Administration (FHWA) rules and procedures (FHWA 1995) and the State of Hawai'i Department of Transportation (HDOT) Noise Analysis and Abatement Policy (HDOT, 1996). Its elements include:

1. Measurements of existing noise levels at representative noise sensitive receivers;
2. Prediction of future traffic noise levels;
3. Comparison of existing and predicted future traffic noise levels with the FHWA Noise Abatement Criteria (NAC);
4. Recommendations to reduce noise impacts;
5. Evaluation of possible noise barriers; and
6. The effects of construction noise and proposed mitigation measures.

CHAPTER 2
PROJECT DESCRIPTION

The County of Hawaii Department of Public Works (DPW) and the Federal Highway Administration (FHWA) are proposing improvements to Kuakini Highway between Hualalai Road and the future intersection with Alii Highway in Kailua Village, North Kona on the island of Hawaii (Figure 2-1). The improvements of the Proposed Action would include increasing the vehicle capacity of Kuakini Highway within the project limits. The project is included in the current Statewide Transportation Improvement Program (STIP) and the Hawaii Long Range Land Transportation Plan.

DPW has recently completed the widening and improvement of an adjacent stretch of Kuakini Highway, from Palani Road to Hualalai Road. That project, now called "Phase 1" of the Kuakini Highway widening, is separate from the action currently under consideration. The current action, widening from Hualalai Road to future Alii Highway, has been designated Phase 2.

The alternatives studied in this report are:

No-Build Alternative – The No-Build Alternative assumes that the widening of Kuakini Highway would not be accomplished by future year 2020. The existing two-lane cross-section would remain.

Build Alternative – The Build Alternative primarily involves widening Kuakini Highway to a four-lane configuration from Hualalai Road and the future intersection with Alii Highway. Additional improvements include auxiliary lanes, bike lanes and concrete sidewalks on both sides, curb and gutter, utilities, drainage system, highway lighting, and intersection improvements (Figure 2-2).

Figure 2-1. Project Location

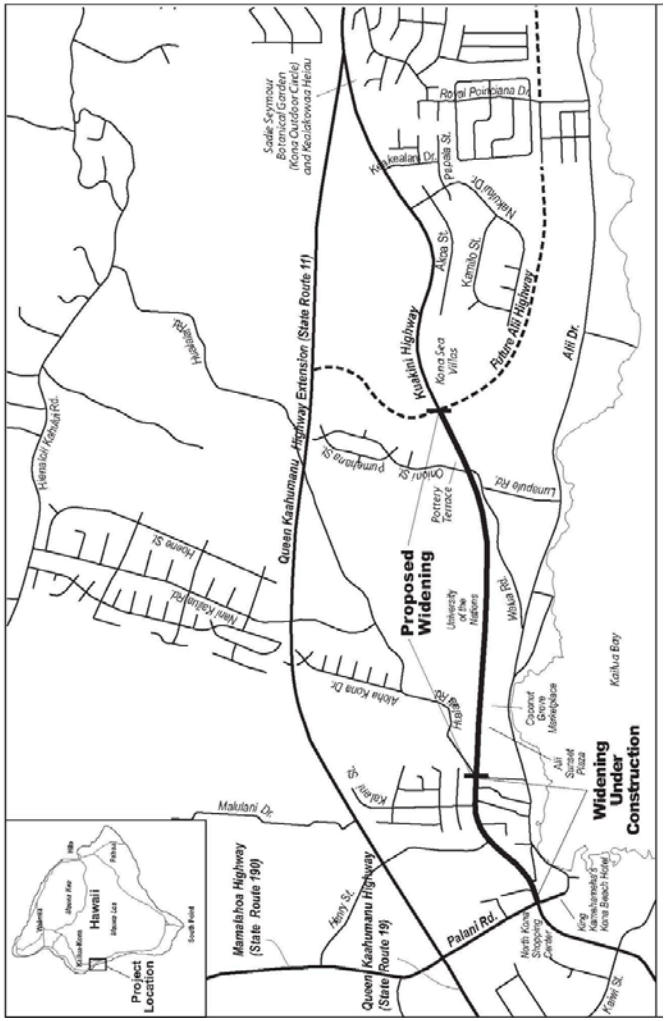
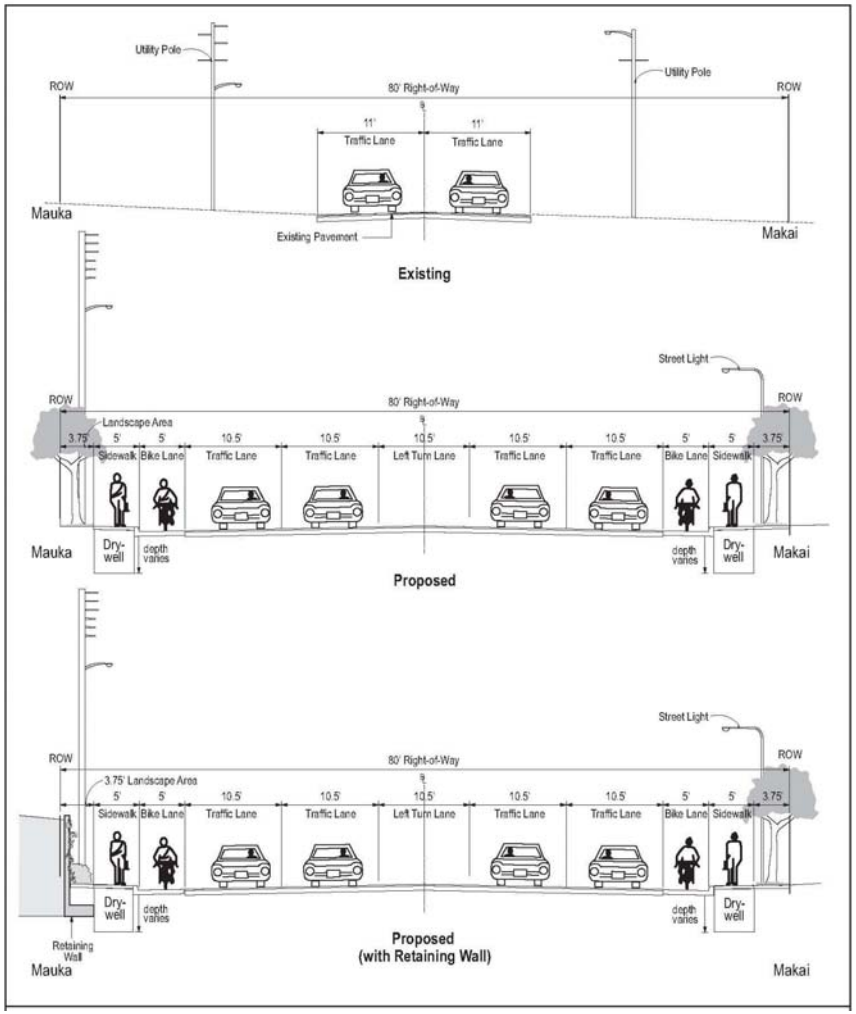


Figure 2-2. Build Alternative Cross Section



CHAPTER 3
EXISTING NOISE ENVIRONMENT

3.1 BACKGROUND

Noise is defined as any sound that is undesirable or interferes with normal human activities. The decibel (dB) scale is used to quantify sound intensity and represents the ratio between a given sound and the faintest sound detectable by human hearing. Because sound pressure levels vary widely within the range of human hearing, the dB scale is logarithmic. The human ear is not equally sensitive to all frequencies within the entire sound spectrum. Accordingly, noise measurements are made using an A-weighting (dBA) scale to correspond to human perceptions of noise. A-scale sound levels are currently in use in many community and city noise ordinances and in state and city highway traffic noise codes.

Time variation in noise exposure is typically accounted for as a constant energy level equivalent (Leq) for a given time period. The Leq is the constant noise level over some 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). For example, Leq(h), expressed in A-weighted decibels (dBA), is the calculated constant noise over one hour which is equivalent in total energy to the varying noise levels actually measured during that one hour.

3.2 NOISE STANDARDS

The HDOT Noise Analysis and Abatement Policy implements FHWA regulations on noise abatement (23 CFR 772) for the State of Hawai'i. The regulations and policy require that a noise analysis be performed whenever potentially affected receivers exist, either as developed lands or lands that are planned, designed or programmed for future use.

The FHWA has established Noise Abatement Criteria (NAC), shown on Table 3-1, for different exterior and interior land use activities. The NAC do not constitute legally enforceable noise standards, but represent a yardstick for evaluating the effect of project noise on the surrounding community. The NAC have been adopted by the State of Hawai'i as its standard.

Under HDOT policy, a noise impact occurs when the predicted traffic noise levels approach or exceed the NAC, or when the predicted traffic noise levels substantially exceed the existing noise levels. "Approach" means at least 1 dBA less than the NAC, and "substantially exceed the existing noise levels" means an increase of at least 15 dBA. If the NAC are approached or

exceeded, or if there is a substantial increase above the existing noise level, noise abatement measures must be considered.

Changes in traffic noise are assessed using human perceptions of sound level changes. Generally, changes in noise levels of less than 3 dBA are barely perceptible to most listeners, but an increase of 10 dBA is perceived as a doubling (or halving for a decrease) of noise levels. These guidelines permit estimation of an individual's probable perception of changes in noise levels.

Table 3-1. Noise Abatement Criteria (NAC)

Activity Category	Leq (h) for Noisiest Traffic Hour - dBA	Description of Activity
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B.
D	----	Undeveloped lands
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Notes: Leq(h) is the one-hour energy equivalent sound level.
Source: Federal Highway Administration

The interior noise level standard in activity category "E" applies to:

- Indoor activities for those parcels where no exterior noise sensitive land use or activities have been identified, such as apartment buildings, hospitals, and auditoriums; and
- Situations where the exterior activities are either remote from the highway or shielded, so that while the exterior activities remain undisturbed, noise nevertheless affects interior activities, motels/hotels with the building between the roadway and the pool area is one example.

3.3 EXISTING AND FUTURE NOISE-SENSITIVE LAND USES

Existing and future noise sensitive land uses and activities adjacent to the proposed corridor and nearby major roadways were identified from site inspections and existing mapping. These land use activities include residences, recreation and park areas, and institutions such as

schools and churches. All of these activities are considered Category B, which has an exterior NAC of L_{eq}(h) 67 dBA.

3.4 NOISE MEASUREMENT SITES

Five short-term (15 to 30-minute) and two long-term (24-hour) measurements were taken at noise sensitive locations along the proposed alignments. The approximately location of the measurements sites is illustrated in Figure 3-1.

3.4.1 Short-Term Noise Measurements

Noise level measurements were conducted for a 15 to 30-minute period at 5 sites. These sites extend from residences near the Onioni Street/Walua Road intersection in the south to on Hualalai Road to the north (Figure 3-1). The short-term measurements were then compared with the noise levels from the long-term 24-hour measurements (see Section 3.4.2) and adjusted to a peak-hour, or worst traffic noise hour noise level. This was done by using the difference between the peak hour measurement and the hourly measurement at the long-term site. Traffic volumes were simultaneously counted for most of the measurement sites. The traffic counts used three vehicle classifications: automobiles, medium trucks, and heavy trucks. Speeds were obtained using a radar gun. Noise measurements were not taken unless traffic conditions were free-flow. The following is a description of the noise sensitive activities at the measurement sites:

3.4.1.1 Site 1

At Kona Islander Inn, a 15-minute measurement was taken approximately 18 feet from the front of the Kona Islander Inn and approximately 80 feet to Kaukini Highway at a location that best represents the closest areas of human activity with the most exposure to Kaukini Highway. The surrounding area consists of commercial and mixed residential buildings. A Leq of 57.9 dBA was recorded at 1:30 p.m.

3.4.1.2 Site 2

Open space area in front of the Royal Kailian Condominiums. A 15-minute measurement was taken approximately 230 feet from the front of the pool and approximately 33 feet from Kaukini Highway on top of the stone wall between Kaukini Highway and the condominiums, which is actually within the right-of-way (ROW) for the highway. The condominium is slightly elevated in relation to Kaukini Highway. The surrounding area consists of multi-family condominiums, University of Nations and open space. A Leq of 66.7 dBA was recorded at 2:10 p.m. at Site 2.

Because the measurement was taken in the highway ROW between the residential property and the current roadway surface, the measurement is used to just to verify the TNM model. Model site 2A (Section 3.5.1) will be used to address noise impacts on the property of the Royal Kailian Condominiums.

3.4.1.3 Site 3

For residences located on the Kaukini Highway side of the Billfisher Condominium, a 15-minute measurement taken between Kaukini Highway and the property line of the Billfisher Condominium, because it allowed traffic count to be taken during the measurement. The measurement location was actually within the ROW for the highway though. The surrounding area consists of residential and commercial land uses. A Leq of 66.4 dBA was recorded at 11:30 a.m. Because the measurement was taken in the highway ROW between the residential property and the current roadway surface, the measurement is used only to verify the TNM model. Model site 3A (Section 3.5.2) will be used to address noise impacts on the property of the Billfisher Condominiums.

3.4.1.4 Site 4

5921 Walua Road (Trent Residence), a 15-minute measurement taken at the side of the driveway facing Kaukini Highway. This area best represents the areas of human activity with the most exposure to traffic noise on from Kaukini Highway. The surrounding area consists of single-family homes and mixed-use commercial buildings. A Leq of 52.9 dBA was recorded at 12:30 p.m. at Site 4.

3.4.1.5 Site 5

Site 5 was near the Bleck residence at 5885 Walua Road. The measurement was taken on the side of the home, 20 feet from the curb line of Kaukini Highway in the gravel area between the highway and 5885 Walua Road. The measurement was taken in this area because access to the area of frequent human use at the home was not readily available. The measurement site was within the highway ROW. The surrounding area consists of single-family homes and commercial properties. A Leq of 62.7 dBA was recorded at 12:20 p.m. Because the measurement was taken in the highway ROW between the residential property and the current roadway surface, the measurement is used to just to verify the TNM model. Model sites 5A and 5B (Section 3.5.3 and 3.5.4) will be used to address noise impacts on the residence in the area..

3.4.2 Long-Term Noise Measurements

Long term (24 hour) noise measurements were conducted at 2 sites to determine the noisiest traffic hours within the project area. Measurements were taken on August 9th and November 16th 2006.

3.4.2.1 Site A

A 24-hour measurement was taken at Site A, a residential area just north of Onioni Street and 45 feet from Kaukini Highway. The measurement location was chosen because it best represents areas of human activity with the most exposure to traffic noise on Kaukini Highway. The surrounding area is open space with mixed-use commercial located across Kaukini Highway. A peak-hour Leq of 65.2 dBA was measured at 6:00 A.M. on August 9, 2005 at Site A.

3.4.2.2 Site B

A 24-hour measurement was taken at the Kama'aina Hale Condominium, north of the University of Nations, 30 feet from the nearest building. The measurement location was chosen because it best represents the condominium's area of human activity with the most exposure to traffic noise from Kaukini Highway. The surrounding area is open space. A peak hour Leq of 65.1 dBA was measured at 4:00 P.M. on November 16, 2005.

3.5 MODELING SITES

Four residential sites were modeled to supplement the measured sites or replace measurement sites that were taken along the existing roadway and within the highway ROW, but not in areas of frequent human use. The approximately location of the modeled sites is illustrated in Figure 3-1.

3.5.1 Site 2A

The Royal Kailuan Condominium modeling Site 2A was chosen to replace measurement Site 2 (Section 3.4.1.2), which is in located on the existing ROW line and not in an area of frequent human use. Modeling Site 2A is located 50 feet west of measurement Site 2 and approximately 30 feet from the edge of the proposed roadway. A worst hour Leq of 65 dBA was modeled for Site 2A.

3.5.2 Site 3A

King Fisher Condominium modeling location was chosen to show noise levels at the front of the building at a location that better represents area of frequent activity. Modeling Site 3A replaces measurement Site 3 (Section 3.4.1.3), which is in the located in the highway ROW between the existing highway surface and the property line of the King Fisher Condominiums. Site 3A is located 90 feet south of measurement Site 3 and would be 10 feet from the front of the condominium. A worst hour Leq of 60 dBA was modeled for Site 3A.

3.5.3 Site 5A

Modeling Site 5A is located at a residence between Kaukini Highway and Walua Road. This modeling location was chosen to replace measurement Site 5 (Section 3.4.1.5), which is in the gravel parking area between the home and Kaukini Highway, which was within the highway ROW. Site 5A is located 60 feet west of the current edge of roadway and would be between 20 and 45 feet from the proposed edge of roadway. A worst-hour Leq of 57 dBA was modeled for Site 5A.

3.5.4 Site 5B

Modeling Site 5B is located at a residence between Kaukini Highway and Walua Road. This modeling location was chosen to supplement modeling Site 5A. Site 5B is located 55 feet west of the current edge of roadway and would be between 20 and 40 feet from the proposed edge of roadway. A worst-hour Leq of 63 dBA was modeled for Site 5B.

3.5.5 Site B-M-1

Modeling Site B-M-1 is located at the Kama'aina Hale Condominium to supplement Site B (Section 3.4.2.2). Site B-M-1 is located 60 feet west of the current edge of roadway and would be 25 and 45 feet from the proposed edge of roadway. A worst-hour Leq of 66 was modeled for Site B-M-1.

3.5.6 Site B-M-2

Modeling Site B-M-1 is also located at the Kama'aina Hale Condominium to supplement Site B (Section 3.4.2.2). Site B-M-2 is located 60 feet from the current edge of roadway and would be 25 and 45 feet from the proposed edge of roadway. A worst-hour Leq of 67 was modeled for Site B-M-2.

3.6 MODEL CALIBRATION

The traffic noise prediction model was calibrated to adjust the model to actual site conditions. Model calibration is performed by adjusting calculated future noise levels by adding a constant derived from the difference between measured and calculated noise levels at representative sites. The distinction between calculated and predicted noise levels is as follows:

- Calculated noise levels (existing or future) are the results of the model
- Predicted noise levels are adjusted or "calibrated" modeled values

FHWA Traffic Noise Model (TNM) version 2.5 was used to model existing traffic noise levels at the measurement sites along the existing Kuakini Highway and the sites along the proposed alternative (Figure 3-1). Geometries of the existing roadway and noise modeling sites were entered into the model. Traffic volumes counted during the short-term measurement periods were scaled up to one-hour volumes and entered into the model along with the measured vehicle speeds.

There is reasonable agreement between measured and modeled noise levels (within 2.0 dB) for all the measured sites directly on Kaukini Highway. Sites 2A, 3A, 5A and 5B were modeled to show noise levels at the outdoor human use areas.

3.7 EXISTING NOISIEST TRAFFIC HOUR

To determine the existing worst-hour traffic noise levels, the 15-minute traffic counts taken during the noise readings were expanded to hourly volumes (multiplied by four) and entered into the TNM model. The worst-hour noise level is based on the traffic volumes measured during long-term noise measurements on August 9, 2005 (Section 3.4.2). No corrections were made for local roadways. The measured traffic conditions on local roadways were assumed to represent average conditions. The vehicle classifications that were observed and counted when the existing noise level measurements were conducted (Table 3-2) were used to model the existing year traffic noise.

Table 3-2. Existing Vehicle Classifications

Roadway Segment	Autos	Medium Trucks	Heavy Trucks
Northbound Kaukini Highway	99%	1%	0%
Southbound Kaukini Highway	99%	1%	0%

3.8 RESULTS OF EXISTING NOISE MEASUREMENTS

Table 3-3 presents the modeled existing worst-hour traffic noise levels, the number of buildings represented by each measurement site, and the NAC for each of the short-term and modeled measurement locations. Worst-hour traffic noise levels for residential areas range from 53 dBA to 66 dBA depending on the proximity of the receiver to the roadway traffic and the presence of buildings and topography providing noise attenuation between the receiver and the roadway. The worst-hour traffic noise levels approach or exceed the NAC at two of the measurement sites.

Figure 3-1. Noise Measurement Locations

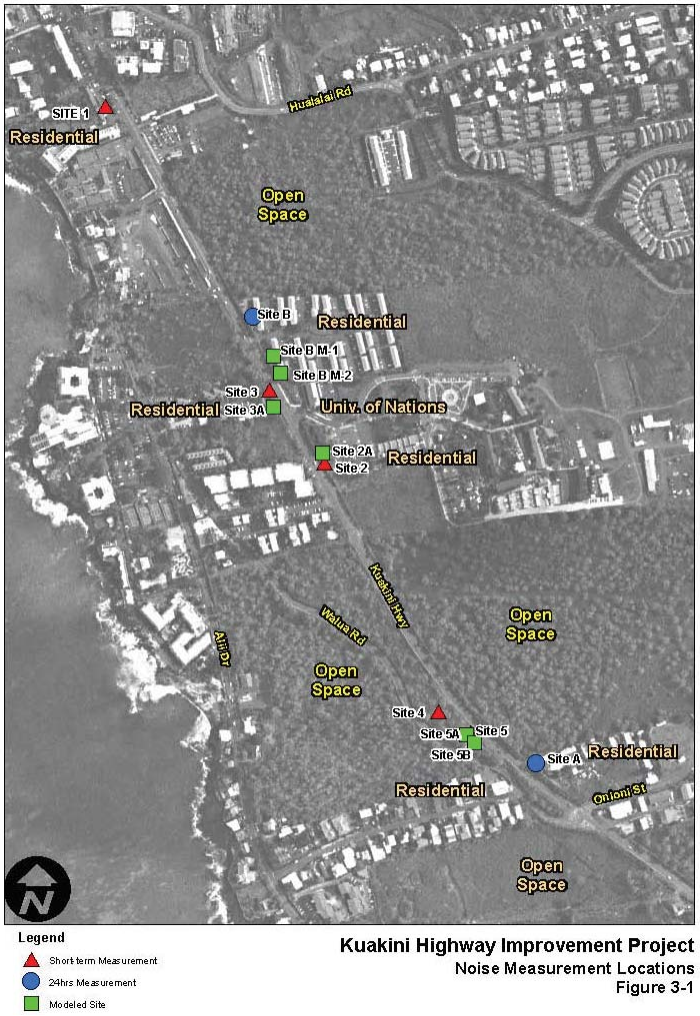


Table 3-3. Existing Worst Hour Traffic Noise Levels

Site	Location	Type of Develop-ment	Date and Time of Measure-ment	Length of Measure-ment	Number of Receivers Represented	Noise Abatement Category (Criterion)*	Measured Hourly Leq(h), dBA	Modeled Worst-Hour Leq(h), dBA
Site 1	Kona Islander Inn	Hotel	11-17-05 1:30 p.m.	15 min	10	B	57.9	57.5
Site 2	Royal Kailuan Condominium	Residential	11-17-05 2:10 p.m.	15 min	0	B	**66.7**	64.7
Site 2A	Royal Kailuan Condominium (Modeling Site)	Residential		Modeled	44	B	n/a	61.4
Site 3	Bill Fisher Condominium	Residential	8-9-05 11:30 a.m.	15 min	0	B	**66.4**	**66.4**
Site 3A	Bill Fisher Condominium (Modeling Site)	Residential		Modeled	12	B	n/a	56.2
Site 4	5921 Walua Road	Residential	8-9-05 12:30 p.m.	15 min	2	B	52.9	52.9
Site 5	5885 Walua Road	Residential	11-17-05 12:20 p.m.	15 min	0	B	62.7	63.9
Site 5A	5885 Walua Road (Modeling Site)	Residential		Modeled	2	B	n\a	53.5
Site 5B	5885 Walua Road (Modeling Site)	Residential		Modeled	2	B	n\a	58.0
Site A	Residence north of Onioni Street	Residential	8-9-05	24 hrs	2	B	n\a	60.2
Site B	Kama'aina Hale Condominium	Outdoor	8-9-05	24 hrs	8	B	n\a	65.5
Site B-M-1	Kama'aina Hale Condominium	Outdoor		Modeled	8	B	n\a	64.3
Site B-M-2	Kama'aina Hale Condominium	Outdoor		Modeled	8	B	n\a	65.5

Note : See Table 3-1 for descriptions of Noise Abatement Categories.
Bold = level approaches or exceeds the NAC.
A "Receiver" is an area of frequent human outdoor activity, homes, apartments, motel, hotels, etc (generally one receiver per building).
Modeled worst hour Leq(h) values are within 2 dBA of measured values indicating the model is correctly calibrated.

CHAPTER 4
FUTURE TRAFFIC NOISE IMPACTS

The noise impact analysis considers traffic noise levels at receivers for the two alternatives.

4.1 PREDICTION METHODOLOGY

FHWA Traffic Noise Model (TNM) was used to model the noise levels in 2020 at 13 sites for the No Build Alternative along Kaukini Highway. Measurement sites 2, 3, and 5 were within the existing ROW and were only used to verify the TNM models, so only 10 sites are modeled for the Build Alternative. The No Build Alternative is used as the baseline of future traffic noise levels. Noise levels were calculated for the Year 2020 traffic.

Input variables to noise modeling and analysis include traffic volumes, speeds and vehicle fleet mix (auto, medium truck, and heavy truck percentages). The noise analysis considers the peak traffic hour as the noisiest hour of the day. The number of vehicles expected to travel on Kuakini Highway in 2020 is based on traffic data from Traffic Modeling analysis, July 2006, and summarized below.

Table 4-1. No Build Alternative 2020 Traffic Volumes

Roadway	Between Cross Street	Between Cross Street	NB Vehicles per Hour	SB Vehicles per Hour	Posted Speed Limit (MPH)
Kaukini Hwy	Future Alii Hwy	Onioni St	740	475	40
Kaukini Hwy	Onioni St	Univ. of Nations Entrance	865	605	40
Kaukini Hwy	Univ. of Nations Entrance	Hualalai Rd	955	795	40

Note: NB = Northbound
SB = Southbound

Table 4-2. Build Alternative 2020 Traffic Volumes

Roadway	Between		NB Vehicles per Hour	SB Vehicles per Hour	Posted Speed Limit (MPH)
	Cross Street	Cross Street			
Kaukini Hwy	Future Alii Hwy	Onioni St	740	475	40
Kaukini Hwy	Onioni St	Univ. of Nations Entrance	865	605	40
Kaukini Hwy	Univ. of Nations Entrance	Hualalai Rd	955	795	40

Note: NB = Northbound
SB = Southbound

Future vehicle mix is projected to be 99 percent autos and one percent medium trucks for all roadways. Vehicle mix is based on traffic counts taken during the noise measurements (Table 3-2).

4.2 NOISE IMPACT ANALYSIS

In terms of the one-hour L_{eq}(h) noise descriptor, a noise impact could potentially require mitigation if either of the following conditions is predicted to occur:

- Future year traffic noise approaches or exceeds the FHWA NAC; or
- Future year traffic noise substantially exceeds (15 dBA or more) the existing ambient noise level.

4.2.1 No-Build Alternative

Under the No-Build Alternative, predicted 2020 traffic noise levels at the receiver sites are expected to be in the range of no change to a 3 dBA increase over the existing peak hour noise levels. The NAC of L_{eq}(h) 67 dBA is predicted to be approached or exceeded at two receivers, Site B and B M-2 (Table 4-3).

4.2.2 Build Alternative

Predicted 2020 traffic noise levels for the Build Alternative are expected to increase over the No Build noise levels. The NAC of L_{eq}(h) 67 dBA is predicted to be approached or exceeded at three receivers, Site B, Site B-M-1 and Site B-M-2 (Table 4-4). Sites 2, 3 and 5 were above the NAC for the No Build Alternative but are within the highway ROW and therefore within the footprint of the Build Alternative.

Table 4-3. No Build Worst Hour Traffic Noise Levels

Site	Location	Modeled Existing Worst-Hour Leq(h), dBA	Modeled No Build 2020 Worst-Hour Leq(h), dBA	Leq(h), dBA Increase (+) or Decrease (-)	Noise Abatement Category (Criterion)	Impact Type* (S, A/E, or None)
Site 1	Kona Islander Inn	57.5	60	+2	B	None
Site 2A	Royal Kailuan Condominium (Modeling Site)	61.4	64	+3	B	None
Site 3A	Bill Fisher Condominium (Modeling Site)	56.2	59	+3	B	None
Site 4	5921 Walua Road	52.9	56	+3	B	None
Site 5A	5885 Walua Road (Modeling Site)	53.5	56	+2	B	None
Site 5B	5885 Walua Road (Modeling Site)	58.0	61	+3	B	None
Site A	Residence north of Onioni Street	60.2	63	+3	B	None
Site B	Kama'aina Hale Condominium	65.5	**68**	+2	B	A/E
Site B-M-1	Kama'aina Hale Condominium	62.3	64	+2	B	None
Site B-M-2	Kama'aina Hale Condominium	63.5	**66**	+2	B	A/E

Note: **Bold** = level approaches or exceeds the NAC.
*Impact Type: S = Substantial Increase (15 dBA or more), A/E = Approach or Exceed NAC

Table 4-4. Build Alternative Worst Hour Traffic Noise Levels

Site	Location	Modeled 2020 No Build Worst-Hour Leq(h), dBA	Modeled 2020 Build Alternative Worst-Hour Leq(h), dBA	Leq(h), dBA Increase (+) or Decrease (-)	Noise Abatement Category (Criterion)	Impact Type* (S, A/E, or None)
Site 1	Kona Islander Inn	60	61	+1	B	None
Site 2A	Royal Kailuan Condominium (Modeling Site)	64	65	+1	B	None
Site 3A	Bill Fisher Condominium (Modeling Site)	59	60	+1	B	None
Site 4	5921 Walua Road	56	57	+1	B	None
Site 5A	5885 Walua Road (Modeling Site)	56	57	+1	B	None
Site 5B	5885 Walua Road (Modeling Site)	61	63	+2	B	None
Site A	Residence north of Onioni Street	63	64	+1	B	None
Site B	Kama'aina Hale Condominium	**68**	**68**	0	B	A/E
Site B-M-1	Kama'aina Hale Condominium	64	**66**	+2	B	A/E
Site B-M-2	Kama'aina Hale Condominium	66	**67**	+1	B	A/E

Note: **Bold** = level approaches or exceeds the NAC.
*Impact Type: S = Substantial Increase (15 dBA or more), A/E = Approach or Exceed NAC

CHAPTER 5
NOISE ABATEMENT MEASURES

Noise abatement measures must be considered as part of the project if traffic noise impacts are identified. Impacts occur at sites where traffic noise levels approach or exceed the NAC of L_{eq}(h) 67 dBA, or substantially exceed (by 15 dBA or more) the ambient noise levels. HDOT's Noise Analysis and Abatement Policy is used to determine whether noise abatement measures can be implemented, depending on whether these measures are reasonable and feasible based on the following criteria:

- Provide a minimum noise reduction of 5 dBA
- Cost of noise abatement does not exceed $35,000 per residence benefited
- Number of residences protected will include all dwelling units - owner occupied houses, rental units, mobile homes, etc. All units benefited by a 5 dBA or more noise reduction are counted regardless of whether they were identified as impacted
- Views from impacted residences are a major consideration in the reasonableness of noise abatement measures
- Residential areas where future traffic noise levels are greater than 70 dBA, or 20 dBA higher than existing noise levels, will be given greater consideration
- Residential areas along highways at a new location, and residential areas constructed before an existing highway, will be given greater consideration

Noise abatement would only be considered at existing noise sensitive sites, or planned development sites where building permit approvals have been obtained, and would only apply to outdoor ground level areas.

The noise abatement to be included in the proposed project will be based on an engineer's cost estimate of the feasible abatement measures identified in this report after the preferred alternative is selected.

5.1 NOISE ABATEMENT EVALUATION: NO BUILD ALTERNATIVE

The No Build Alternative has one site, Site B that approaches or exceeds the NAC (Table 4-3). The No Build Alternative is used as the baseline of future traffic noise levels. Noise abatement was not modeled for the No Build alternative.

5.2 NOISE ABATEMENT EVALUATION: BUILD ALTERNATIVE

The Build Alternative has three sites, Site B, Site B-M-1 and Site B-M-2, that are predicted to approach or exceed the NAC in 2020 (Table 4-4). The future 2020 noise level at Site B is the same for either the No Build Alternative or the Build Alternative, exceeding the NAC of 67 dBA. Under the Build Alternative, this site is considered to have a noise impact requiring noise abatement.

A noise barrier wall was modeled for the impacted receivers at Site B, Site B-M-1 and Site B-M-2, the Kama'aina Hale Condos. Table 5-1 shows the modeled noise level reduction for different heights of noise barrier walls.

Table 5-1. Modeled Noise Levels, Leq(h) and Insertion Loss, dBA for Build Alternative

Site	Leq (h) dBA Without Abate-ment	Noise Barrier	Location of Barrier	With Barrier H= 8 ft		With Barrier H= 10 ft		With Barrier H= 12 ft		With Barrier H= 14 ft	
				Leq (h) dBA	I.L. dBA	Leq (h) dBA	I.L. dBA	Leq (h) dBA	I.L. dBA	Leq (h) dBA	I.L. dBA
Site B	68	NB-1	EOS	**60**	**8**	58	10	57	11	56	12
Site B-M-1	66	NB-2	EOS	**57**	**9**	55	11	54	12	54	12
Site B-M-2	67	NB-2	EOS	64	3	**62**	**5**	60	7	60	7

Note: ft = feet; I.L. = Insertion Loss; NB = Noise Barrier; EOS = edge of shoulder; ROW = right-of-way
(**XX**) = Values bolded are the abated noise level (Leq (h) dBA) and insertion loss (I.L. dBA) for the recommended noise barrier heights. (I don't understand why you need this here)

Noise barriers NB-1and NB-2, along the edge of the shoulder between Kuakini Highway and Kamaʻāina Hale Condos for a length of approximately 235 feet for NB-1 and 225 feet for NB-2, would provide a minimum of 5 dBA traffic noise reduction to the impacted receivers at Sites B, B-M-1, and B-M-2. NB-1's length is the entire frontage of the condos along Kuakini Highway north of the driveway. NB-2's length is the entire frontage of the south of the driveway to the property line. The modeled and recommended barrier location is presented in Table 5-2 and shown in Figure 5-1.

Table 5-2. Feasible Noise Abatement Measure for Build Alternative

Barrier I.D. No.	Location	Approx. Barrier Length	Receiver Sites Benefited	Location of Barrier in Report Graphics
NB-1	EOS	235 ft	Site B	Figure 5-1
NB-2	EOS	225 ft	Site B-M-1 and Site B-M-2	Figure 5-1

Note: EOS = edge of shoulder.

The reasonableness of the various feasible noise barriers was then evaluated by comparing the maximum allowable cost to the engineer's cost estimate for the feasible noise barriers (Table 5-3). A noise barrier is deemed reasonable only if the estimated cost is less than the maximum allowable cost. The noise barrier would protect eight residences along the northbound side of Kaukini Highway, just north of the University of Nations. At an allowance of $35,000 per benefited residences, the maximum allowance for the NB-1 noise barrier is $280,000 and for $560,000 for NB-2.

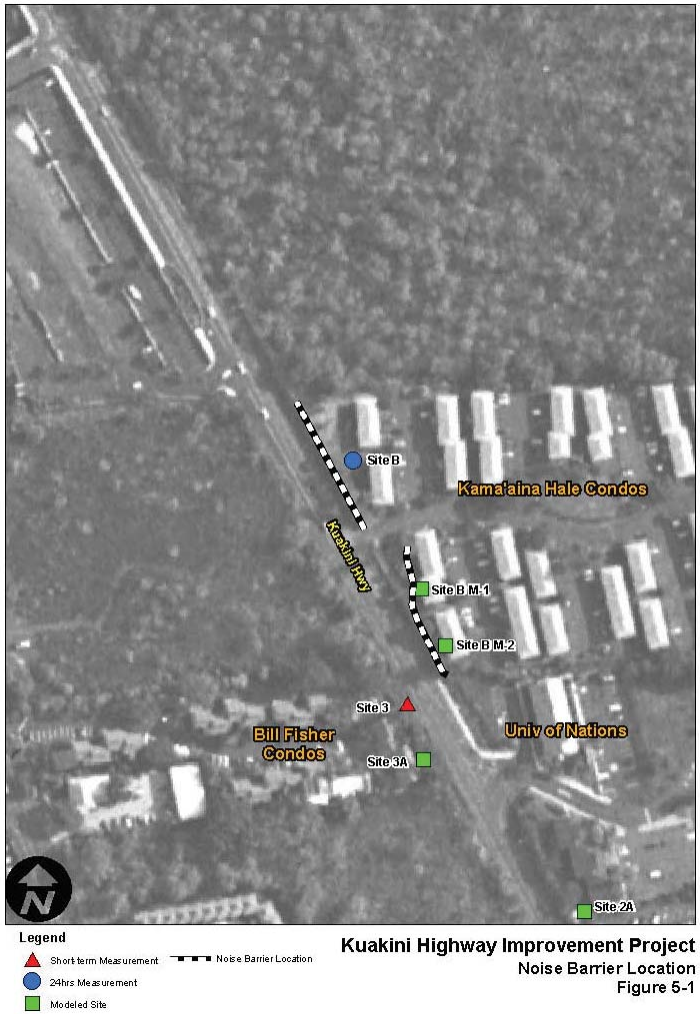
Table 5-3. Summary of Noise Barrier Reasonableness for Build Alternative

Noise Barrier I.D.	Height	Number of Benefited Residences	Maximum Allowance per Benefited Residence	Maximum Allowance Per Noise Barrier	Noise Barrier Engineer's Cost Estimate	Is Barrier Reasonable?
NB-1	8 feet	8	$35,000	$280,000	$79,900	Yes
NB-1	10 feet	8	$35,000	$280,000	$99,875	Yes
NB-1	12 feet	8	$35,000	$280,000	$115,150	Yes
NB-1	14 feet	8	$35,000	$280,000	$128,075	Yes
NB-2	8 feet	16	$35,000	$560,000	$76,500	Yes
NB-2	10 feet	16	$35,000	$560,000	$95,625	Yes
NB-2	12 feet	16	$35,000	$560,000	$110,250	Yes
NB-2	14 feet	16	$35,000	$560,000	$122,625	Yes

5.3 PRELIMINARY NOISE ABATEMENT DECISION

A 10 foot high 235 foot long noise barrier for NB-1 is recommended for the edge of the shoulder along the northern section of the Kamaʻāina Hale Condos and a 8 foot high 225 foot long noise barrier for NB-2 is recommended for the edge of the shoulder along the southern half of the Kamaʻāina Hale Condos because it would abate the modeled noise impact to a level below the NAC. A higher noise barrier is not recommended because: (a) the incremental noise benefit is small, (b) taller barriers have other impacts, such as visual impacts, and (c) taller barriers are more costly, making them less reasonable.

Figure 5-1. Noise Barrier Location



CHAPTER 6
CONSTRUCTION NOISE IMPACTS

The duration and level of construction noise depend on the phase and type of activity, such as:

- ground clearing, demolition and removal of existing structures, trees, rocks and soil;
- excavation;
- placement of foundations and roadbeds, including pile driving;
- erection of structures including retaining walls; and
- finishing, including filling, grading, paving, landscaping and cleanup operations.

The first two phases, ground clearing and excavation, typically generate the highest noise levels. Noise generated by construction equipment, including trucks, graders, bulldozers, concrete mixers and portable generators can reach levels from 67 dBA to 98 dBA at 50 feet. Construction equipment noise emissions are regulated by the Environmental Protection Agency's Noise Control Program (Part 204 of Title 40, Code of Federal Regulations). Presently, air compressors are the only equipment under regulation, and no new regulations are currently under consideration.

Noise levels for equipment which might be used during the excavation and construction of the proposed project are presented in Table 6-1. The noise levels presented are at a reference distance of 50 feet. Since construction equipment noise levels decrease at a rate of approximately 6 dBA per doubling of distance, at 100 feet the noise levels would be about 6 dBA less than the levels shown at 50 feet. Similarly, at 200 feet the noise levels would be 12 dBA less than shown. Intervening structures or topography can act as a noise barrier to further reduce noise levels.

Table 6-1. Construction Equipment Noise Levels

Source	L_{max} 50 feet	Model Tested
Backhoe	85 dBA	John Deere 609A
Front Loader	84 dBA	Caterpillar 980
Dozer	84 dBA	Caterpillar D7e
Grader	91 dBA	Caterpillar 16
Scraper	92 dBA	Caterpillar 660
Compressor	80-89 dBA	Various Tested
Pile Driver	95-100 dBA	Various Tested

Source: Federal Highway Administration, Highway Construction Noise: Measurement, Prediction, and Mitigation, 1976

The State of Hawai'i Department of Health (DOH) maintains community noise control standards that apply to construction noise. The project could not exceed the stipulated noise limits unless a variance is granted by the DOH.

Two measures which would minimize adverse construction noise impacts are:

- limit activities to between 7:00 a.m. and 6:00 p.m. on weekdays, and between 9:00 a.m. and 6:00 p.m. on Saturdays, and
- require construction equipment to have mufflers in good working order.

Noise control measures during construction would be required to minimize impacts on existing noise sensitive land uses. Because impacts to residences cannot be accurately determined without detailed construction plans and schedules, the measures recommended in this section should be re-evaluated in greater detail as project design is refined.. General abatement measures presented below are recommended as guidelines in developing construction plans that consider the adverse impacts of construction noise.

1. Design Considerations - During the early stages of construction plan development, natural and artificial barriers, such as ground elevation changes and existing buildings, can be considered for use as shielding against construction noise. Strategic placement of stationary equipment, such as compressors and generators, could reduce impacts at the sensitive receivers.
2. Construction of Noise Barriers During Initial Stages - Noise barriers planned for permanent placement along the ROW for traffic noise abatement could be constructed during the initial stages to reduce the impacts of construction noise. Initial construction of noise barriers would significantly reduce construction noise impacts at the sensitive receivers.
3. Alternate Construction Methods - Certain phases of highway construction work such as pile driving may produce noise levels in excess of acceptable limits, even when feasible noise reduction methods are used. These impacts may be reduced by using alternate methods of construction. In the case of pile driving, vibration or hydraulic insertion could be used. Drilled holes for cast-in-place piles are another alternative that would produce significantly lower levels of noise.
4. Source Control - The contractor shall comply with HDOT Standard Specifications and all local sound control and noise level rules, regulations and ordinances which

apply to any work performed pursuant to the contract. Each internal combustion engine used for any purpose on the job, or related to the job, shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated on the project without a muffler.

5. Time and Activity Constraints - The noisier activity involving large machinery could be limited to daytime hours when most people normally impacted are either not present or engaged in less noise sensitive activities. Nighttime construction would require a variance. Compliance with local noise ordinances is anticipated to mitigate impacts associated with construction noise. To comply with the ordinance, all construction activities adjacent to residential uses will be limited to daytime hours (7:00 a.m. to 7:00 p.m.), Monday through Saturdays.
6. Community Relations - Community meetings can be held to explain the construction work, time involved, and the control measures to be taken to reduce the impact of the construction noise.

The aforementioned measures can be incorporated into site specific construction plans in order to minimize noise impacts to sensitive receivers along the project corridor, and additional noise emission limits could be developed as well. Construction hours could be set, and noise level criteria could be decided upon and adhered to during construction.

CHAPTER 7
REFERENCES

Federal Highway Administration (FHWA); Highway Construction Noise: Measurement, Prediction, and Mitigation, 1976

Federal Highway Administration (FHWA); Procedures for Abatement of Highway Traffic and Construction Noise, Code of Federal Regulations 23CFR 772, 1995

State of Hawaii, Department of Transportation (HDOT), Highways Divisions; Noise Analysis and Abatement Policy, October, 1996

APPENDIX H CULTURAL IMPACT ASSESSMENT

— draft report —

A Cultural Impact Assessment Study for the Kuakini Highway Improvements Project, Phase 2 Hualalai Road to Alii Highway, Kailua Kona, Island of Hawai‘i

by

Usha K. Prasad

Social Research Pacific, Inc.

Prepared for:

Parsons Brinckerhoff Quade & Douglas, Inc.

Under contract with

INTERNATIONAL ARCHAEOLOGICAL RESEARCH INSTITUTE, INC.

APRIL 2006

IARII 200530

— DRAFT REPORT —

A CULTURAL IMPACT ASSESSMENT STUDY FOR THE

KUAKINI HIGHWAY IMPROVEMENTS PROJECT, PHASE 2 HUALALAI

ROAD TO ALII HIGHWAY, KAILUA KONA

ISLAND OF HAWAI‘I

by
Usha K. Prasad, Ph.D.

Social Research Pacific, Inc.
667 Old Mokapu Road
Kailua, Hawai‘i 96734

Prepared for:

Parsons Brinckerhoff Quade & Douglas, Inc.
American Savings Bank Tower
1001 Bishop Street, Suite 2400
Honolulu, Hawai‘i 96813

Under contract with

International Archaeological Research Institute, Inc.
2081 Young Street
Honolulu, Hawai‘i 96826

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INTRODUCTION

Planning is underway for the Kuakini Highway Improvements Project, Phase 2, in Kailua-Kona, Hawai‘i Island. The proposed improvements extend from the intersection of Kuakini Highway and Hualalai Road to the intersection with the proposed future Alii Highway. The project, which specifically involves a widening of the roadway would be a continuation of improvements currently underway (Phase 1) for the portion of the highway that ends at Hualalai Road. Phase 2 includes an area that is approximately 6000 meters (1.2 miles) long. This Cultural Impact Assessment (CIA) is being prepared for International Archaeological Research Institute, Inc. (IARII) by Social Research Pacific, Inc (SRPI), and assesses the possible impacts that the Kuakini Highway project may have on cultural resources and practices in the project area.

Preparation of the CIA, as explained in the main CIA guidance document (Hawai‘i, State of, Environmental Council 1997), involves collection of ethnographic and ethnohistorical information for the purpose of identifying impacts of a "proposed action on cultural practices and features associated with the project area." The two primary tasks identified for completing this study are ethnographic and documentary research. Ethnographic information gathered from interviews, discussions, and site visits have helped to identify (a) areas of traditional significance in and around the Kuakini Highway project area, and (b) the potential impacts of the proposed project. Information from archival research provides the culturally significant traditional native Hawaiian context of the project area.

The CIA study was done by Usha K. Prasad, Ph.D., of SRPI. This draft report concludes the primary analysis for the CIA. The potential cultural impacts and areas/places of traditional [cultural] Hawaiian significance identified during the course of this study are presented here. A more comprehensive report of historic properties in the vicinity of the project area is found in the archaeological survey report (Rasmussen 2006) that this CIA accompanies.

Project Goals

Articles IX and XII of the State Constitution of Hawai‘i (Chapter 343, Hawai‘i Revised Statutes) require government agencies to promote and preserve cultural beliefs, practices, and resources of Native Hawaiians and other ethnic groups. As such, environmental impact assessments and statements need to study the impacts of a proposed action on cultural practices and features associated with a project area. Act 50 (April 26, 2000), Section 343-2, of the Hawai‘i Revised Statutes (HRS) further amends the definition of environmental impact statement to include ‘effects of a proposed action on the economic [and] welfare, social welfare, and cultural practices of the community and State.' The "Guidelines for Assessing Cultural Impacts," adopted by the Environmental Council of the State of Hawai‘i, on November 19, 1997, identifies the protocol for conducting cultural assessments (see Appendix A). This study follows the guidelines established by the Environmental Council (EC); its results are presented in accordance with the six protocols established by the EC guidelines.

This CIA is based on ethnographic and archival research completed on the Kuakini Highway project area and its surroundings. While the EC protocol is followed in its entirety, the primary goals of this study were to (a) identify cultural resources and cultural practices in and around the project area, and (b) assess the potential for impacts to these as a result of the proposed widening of the highway. The identification of historic properties (including potential (cultural resources) in the project area was conducted by IARII during the time the ethnographic work was being done on this CIA. One type of cultural resource that is of particular concern is the presence of burials within the project corridor. While the archaeology survey identified surface structures, the ethnographic interviews attempted to identify any other known historic properties, especially burials, that may be within the construction corridor and it general vicinity. Since burials have been found during previous work along Kuakini Highway, a major goal of the ethnographic study was to locate individuals and families who could help identify other potential burials and areas of general concern. While no additional burial locations were identified during the course of the interviews and site visits, it is possible that unknown burials and associated features may be encountered during project construction.

In order to meet the goals identified for this study, interviews and site visits were completed with *kūpuna* (Hawaiian elders) who are knowledgeable about the area's native Hawaiian cultural properties and practices. Interviews were also held with present and former residents of the project area, both of Hawaiian and non-Hawaiian ancestry. It should be noted that the CIA guidelines emphasize that these policies require government agencies to promote and preserve the cultural beliefs, practices, and resources of native Hawaiians, as well as those of other ethnic groups. An important consideration for the Kailua-Kona area is that the present community is predominantly of non-Hawaiian ancestry. Two site visits to Kailua-Kona were completed. Both entailed walks in and around the project area to identify cultural resources and general areas of [historic] cultural significance. (A third visit for the purpose of presenting the project to the Hawai‘i Island Burial Council was also completed).

Of the cultural resources identified (through written records, oral accounts and site visits) in the project area, burials of native Hawaiians who were once *kupa* (citizen/resident) to this land may be inadvertently found during the project. Several burial sites have previously been identified (at least two of these have modern markers) in the immediate vicinity of the project area. One of these is an individual burial marker built on the sidewalk along the existing Kuakini Highway, fronting Coconut Grove Marketplace. The second lies adjacent to the southeastern edge of the parking lot of Coconut Grove Marketplace.

Project Location

The project area is located on the western slopes of Hualālai Mountain on the island of Hawai‘i (Fig. 1). It is within the traditional land district of Kona and crosses most of Kailua-Kona town before merging with Queen Kaahumanu Highway to continue as the state-owned Kuakini Highway. The county-owned Kuakini Highway, which is the subject of this report, is situated *makai* (towards the ocean) of Queen Kaahumanu Highway, running parallel to it for most of the way. Although a relatively small segment of the highway, the portion of Kuakini Highway that makes up the project area falls within nine traditional land units or *ahupua‘a* (Fig. 2). These are:

1. Hienaloli 6th
2. ‘Auhaukea‘e 1st
3. ‘Auhaukea‘e 2nd
4. Pua‘a 1st [1]
5. Pua‘a 2nd
6. Pua‘a 3rd
7. Waiaha 1st
8. Waiaha 2nd
9. Kahului 1st

While Kuakini Highway serves as a major corridor[2] through the busy town of Kailua, it also crosses through a historically significant native Hawaiian settlement area. Remnants of prehistoric and historic uses of the area are still found in features such as historic walls, fence enclosures, burials, and *heiau* (religious shrines of varied significance). Kailua is one of the few areas in Hawai‘i that offers an opportunity to look at human settlement, spanning the period from the earliest chiefdoms known to the present day. In this time, land use [of Kailua as well as the remainder of Kona] has changed dramatically, as has the population. This temporal history of Kailua-Kona is briefly discussed in the following section.

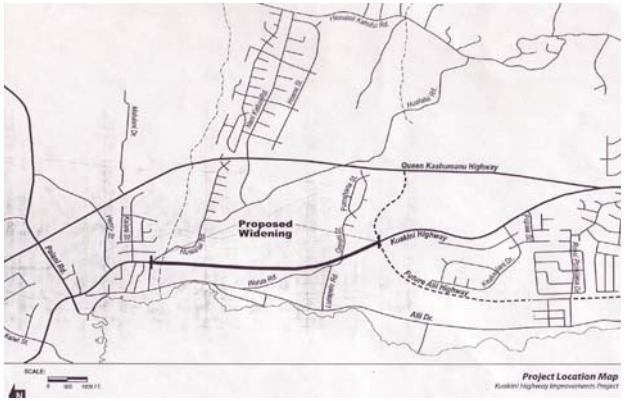

Figure 1. Map of the Project Area.

[1] An effort to locate when or why the *ahupua‘a* subdivisions took place did not yield more specific information. It is known however, that Puapua‘a 1st and Puapua‘a 2nd (*ahupua‘a* south of the project area) were originally listed as Puapua‘a-iki and Puapua‘anui. It is likely that this ‘re-labeling (from Hawaiian to English) was also done with the remaining *ahupua‘a* within the project area. It is also very likely that the subdividing was done to delineate specific boundaries for a family member or group.

[2] Alii Drive, which runs parallel to the shoreline, forms the other major thoroughfare in Kailua.

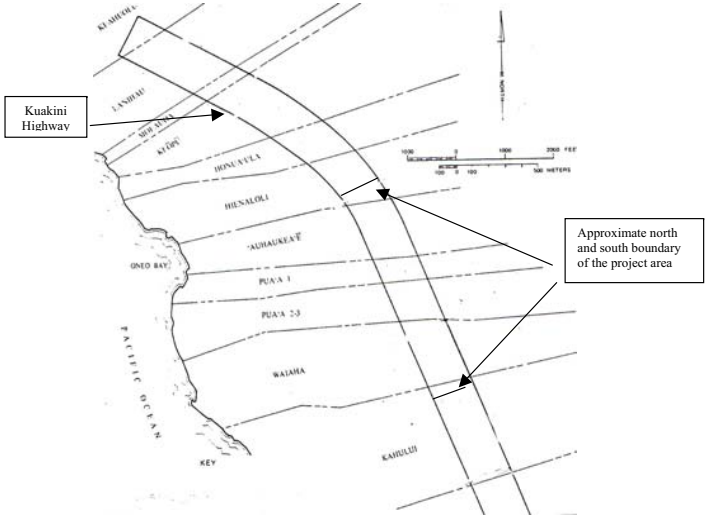

Figure 2. Traditional Land Units (*ahupua‘a*) in the Project Area.

Overview – The Project Area and Its Surroundings

The lands within which the project area falls form a very significant part of Hawai‘i’s history. Settlement and use of Kona lands is known from as early as the 1400s, when ‘Ehu-kai-malino was chief. According to Kamakau (1961:32), ‘Ehu ranked second only to Liloa and was his contemporary. The greatest of all kings was perhaps ‘Umi-a-Liloa, the son of Liloa who is known for conquering and uniting and island of Hawai‘i. These early kingdoms would involve significant economic, political and religious development of the area. Population would have increased, as would have the number of permanent settlements in and around the kingdom. In order to accommodate the needs of a larger, more settled population, food resources (agriculture, fishponds,) and religious features (*heiau*) would have increased. The growing (and sedentary) population gave impetus for large scale developments such as the Kona Field System. T. Stell Newman (1970), who completed one of the earliest archaeological studies of this agricultural system, estimated that it was up to three miles wide and eighteen miles long (National Register of Historic Places, Site 10-37-6601). Figure 3 shows Newman’s map of the portion of the Kona Field System that stretched across Kealakekua Bay. The fields continued north to include the area in back of Kailua town and somewhat beyond. According to Kelly (1983:70-71) what is

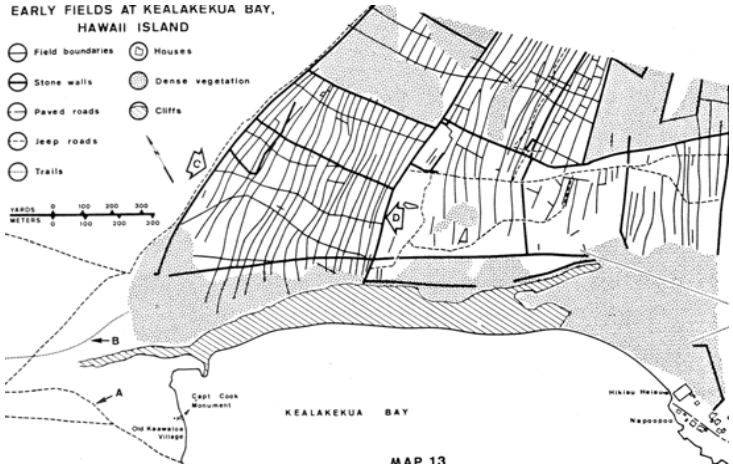

Figure 3. Map of Early Fields at Kealakekua Bay, Hawai‘i Island (Map 13 in Newman 1970).

known today as the Kona Field System is based on claims to cultivated lands documented in the Native Register (prior to passage of the Kuleana Act in 1850). Plants such as taro, sweet potato, breadfruit, sugarcane, plantains and paper mulberry were cultivated in elaborate terraces that spanned from Kailua to Kealakekua (Handy and Handy 1991:525-527).

Once he united all of the districts on Hawai‘i (through warfare), the great chief ‘Umi-a-Liloa wanted to make Kona his new home. Under his rule, the island was divided into two kingdoms – one located in Kona and the other in Hilo (Kamakau 1992:34). After ‘Umi’s time, a succession of chiefs reigned in Kona. In historic times, following the death of Captain Cook, the great chief Ka-lani-‘opu‘u moved to Kailua after brief stays in Kainaliu and Keauhou (Kamakau 1992:105). Kuakini, whose name is used on several sites and features in Kailua including the project area, was one of the last of the Hawaiian high chiefs to live in Kailua.

Early historical accounts of Kailua describe how the town appeared to these visitors. Commonly cited for his detailed description of the town of Kailua, the missionary William Ellis left a lasting impression of his visit to Hawai‘i in 1823. In the following account, Ellis describes what he saw as he walked from the shoreline further inland and eventually to points south of Kailua:

> The houses, which are neat, are generally built on the sea-shore, shaded with cocoanut [sic] and *kou* trees, which greatly enliven the scene. The environs were cultivated to a considerable extent in every direction. Small gardens were seen among the barren rocks on which the houses are built, wherever soil could be found sufficient to nourish the sweet potato, the water melon, or even a few plants of tobacco, which in many places seemed to be growing literally in the fragments of lava collected in small heaps around their roots (Ellis 1963:27).
>
> After traveling over the lava for about a mile, the hollows in the rocks began to be filled with a light brown soil; and about half a mile further, the surface was entirely covered with a rich mould, formed by decayed vegetation and decomposed lava. Here they enjoyed the agreeable shade of bread-fruit and *ohia* trees….The path now lay through a beautiful part of the country, quite a garden compared with that through which they had passed, on first leaving the town. It was generally divided into small fields, about fifteen rods square, fenced with low stone walls, made of fragments of lava which had been gathered from the surface of the enclosures. These fields were planted with bananas, sweet potatoes, mountain taro, tapa trees, melons and sugar-cane, flourishing luxuriantly in every direction. Having travelled about three to four miles thorough this delightful region, and passed several valuable pools of fresh water, they arrived at the thick woods, which extends several miles up the sides of the lofty mountain that rises immediately behind Kairua.
>
> Leaving Kairua, we passed through the villages thickly scattered along the shore to the southward. The country around looked unusually green and cheerful, owning to the frequent rains, which for some months past have fallen on this side of the island. Even the barren lava, over which we travelled [sic], seemed to veil its sterility beneath frequent tufts of tall waving grass, or spreading shrubs and flowers.
>
> The sides of the hills, laid out for considerable extent in gardens and fields, and generally cultivated with potatoes, and other vegetables, were beautiful.
>
> The number of heiaus, and depositories of the dead, which we passed, convinced us that this part of the island must formerly have been populous. The latter were built with fragments of lava, laid up evenly on the outside, generally about eight feet long, from four to six broad, and about four feet high. Some appeared very ancient, others had evidently been standing but a few years (ibid 72-73).

Ellis’ descriptions include some of the important cultural resources and land use practices that were taking place in Kailua in the early 1800s. He was unaware that he was witnessing at least one if not two major agricultural developments known from Kona. Ellis’ description is likely referencing what is now known as the Kona Field System (see above), but he may also have come across the Kūāhewa[3] plantation which was started by Kamehameha I.[4]

Kamakau (1992:204) describes Kūāhewa as a large tract of land in the uplands of Kailua. The Hawaiian newspaper, *Ka Nai Aupuni* (July 16, 1906), describes a visit by Kamehameha to Kūāhewa (in Handy and Handy 1991:524):

[3] It is unclear as to the location of Kūāhewa plantation in relation to the Kona Field System. Using Kamakau’s account and information from local informants, in 1954 Kelsey and Kekahuna located Kūāhewa in portions of Lanihau 2, Moeauoa 1 and 2, and Keōpū 1 *ahupua‘a* (in Kelly 1983:75).

[4] Kamehameha returned to Kamakahonu (the eye of the turtle), from where he ruled over Hawai‘i. Once a fairly elaborate compound, the modern pier at Kailua was constructed above the grounds of Kamakahonu. The rebuilding of ‘Ahu‘ena Heiau, in its present replica form, was undertaken by Kamehameha I (Kona Historical Society 1998:24).

Very early in the morning everyone went to the shady uplands, and there they began to till the soil. There was no favorite of Kamehameha's who did not grasp the *'o'o* and dig. All the chiefs and commoners united in this work. Kamehameha himself toiled with his chiefs and commoners.

In this work he grouped the men into three groups; the first, second, and third divisions. The work of the first group was to pull up the brush and to clear the field of weeds. The second group did the digging and the breaking of the clods to soften the soil so that the digging implements could easily penetrate it for taro planting. The third group planted taro stalks of every variety as well as sugar cane and bananas….

When the men removed themselves from the field Kamehameha stared at the field that was cleared and planted by the men. It was very great…One of his chiefs remarked, "This is a great patch of the Chief's; it is huge (*kuahewa*), indeed. One could not see the borders of the field which belongs to the Chief who is strong for planting."

The chiefs and commoners exclaimed over the great patch of their Chief's….Then Kamehameha spoke to his men, "O chiefs, and, too, my children, inasmuch as you have worked and planted food plants in the field, if any among you wish for any of the things that his hands had planted, then when I send him here to pull up some of the food plants, [do this]: When you break the sugar cane or cut down the bananas or pull up the taro, cut off the tops of the taro and replants them in the ground before you leave the patch.

According Kelly (1983:75), a drawing by Persis Thurston (Fig. 4), shows a large walled farm in "either the upper portion of the 'āpa'a, or in the lower 'ama'u zone, and may be the site of the Kūāhewa gardens." Kelly's conclusions are based on the site being unusually large

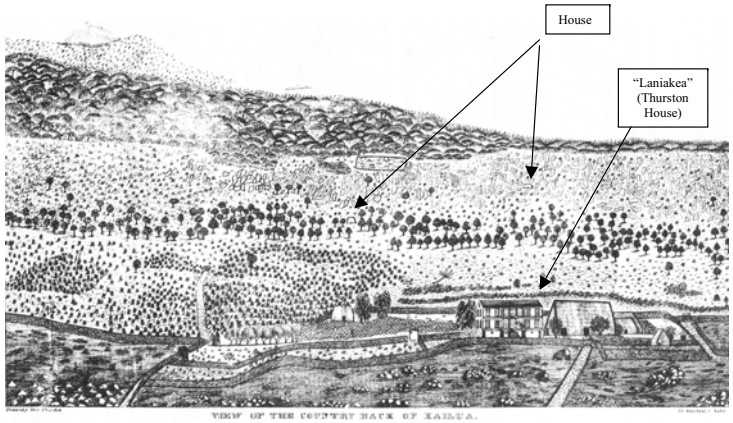

Figure 4. View of the Country Back of Kailua (drawing by Miss Persis Goodale Thurston c. 1840, in Kelly 1983:61)**.**

compared to other gardens shown in the drawing, and because it is walled, oriented laterally, and appears to contain two houses within its walls (ibid).

While its importance as a major cultural center for Hawai'i has remained up through the present, settlement and development of Kona began to change more dramatically after the arrival of foreigners. Among the first to arrive and settle in Kona was the Reverend Asa Thurston. Thurston returned to settle in Kona in 1823 and built a house near Laniakea Cave (which also became the name of his residence); though currently in a densely overgrown area, the remnants of this house area can be found near the project area (figures 5a and 5b).[5] Other changes included the departure of Hawaiians from the Kona lands and the subsequent abandoning of the Kona Field System (Kalima 1994). Even though many Land Commission Awards (LCA) awards were made to native Hawaiians who had claims to the Kona lands, it did not stop the exodus from continuing. The demand for marketable produce to provision the whaling and trading ships calling in at the ports of Kona may have been the primary reason Hawaiians gave up subsistence fishing and farming (Kelly 1983:8-9). Figure 6 is a 1952 map showing LCA lots and Grants and Patent Land Sales in the general vicinity of the project area. Table 1 shows LCA awarded lands which are crossed by the Kuakini Highway Project Area.

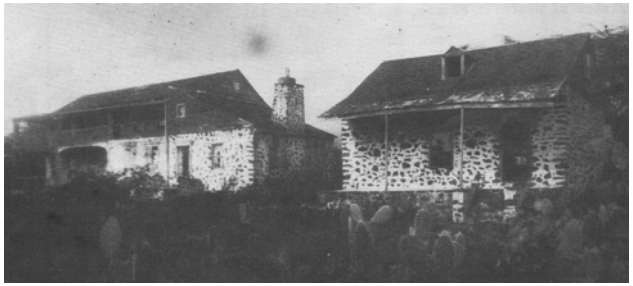

Figure 5a. Photograph by W. T. Brigham, June 11, 1890, showing "Laniakea" on the left and the Thurston Schoolhouse on the right (Fig. 12 in Kelly 1983:13)**.**

[5] The entrance (mouth) to Laniakea Cave, though within the same compound as the ruins of the Thurston House, is difficult to determine because of the modern stone wall foundation that prevents entrance to the house site. The seaward exit of Laniakea Cave is easily found along the shoreline.

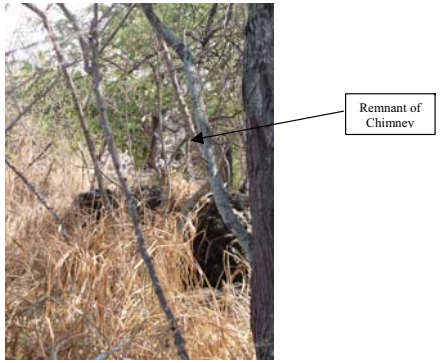

Figure 5b. Photograph of Thurston House Ruins, January 2006, with possible Chimney Feature in the Upper Right Corner.

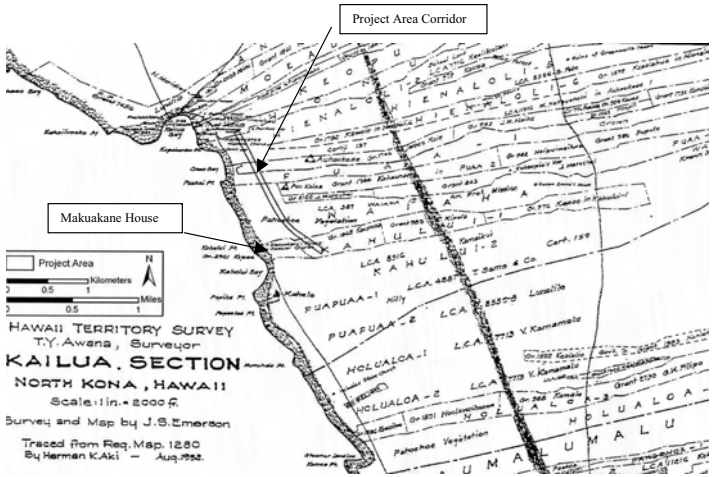

Figure 6. LCA Lots within the Project Area

Table 1. *Ahupua'a* Lands Crossed by the Kuakini Highway Project Area.

Ahupua'a	Awardee	Land Comm. Award	Acreage
Hienaloli 6th	Government	--	--
'Auhaukea'e 1st	Kekauonohi	11,216.37	334
'Auhaukea'e 2nd	Government	--	--
Pua'a 1st	Kamehameha, Lot	7715:13	859
Pua'a 2nd	Government	--	--
Pua'a 3rd	Government	--	--
Waiaha 1st	A.P. Mission	387	--
Waiaha 2nd	Crown Land	By Legislative Act of 10/14/1890	--
Kahului 1st	Government	--	--

It is important to note that along the project area corridor, no home owners were identified that could be connected or linked back to the LCA awardee of that land. Only the 'Duarte Apartments' appear to remain on ancestral lands but no LCA record was found to be associated with the Duarte family at this parcel. (LCA records also show a Thomas Duarte, along with Joseph Gomes, associated with LCA No. 387 in neighboring Wai'aha Ahupua'a). The Duarte Apartment compound is located at the southern, *mauka* end of the project area. It is within Kahului 1st *ahupua'a.* The compound may be a part of (or once was a part of) Land Grant number 1865, sold or given to Kaupena. However, according to Auntie Josephine Nahale Kamoku, who is a resident of the apartments, the compound is on lands once owned by her great grandfather, Joseph K. Nahale. J. K. Nahale was the original owner of the land. The present owner and landlord, Mr. Duarte, is a cousin of Auntie Josephine's. Mr. Duarte's father built the apartments in 1945; he and Auntie Josephine's grandfather were brothers. Although she has lived in the complex for the past 45 years, she's unsure as to when the land was divided between the elder relatives, or which portion of how much of the land belongs to her.[6]

The movement out of Kailua town continues to the present day. Of the *kūpuna* and former residents interviewed for the current study, only a handful remains either on family lands or within Kailua town.[7] At present, the population of Kailua is predominantly non-Hawaiian. According to the latest census (U.S. Census Bureau, 2000) out of an estimated 9,870 residents, only 10.8% is native Hawaiian. Mixed native Hawaiian and other Pacific Islander constitutes a total of 32.9%. Also, nearly half of the current residents of Kailua were not born in Hawai'i; only 52% were born in the State of Hawai'i. These figures demonstrate that in a little more than 200 years, the native Hawaiian population that was once formed Kailua town (prior to the introduction of new diseases, non-traditional job opportunities, commercial farming and ranching

[6] Several of the *kūpuna* told they knew of family lands that had been leased out but were never [re]claimed. These are ancestral lands that still belong to them; however, they are either unable to afford the legal fees or have no means of gathering information needed to make the claim.

[7] Many of these former residents of Kailua town moved upland (*mauka*), where they still had family lands.

ventures, etc.) has dwindled to a small minority. Based on the level of development underway, it would appear that the native population will decrease even further yet.

All places in Hawai‘i are of importance to native Hawaiians. And all places have some cultural value. But the significance of the native Hawaiian history in Kailua (Kona) presents a unique temporal context unlike any other in the islands:

- First, the native Hawaiian history of Kailua (and Kona) has been continuous; it extends back 600+ years. It is also fairly well documented through genealogical records, in chants, myths, and in the historical records left by the early visitors to the islands.

- Second, in the post Mahele period (after 1840) there were numerous LCA awards given in the Kailua area. (Some native Hawaiians also purchased lands from the government). Even though some of these lands have since been abandoned, vacated or sold, family names from the initial LCA awards, land grants, and patent records can still be associated with parcels or areas of land. The combined number of LCA awards, land grants, and patents indicate that there is a fairly large number of native Hawaiians who could lay ancestral (or land use) claim to the lands.

- Third, the native Hawaiians who lived, worked, and played in these lands left some permanent imprints. The project area, though largely surrounded by modern development (concrete buildings, other roadways, sidewalks, etc.) is also surrounded by remnants of structures and features of the earlier Hawaiian occupants. Among these features are stone walls, housing platforms, and boundary markers that represent the transitional period when Kailua was being introduced to plantation and ranching.

This long-standing history, first of native Hawaiian settlement and land use, followed by plantation and ranch related uses of the land, has several implications for the intended goals of this CIA study. The use of the land, native and otherwise, that has contributed to the culture that presently exists in Kailua is an important consideration in addressing impacts. Much of the culture that remains in Kailua is no longer native Hawaiian—nor are many of the current land use practices. But there are still small segments of the native Hawaiian population residing in Kailua and historic cultural resources that remain. A recent decision made by the Hawai‘i Supreme Court regarding land use on the island of Hawai‘i, calls attention to the need to recognize native Hawaiian cultural practices in the face of development:

> [T]he past failure to require native Hawaiian cultural impact assessments has resulted in the loss and destruction of many important cultural resources and has interfered with the exercise of native Hawaiian culture. The legislature further finds that due consideration of the effects of human activities on native Hawaiian culture and the exercise thereof is necessary to ensure the continued existence, development, and exercise of native Hawaiian culture (Ka Pa‘akai O Ka‘aina v. Land Use Commission 2000:26-27).

The importance of the above Supreme Court determination is that it emphasizes the need to identify/address impacts on cultural resources, which includes “activities of native Hawaiian

culture,” by land development projects before they occur.[8] The current project area is largely developed…there are very few sections along the Kuakini Highway corridor that have not been disturbed or changed in the last 200 years. Yet there are potential traditional land units (LCA, land grants, etc.) and other known cultural resources that remain. The following section identifies, based largely on interviews with *kūpuna* and others, what potential cultural impacts may result from the current proposed project.

[8] The land area which this Supreme Court decision references is in the *ahupua‘a* of Ka‘upulehu; it is a short driving distance north of the current project area.

STUDY RESULTS: IDENTIFICATION (AND MITIGATION) OF POTENTIAL CULTURAL IMPACTS FOR THE EXPANSION OF KUAKINI HIGHWAY

The purpose of Articles IX and XII of the Hawai‘i State Constitution is to "promote and preserve cultural beliefs, practices, and resources of Native Hawaiians and other ethnic groups." The goal of a CIA is to study the impacts of a proposed action on cultural practices and features associated with a project area. Included in these impacts are 'effects of a proposed action on the economic [and] welfare, social welfare, and cultural practices of the community and State.'

The OEQC guidelines (see App. A) identify several possible types of cultural practices and beliefs that are subject to assessment. These include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The guidelines also identify the types of potential cultural resources associated with cultural practices and beliefs that are subject to assessment. "The types of cultural resources subject to assessment may include traditional cultural properties [TCPs] or other types of historic sites, both man made and natural, including submerged cultural resources, which support such cultural practices and beliefs." (CIA Guidelines 1997:2).

For CIAs completed in the state of Hawai‘i, it is very important to gather information from *kūpuna* about cultural practices and beliefs. The *kūpuna* are the bearers of traditional and cultural knowledge of Hawaiian culture. While the *kūpuna* provide knowledge about traditional Hawaiian culture, members of the community most directly affected by project related changes often will include non-Hawaiians. The ethnic or cultural background of these individuals differs from their host (Hawaiian) culture and they too are likely to be affected. An assessment of cultural impacts in Hawai‘i, more often than not, will consider the affects of an undertaking on the culture(s) directly impacted. That being said, it is important to reiterate that the ethnic make-up of the community that surrounds the Kuakini Highway corridor is predominantly non-Hawaiian. The community that uses Kuakini Highway corridor however, includes many Hawaiians. Both groups, the latter who have direct ties to the traditional uses of these lands, and the former, who have come to call this part of Kailua-Kona home, are to be addressed by this study.

In brief, the information gathered shows that that:

1. There is concern for potential cultural impacts to historically significant cultural properties that are in and surround the general vicinity of the project area. The majority of these properties have been presented in archaeological studies done for the project area.
2. There were no traditional cultural practices/activities that were observed during the study period. However, some of the significant cultural properties are human burials that are tended to by the descendents. Most of these culturally significant properties (those evaluated as having "important historical cultural value to an ethnic group" because of Criterion E under Chapter 146 of the State Historic Preservation Division rules and regulations governing historic preservation) are also likely TCPs (Rasmussen 2006).

3. There are also some social and economic concerns with regards to the potential impacts of the proposed project but these are beyond the scope of the present study.

Because a CIA study addresses the ethnic (human) community within and around a specific project area, its findings are specific to that given setting. In Hawai‘i, many communities share similar histories, resources and perhaps ethnic make-up, but there are also differences that set these communities apart. The town of Kailua presents its own unique situation—much of it relating directly to its unique and lengthy history as an integral part of the Hawaiian Kingdom and Hawaiian culture. This has been presented in the previous section of this report. The remainder of this report addresses the results of the study, which are presented in accordance with the protocols established by the OEQC's guidelines for completing CIA studies in the State of Hawai‘i. These guidelines, though not consistently applicable to each situation (project), provide a means by which to organize and present the findings. The six OEQC protocols are as follows:

PROTOCOL 1: Identify and Consult with Individuals and Organizations with Expertise Concerning the Types of Cultural Resources, Practices and Beliefs Found within the Broad Geographical Area, e.g., District or Ahupua‘a

A major objective of this CIA study was to identify individuals and organizations that could help identify the cultural resources, practices and beliefs of the Kailua-Kona area. Particular effort was made to locate *kūpuna* who could share their knowledge about the past cultural uses of these lands; several of these *kūpuna* still live within the District of Kona. Along with *kūpuna*, several groups and organizations (see Appendix B) provided important information about the cultural history of the Kailua-Kona area.[9] Altogether, general information about the area came from the following:

1. *Kūpuna*
2. Former and present native Hawaiian residents of Kailua-Kona
3. The *kahu* for Kealakowaa Heiau and the *kahu* for Ahuena Heiau
4. Office of Hawaiian Affairs (OHA), West Hawaii
5. The Kona Historical Society

Several *kūpuna* shared their knowledge and experiences of living in Kailua or visiting Kailua in the early 1900s. Auntie Elizabeth Lee and Auntie Mildred Awong Arjona were particularly informative about the changes each witnessed in Kailua and Kona from the early to the mid 1900s. While their accounts are not included in the body of this report, the information shared by both women helped to develop a 'picture' of the changing Hawaiian culture that once thrived in Kona. Also, information from *kūpuna* Francis Keanaaina, who was interviewed by this author for an earlier oral history of the Kailua area, is cited in this report. Uncle Francis has spent his entire life in the Kailua area. He is a fifth generation of the Keanaaina family from the

[9] Appendix B is a list of people who provided information directly relevant to the project area; it does not include the names of individuals who provided incidental information towards the overall study.

Kailua area. According to Ruby McDonald, OHA's West Hawaii Office Community Liaison, who is the niece of Uncle Francis, her family comes from five *ahupua'a* in Kailua. These are 'Auhaukea'e, Kahului, Pua'a, Keōpū, and Lanihau; the current project area corridor crosses through the *makai* portion of the first three (see Fig. 2).

PROTOCOL 2: Identify and Consult with Individuals and Organizations with Knowledge of the Area Potentially Affected (APA)[10] by the Proposed Action

Appendix B provides a list of all individuals and organizations contacted and interviewed for this study. Along with *kūpuna* and individuals, listed are groups and their representatives that are within the immediate vicinity of the project area:

1. Current Residents of Kailua
2. Former residents (elders including *kūpuna*) of Kailua
3. Office of Hawaiian Affairs in Kona
4. Hawai'i County office in Kona
5. Residents and commercial land users along existing Kuakini Highway

While elders who make up 'former' residents of Kailua town significantly outnumber those who have remained in the town, there are several individuals who were witness to the initial construction of Kuakini Highway. Some of them recall the findings of burials, lava tubes/caves, etc. during the construction. (See discussion under Protocol 5 on ethnographic data gathered for this study that supports knowledge of burials, caves, etc.). One account comes from Ruby McDonald's uncle, John Keanaaina, who in 1954 was asked to enter an inadvertent cave find containing burials. A second account was provided by Helen Weeks to the Kona Outdoor Circle which included a map (Fig. 7) that her husband, John Weeks, had worked with while surveying the original corridor alignment for Kuakini Highway. (John Weeks was the resident engineer for the initial Kuakini Highway project.) In this account (H. Weeks n.d.), Mrs. Weeks notes that her husband discovered "Halehau- Kealakō wa'a" (Kealakōwa'a Heiau). The discovery led to Mr. Henry Kekahuna's drawing (c. 1955) of the "various platforms and dimensions", and subsequent realignment of the original surveyor's design.

[10] The Area Potentially Affected (APA) can be used interchangeably with 'Area of Potential Effect' (APE), which is defined in Section 106 of the National Historic Preservation Act, as amended, and relevant to federally based studies/projects.

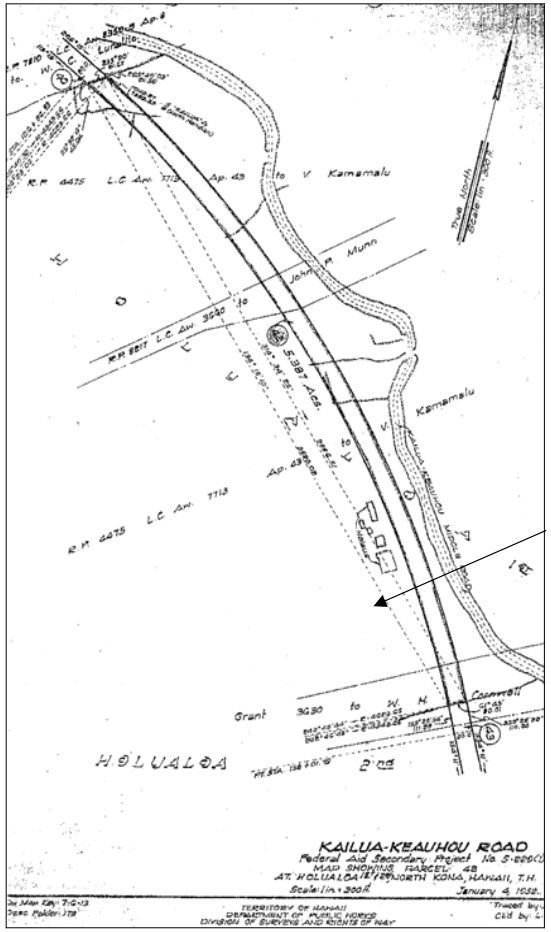

Figure 7. Map showing the Kailua-Keauhou Road and Surveyor's Right of Way Lines for the Proposed Kuakini Highway in 1952 (Map Courtesy of R. McDonald)**.**

PROTOCOL 3: Receive Information from or Conduct Ethnographic Interviews and Oral Histories with Persons Having Knowledge of the Potentially Affected Area

Information gathered from the ethnographic field studies came from the sources identified in Protocols 1 and 2. Both groups - those with knowledge about the cultural resources of the greater Kailua-Kona area and those who are in close proximity to the project area - provided useful information for addressing the potential cultural impacts of the proposed project. The content and interpretive results of these data differ in terms of their relevance to cultural (as opposed to social) impacts. Data directly pertinent to cultural issues are presented under Protocol 6.

PROTOCOL 4: Conduct Ethnographic, Historical, Anthropological, Sociological, and Other Culturally Related Documentary Research

Ethnographic research was the primary method for gathering data for this study. As is the nature of ethnographic studies, the information being gathered is both anthropological and sociological in nature. The Kailua-Kona area is a multicultural setting; there are some native Hawaiian families in the area but the town is more reflective of its urban, non-Hawaiian character.

In addition to ethnographic research, documentary research was conducted throughout the duration of this study. The information presented in the earlier portions of this report combines the results of both oral (ethnographic) and documentary (written) data that were gathered for this study. Neither the ethnographic study nor the documentary research is considered to be exhaustive.[11] It is however, considered to be appropriate for the needs of the current project. The town of Kailua has a very rich cultural history. To fully address this history would involve considerable time and effort.

PROTOCOL 5: Identify and Describe the Cultural Resources, Practices and Beliefs Located within the Potentially Affected Area

The identification of cultural resources, practices and beliefs associated with the project area comes primarily from oral/ethnographic sources; some of these have been referenced in previous sections of this report. Written documents, particularly the results of archaeological studies, also provide valuable information on the cultural resources found in and around the immediate vicinity of the project area. While modern day Kailua is fairly urban (and non-Hawaiian) in character, remnants of its traditional Hawaiian past remain; as do some of the resources and practices of its non-Hawaiian past. The individuals who provided information for this study were sought because of their knowledge of both Kailua's native Hawaiian and non-

[11] There are other *kūpuna* and lineal descendants of these [Kailua-Kona] lands who were not located by the present study. While efforts were made to locate all individuals whose names are known or were referred, there are many who have not yet been identified.

Hawaiian history. These included *kūpuna,* other elders of non-Hawaiian ancestry, and [present and former] area residents.

The remnants left behind by the native Hawaiians and other settlers of this land tell much about the cultural resources and associated land use practices of the area. A total of twenty-four archaeological features (three platforms, one C-shape, one occupation area, ten walls, one walled enclosure, four rock mounds, three modified outcrops, and one collapsed lava bubble) were identified within the immediate vicinity of the project area (Rasmussen 2006). According to Rasmussen (ibid), there are *kuaiwi* (agricultural walls), rock mounds, some features that may be a part of Site 6601 (the Kona Field System), and some possibly modified outcrops. Site 6302, Kuakini's Wall, is visible in several places along the road corridor. Site 7248, Laniakea Cave, likely lies under the existing Kuakini Highway at the northern most end of the project corridor. While the majority of these are native (or traditional) Hawaiian features, some appear to be features that were modified by the later non-Hawaiian settlers.

The non-Hawaiians who settled in Kona consist of two general groups: Christian missionaries, businessmen and farmers primarily of Caucasian ancestry; and the plantation laborers who were primarily of Japanese ancestry. The influence of the early Christians was profound; it redirected the course of native Hawaiian history. Historic properties such as churches, court houses, jails, schools, and structural remnants of commercial ventures indicate the influence and land use of the early non-Hawaiian settlers. And although not addressed in this study, there is a substantial history associated with the early plantation period of Kona. As with the Christians, the cultural practices and beliefs of the Japanese would [initially] differ dramatically from native Hawaiians.

Historic properties that represent the two groups of non-Hawaiian settlers in the vicinity of the project area mostly predate the existing Kuakini Highway. As with the native Hawaiians that once lived in the area, many of the non-Hawaiians moved away. It was during the initial construction of Kuakini Highway that some of the properties (remnants) belonging to these earlier settlers were discovered. While some properties were damaged or outright destroyed in the construction process, the number and type of discoveries made were quite significant; some of these have been mentioned above. Among the findings were human burials within and along the highway corridor. For the most part, the burials are believed to be associated with the native Hawaiian settlers of these lands.

In interviews completed for this study, questions relating to knowledge of burials and caves in the immediate vicinity of the project area were consistently asked. All *kūpuna* believe that undiscovered burials still exist but whether or not these are in the vicinity of the project area is uncertain. Every one of them also recalls visiting or being told childhood stories about the use of caves in the Kailua area. F. Keanaaina knows there are burials and caves throughout Kona, a few of which he has been able to [re]locate. According to R. McDonald, in 1954 her uncle John Keanaaina was asked to enter a cave (to give a blessing), which had been inadvertently found during the construction of Kuakini Highway. It is unclear as to which cave this event refers but, according to Ruby, her uncle found many burials inside the cave, some of which were wrapped

in *lauhala* mats. Ruby is uncertain if this is Laniakea Cave[12] but she does know that the cave her uncle entered is in the same general area. One of the main concerns Mr. Junior Kanuha, whose family once lived very close to the project area, expressed is the "need to take care of the *iwis*" during construction projects. Mr. Kanuha believes that there are likely to be burials found in the widening of the existing Kuakini Highway corridor. Mr. Curtis Tyler has echoed similar concerns and he is also a descendant of families who once lived in close proximity to the project area. There is general interest and concern over resources, particularly of unidentified burials that may exist in the area.

Associated with familial burials is the practice of caring for the ancestors of these Hawaiian families. A burial crypt (Fig. 8), which has the remains of twenty-one members of the Kapana family, lies a short distance west of the project area; it is still visited and cared for by the lineal descendants of those buried here. The burials in this crypt were moved to its current location by the lineal descendants. R. McDonald is one of the lineal descendants; the lands on which the crypt is situated once belonged to her relatives. A second burial mound lies in the sidewalk adjacent to the existing Kuakini Highway. It is positioned almost due east (towards the highway) from the crypt shown in Fig. 8 and has not been directly associated with a specific family. There are however, some possible lineal descendants. According to R. McDonald, the remains likely belong to a relative of Keōpūlani, and members of the Kanuha, Kapena and Tyler families may be among the possible lineal descendants. Auntie Josephine thought the burial may belong to a member of the Kamaka family. While a definite familial name or lineal descendant has not been identified, several descendants of lineal groups in the area developed a burial treatment plan which led to the building of the burial mound (cf. Inadvertent Discovery of Human Remains – various documents, 1998).

Figure 8. Burial Crypt of the Kapana Family.

As with burials, there is also knowledge about caves in the general vicinity of the project area; some of these are based on actual experiences of visits to the caves, while others are based on information learned from other family members. It is important to note that not all caves that are known are associated with burials. Likewise, it is equally important to note that the exact location of these caves is no longer known. According to R. McDonald, who resided in the family home in Kailua until 1972, her children frequently played inside Laniakea Cave. (Her family home was located next to the present day "Kona Marketplace", which is a short distance

[12] An entrance to Laniakea Cave is located in the same compound as the Thurston ruins (see pp. 7-8).

from the entrance and exit of Laniakea Cave.) Ruby recalls that her children would enter the cave near the Thurston residence (Fig. 5a), and come out near the shoreline exit (near Hale Hālāwai).[13]

Auntie Josephine Nahale Kamoku, who grew up in the "Kalākaua House" (her family home is in Kahalu'u Ahupua'a) recalls that her brother Joseph would frequently explore caves in the Kailua-Keauhou area. He would tell her about finding bones and other items inside these caves. She herself spent time visiting relatives at the Makuakane House (see Fig. 6), which was near the Wai'aha Bridge (near what is present day Kona Village). She has lived at the Duarte Apartments along Kuakini Highway for the past forty-five years. Although never having visited the caves nor seeing the burials which they contained, she believes that this general [project] area is likely to have more 'unknown' caves and burials. In an oral history prepared by Maly (1998), Aunty Luciana Ka'ailehua Makuakane-Tripp, whose ancestors lived in Kahului Ahupua'a, recalls being told by her father about a cave that was to be used in case of emergency. She herself had not visited or seen the cave that her father was referring to.

Along with caves and burials, there is also some concern about structural features such as *heiau*, house foundations, stone walls, and other indicators of previous native Hawaiian land use. However, most individuals, including the *kūpuna* are quick to point out that few 'active' cultural uses of the lands remain, and very few associations can be made between the use and ownership of the features and family lands. Most of these, though valuable for their historic significance, are not known about by the existing cultural community that surrounds it.

In the preceding section, traditional uses of the land and its cultural resources, and the beliefs associated with the project area have been presented. At present, at least one parcel of land may remain in use by the lineal descendants who inherited it. This would be the compound where the Duarte Apartments are located.[14] Based on visits made to the apartment complex and discussions with some of its residents, it does not appear that any 'traditional' Hawaiian land use practices (e.g. agricultural, ceremonial, etc.) are currently taking place. At least three of the residents are members of the Duarte-Nahale-Kamoku family, and some tenants are not related to any of these three original land owning families. In general, it appears that while the project area and its nearby environs have a notable cultural history connected with specific historic properties, there has also been a significant 'discontinuity' in the native Hawaiian or other culture-specific uses of these lands.

Although little has been said directly about the cultural beliefs of the area, the types or category of traditional features that remain reveal a great deal about the beliefs and practices of the early Hawaiians. For instance, there are numerous *heiau* in the Kailua-Kona area, ranging from *Luakini* (associated with human sacrifice and royal rituals) to smaller *ko'a* type *heiau*

[13] The original Hale Hālāwai was built in 1855 as a meeting house for Hawaiian Christians; it was abandoned in the early 1920s and rebuilt at a later time. The seashore exit of Laniakea Cave, shown by Ruby, is behind the present Hale Hālāwai structure/compound.

[14] Auntie Josephine is a *kūpuna* of this family. The land belonged to her great-grandfather, Joseph K. Nahale, who acquired it while serving as an assistant to King Kalaukaua. He gave some of his land to his brother.

associated with fishing or agricultural crops. Some of these structures such as Kealakōwa‘a Heiau (Fig. 7) remain fairly intact, while others such as Site 6322 remain only in remnant form.

Based on information gathered from interviews, field observations and written sources, the following conclusions can be made about cultural resources, practices and beliefs in the immediate vicinity of the project area:

1. Cultural resources in the project area are associated primarily with its past residential and agricultural uses. Burials, most of which are known only from construction related activities, and various structural remnants (walls, *heiau*, etc.) are the two main categories of resources found. While archaeological studies have identified most of the structural remnants along this portion of Kuakini Highway, it is possible that more burials will be encountered during future construction (ground disturbance) activities. (Most of the burials do not have obvious markers and many of the descendants of the families who once lived here are long gone.)

2. Native Hawaiian cultural practices associated with caring for the ancestors (burials) are known from the general vicinity of the project area. No other cultural practices were observed or learned of during the period of this study.

3. Cultural beliefs associated with the traditional uses of the area still exist, and these are almost exclusively associated with the various *heiau* in the area (e.g. Kealakōwa‘a is the only surviving canoe making *heiau*; ‘Ahu‘ena Heiau represents Kamehameha’s early rule at Kamakahonu, etc.).

4. No natural features of cultural significance/belief were identified. However, Laniakea cave and similar lava tube/caves in the area are known to be associated with cultural events in the past.

PROTOCOL 6: Assess the Impact of the Proposed Action, Alternatives to the Proposed Action, and Mitigation Measures on the Cultural Resources, Practices and Beliefs Identified

The cultural impacts identified for the proposed Kuakini Highway expansion project presented in this section are primarily based on the information gathered from ethnographic interviews. These are potential impacts that are likely to occur as a result of changes brought about by expansion of Kuakini Highway. In general, it appears that any potential cultural impact will be long-term or permanent. There will be very few short-term impacts, and of these, changes such as those that result from construction-related activities are likely to be social and economic in nature.

Associated with cultural impacts is the issue of access to resources. It does not appear that access to areas [resources] on either side of the highway will be compromised or change from its present situation. The resources identified - historical (structural) features that are likely Traditional Cultural Properties (TCP)[15] – are found on both sides of the existing highway. Many of these are located within close proximity to the proposed highway expansion corridor. Of these, Site 5608 which consists of a total of seventy-five features (Rasmussen 2006) is the most extensive and is within an undeveloped parcel of land. Site 5608 is located across from Coconut Grove Marketplace in the *ahupua‘a* of ‘Auhaukea‘ē on the *mauka* side of Kuakini Highway. Visits to the site were made with *kūpuna* and others in order to learn more about the features and their surroundings.

Kūpuna Sonny Pa‘alua, who spent his early childhood years growing up on lands adjacent to present day Hilo Hattie’s in Kailua, was not familiar with the site. The coral stones found at Features BBB, CCC, and DDD led Uncle Sonny to believe these features constitute an *ahu*, and that it most likely belonged to a common family and not an *ali‘i*. He knew that these *ahu* were located near habitation or village areas and believes these features would likely have been connected to a house site by a pathway. Auntie Josephine also was not familiar with any of the features associated with Site 5608. Although fairly close to her present residence, she was unaware that these features existed until our discussion. R. McDonald, whose family is directly associated with ‘Auhaukea‘ē Ahupua‘a, knew that features similar to those found at Site 5608 are found throughout the Kailua area. (This was her first visit to Features BBB, CCC and DDD at Site 5608.) These may well have belonged to her ancestors or one of the other Hawaiian families who once lived in ‘Auhaukea‘ē Ahupua‘a.

Of the historic properties identified in the general vicinity of the project area, one feature could be impacted due to its proximity.[16] This is the modern burial mound that is situated within the sidewalk adjacent to the existing highway, near Coconut Grove Marketplace. During the interviews completed for this CIA, attempts were made to associate the burial mound[17] with a family name of its lineal descendants. Names of several families who are currently known to be from or once have lived in the area include the Tyler, Kanuha, and possibly Kapena and Kamaka families (see earlier discussion under Protocol 5). At this time, it is not possible to determine whether or not these remains can be associated with any of these families. However, any ‘reburial’ concerns and/or potential disturbance to the existing feature will need to be addressed by the State Historic Preservation Division (SHPD). All of the families mentioned here should be contacted according to the guidelines that led to creating the Burial Treatment Plan originally developed for this burial. Attempts should be made to identify other families that might have a connection to the burial mound.

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[15] Briefly, a TCP is a historic property that is eligible for the nomination to the National Register of Historic Places (NRHP) because of its association with the cultural practices and beliefs of a living community.

[16] According to Parsons Brinckerhoff Quade and Douglas Inc., the burial mound feature will not be disturbed by project-related construction activities.

[17] Based on information from the SHPD office in Kona, the mound does not contain an actual burial but rather covers the fragments of some human bones that likely belong to one individual. A review of the Burial Treatment Plan design needs to be made in order to determine if the mound is situated directly over the actual fragments of the bone or if it is within close proximity to it.

There are no other known cultural practices, native Hawaiian or otherwise, that are occurring within the immediate vicinity of the project area.

POTENTIAL CULTURAL IMPACTS: A SUMMARY

1. *Known Burial Mound Feature on Kuakini Highway.*

Discussion about the burial mound on Kuakini Highway has already been presented. It is located within the project study area. If adverse impacts to the burial are anticipated, then a decision to relocate or to leave the remains *in situ* will need to be made by the possible lineal descendants and the Hawai‘i Island Burial Council.

Recommendation: A review should be made of the Burial Treatment Plan (BTP) designed for this feature. If the project will affect the burial or mound feature, the lineal descendants (identified in the BTP) should be consulted for advice on the final disposition of the burial.

2. *Inadvertent Burial Finds during Construction-related Activities.*

The traditional cultural landscape through which the project area passes, though significantly altered from its original pre-Kuakini Highway stage, is known to have had extensive settlement and use by native Hawaiians. There are individuals who are *kupa* to this land and can tell about their individual (and family) histories. Very few, however, appear to know if there are any burials on their family lands, or what the disposition of these might be. Because the land was extensively settled and used by native Hawaiians, and because there is little knowledge about the exact location of most family burials, it is possible that burials do exist in the vicinity of the proposed highway corridor. It is also possible that burials will be encountered during construction.

Recommendation: In the event that a burial is found during construction the police, the medical examiner, and either the Hawai‘i office or the State office of the State Historic Preservation Division (SHPD) must be notified immediately. If the burial is more than 50 years old, then SHPD will be responsible for determining the proper disposition of the remains. Following consultation with appropriate parties, if the SHPD determines that removal of the remains is warranted, than the agency overseeing the road widening project will be responsible for developing a mitigation plan prior to removal of the remains. For purposes of consultation, the present document can assist the SHPD in attempts to identify family names and locate possible descendants who once lived in the area.

3. Known (existing) Historic Cultural Resources

There are various historic features in the general vicinity of the project area. Whether or not these feature may be affected by construction activities of this project is addressed in the companion archaeology report (Rasmussen 2006). The archaeology report includes significance criteria of these features based on NRHP guidelines, and recommendations for treatment. It should be noted, however, that none of these features have been identified (linked) to a specific family or former resident of the land by this CIA study.

Recommendation: Follow the mitigation and preservation recommendations made in the archaeological inventory survey report for the current project (Rasmussen 2006).

CONCLUSIONS

The proposed Kuakini Highway Improvements Project consists of widening the existing roadway for approximately 6,000 feet. The existing highway is situated in an urban area, surrounded on either side by residential and commercial properties. Only one portion of the existing highway and proposed corridor borders on lands still used by native Hawaiian families. This is the parcel known as the Duarte Apartments, and is located on the *mauka* side of the road at the furthest southern end of the project area. Some of the families presently living in the Duarte Apartments are descendants of Joseph K. Nahale who owned this land in the late 1800s.

The one known potential impact to a cultural property within the Area of Potential Effect would be to the existing burial/mound that is situated on the sidewalk of Kuakini Highway. Other potential cultural impacts identified include inadvertent burial finds that are made during construction activities, and damage to historic cultural resources in the project area corridor. If any burials are present within the project area, they will only be found once construction efforts are underway. No identification of burial graves or plots was made during this study. There is no specific knowledge that burials are in the project area. However, based on previous burial finds in the general vicinity of Kuakini Highway, and extensive settlement in the area by native Hawaiians in the past, it is possible that burials may be encountered. The proper treatment of burials (or skeletal remains in general) should be conducted if these finds are made. In the event that a burial is found, the State Historic Preservation Division will need to be notified, and, if the burial is more than 50 years old, the Division will make the decision regarding treatment of the burial. If lineal descendants of the burial find can be located, they should be consulted regarding the decision on final disposition of the remains.

There may also be potential cultural impacts to the known historic (archaeological) resources in the area. The archaeological report completed for the Kuakini Highway Improvements Project includes recommendations for treatment of these historic properties.

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APPENDIX A

GUIDELINES FOR ASSESSING CULTURAL IMPACTS
ADOPTED BY THE ENVIRONMENTAL COUNCIL, STATE OF HAWAI'I
NOVEMBER 19, 1997

I. INTRODUCTION

It is the policy of the State of Hawaii under Chapter 343, HRS, to alert decision makers, through the environmental assessment process, about significant environmental effects which may result from the implementation of certain actions. An environmental assessment of cultural impacts gathers information about cultural practices and cultural features that may be affected by actions subject to Chapter 343, and promotes responsible decision making. Articles IX and XII of the State Constitution, other state laws, and the courts of the state require government agencies to promote and preserve cultural beliefs, practices, and resources of Native Hawaiians and other ethnic groups. Chapter 343 also requires environmental assessment of cultural resources, in determining the significance of a proposed project.

The Environmental Council encourages preparers of environmental assessments and environmental impact statements to analyze the impact of a proposed action on cultural practices and features associated with the project area. The Council provides the following methodology and content protocol as guidance for any assessment of a project that may significantly affect cultural resources.

II. CULTURAL IMPACT ASSESSMENT METHODOLOGY

Cultural impacts differ from other types of impacts assessed in environmental assessments or environmental impact statements. A cultural impact assessment includes information relating to the practices and beliefs of a particular cultural or ethnic group or groups.

Such information may be obtained through scoping, community meetings, ethnographic interviews and oral histories. Information provided by knowledgeable informants, including traditional cultural practitioners, can be applied to the analysis of cultural impacts in conjunction with information concerning cultural practices and features obtained through consultation and from documentary research.

In scoping the cultural portion of an environmental assessment, the geographical extent of the inquiry should, in most instances, be greater than the area over which the proposed action will take place. This is to ensure that cultural practices which may not occur within the boundaries of the project area, but which may nonetheless be affected, are included in the assessment. Thus, for example, a proposed action that may not physically alter gathering practices, but may affect access to gathering areas would be included in the assessment. An ahupua'a is usually the appropriate geographical unit to begin an assessment of cultural impacts of a proposed action, particularly if it includes all of the types of cultural practices associated with the project area. In some cases, cultural practices are likely to extend
beyond the ahupua'a and the geographical extent of the study area should take into account those cultural practices.

The historical period studied in a cultural impact assessment should commence with the initial presence in the area of the particular group whose cultural practices and features are being assessed. The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs.

The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man made and natural, including submerged cultural resources, which support such cultural practices and beliefs.

The Environmental Council recommends that preparers of assessments analyzing cultural impacts adopt the following protocol:

(1) identify and consult with individuals and organizations with expertise concerning the types of cultural resources, practices and beliefs found within the broad geographical area, e.g., district or ahupua 'a;

(2) identify and consult with individuals and organizations with knowledge of the area potentially affected by the proposed action;

(3) receive information from or conduct ethnographic interviews and oral histories with persons having knowledge of the potentially affected area;

(4) conduct ethnographic, historical, anthropological, sociological, and other culturally related documentary research;

(5) identify and describe the cultural resources, practices and beliefs located within the potentially affected area; and

(6) assess the impact of the proposed action, alternatives to the proposed action, and mitigation measures, on the cultural resources, practices and beliefs identified.

Interviews and oral histories with knowledgeable individuals may be recorded, if consent is given, and field visits by preparers accompanied by informants are encouraged. Persons interviewed should be afforded an opportunity to review the record of the interview, and consent to publish the record should be obtained whenever possible. For example, the precise location of human burials are likely to be withheld from a cultural impact assessment, but it is important that the document identify the impact a project would have on the burials. At times an informant may provide information only on the condition that it remain in confidence. The wishes of the informant should be respected.

Primary source materials reviewed and analyzed may include, as appropriate: Mahele, land court, census and tax records, including testimonies; vital statistics records; family histories and genealogies; previously published or recorded ethnographic interviews and oral histories; community studies, old maps and photographs; and other archival documents, including correspondence, newspaper or almanac articles, and visitor journals. Secondary source materials such as historical, sociological, and anthropological texts, manuscripts, and similar materials, published and unpublished, should also be consulted. Other materials which should be examined include prior land use proposals, decisions, and rulings which pertain to

the study area.

III. CULTURAL IMP ACT ASSESSMENT CONTENTS

In addition to the content requirements for environmental assessments and environmental impact statements, which are set out in HAR §§ 11-200-10 and 16 through 18, the portion of the assessment concerning cultural impacts should address, but not necessarily be limited to, the following matters:

1. A discussion of the methods applied and results of consultation with individuals and organizations identified by the preparer as being familiar with cultural practices and features associated with the project area, including any constraints or limitations which might have affected the quality of the information obtained.

2. A description of methods adopted by the preparer to identify, locate, and select the persons interviewed, including a discussion of the level of effort undertaken.

3. Ethnographic and oral history interview procedures, including the circumstances under which the interviews were conducted, and any constraints or limitations which might have affected the quality of the information obtained.

4. Biographical information concerning the individuals and organizations consulted, their particular expertise, and their historical and genealogical relationship to the project area, as well as information concerning the persons submitting information or interviewed, their particular knowledge and cultural expertise, if any, and their historical and genealogical relationship to the project area.

5. A discussion concerning historical and cultural source materials consulted, the institutions and repositories searched, and the level of effort undertaken. This discussion should include, if appropriate, the particular perspective of the authors, any opposing views, and any other relevant constraints, limitations or biases.

6. A discussion concerning the cultural resources, practices and beliefs identified, and, for resources and practices, their location within the broad geographical area in which the proposed action is located, as well as their direct or indirect significance or connection to the project site.

7. A discussion concerning the nature of the cultural practices and beliefs, and the significance of the cultural resources within the project area, affected directly or indirectly by the proposed project.

8. An explanation of confidential information that has been withheld from public disclosure in the assessment.

9. A discussion concerning any conflicting information in regard to identified cultural resources, practices and beliefs.

10. An analysis of the potential effect of any proposed physical alteration on cultural resources, practices or beliefs; the potential of the proposed action to isolate cultural resources, practices or beliefs from their setting; and the potential of the proposed action to introduce elements which may alter the setting in which cultural practices take place.

11. A bibliography of references, and attached records of interviews which were allowed to be disclosed.

The inclusion of this information will help make environmental assessments and environmental impact statements complete and meet the requirements of Chapter 343, HRS. If you have any questions, please call us at 586-4185.

APPENDIX B

KŪPUNA AND OTHERS CONSULTED FOR INFORMATION ABOUT TRADITIONAL BELIEFS AND LAND USES IN THE PROJECT AREA

Kūpuna Annie Arakaki Navas
Kūpuna Elizabeth Lee
Kūpuna Francis Keanaaina
Kūpuna Gabriel Makuakane
Kūpuna Josephine Kamoku
Kūpuna Mildred Awong Arjona
Kūpuna Sonny Pa`alua

Alfreda (Kimura) Fujita
Arlyn Gusman
Arthur Keka
Cheryl Iona
Chris Nazarra
Curtis Tyler
Gene Reiser
Herman Kunewa
Iwalai Arakaki
Jo-Anne Kahanamoku-Sterling
Junior Kanuha
Kala`a Willis
Kale Nahale
Kelly Greenwell
Keone Atkinson
Mikahala Roy
Pete Hendricks
Rene (Kimura) Fujita
Ruby McDonald
Sandy Auhoi
Willie Kahulamu