Draft Environmental Assessment

PI`ILANI HIGHWAY WIDENING PROJECT (KILOHANA DRIVE TO WAILEA IKE DRIVE)

Prepared for:

Honua`ula Partners, LLC,
A&B Wailea LLC,
Keaka LLC, and ATC Makena Holdings LLC

Accepting Authority:

State of Hawaii ,
Department of Transportation

October 2010

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Executive Summary

Project Name:		Pi`ilani Highway Widening Project (Kilohana Drive to Wailea Ike Drive)
Type of Document:		Draft Environmental Assessment
Legal Authority:		Chapter 343, Revised Statutes
Agency Determination:		Anticipated Finding of No Significant Impact (FONSI)
Applicable Environmental Assessment review "trigger"		Use of State and County Lands
Location:		Kihei Island of Maui
Landowners:		State of Hawaii County of Maui
Applicants:	(1)	Honua`ula Partners, LLC P.O. Box 220 Kihei, 96753 Contact: Charles Jencks Phone: (808) 879-5205
	(2)	A&B Wailea LLC 11 Pu`unene Avenue Kahului, 96732 Contact: Randy Endo Phone: (808) 877-5523
	(3)	Keaka LLC 2005 East Main Street Wailuku, 96793 Contact: Don Fujimoto Phone: (808) 244-1500

(4) ATC Makena Holdings LLC
c/o Stanford Carr Development, LLC
1100 Alakea Street, 27th Floor
Honolulu, Hawaii 96813
Contact: Rebecca Broudy Collins
Phone: (808) 537-5220

Accepting Authority:

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Contact: Michael Formby, Interim Director
Phone: (808) 587-2150

EA Preparer:

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Project Summary:

Honua`ula Partners, LLC, A&B Wailea LLC, Keaka LLC, and ATC Makena Holdings LLC, in coordination with the State of Hawaii , Department of Transportation, Highways Division proposes to implement the construction of two (2) additional lanes and related improvements to Pi`ilani Highway from approximately 1,000 ft. to beginning of taper north of Kilohana Drive to Wailea Ike Drive at Pi`ilani Highway's existing terminus. Proposed improvements include excavation and embankment work, widening of the road with asphaltic concrete pavement, construction of concrete curb, gutters, sidewalks, drainage systems, storm water retention systems, retaining walls, sound attenuation walls, relocation of electrical transmission lines, guard rails, installation of utilities as may be necessary, and adjustments to existing utilities, including as may be necessary the relocation of existing waterlines. Reconstruction of the existing traffic signal at the Kilohana Drive/Mapu Place/Pi`ilani Highway intersection and installation of new traffic signals at Okolani Drive/Mikioi Place/Pi`ilani Highway intersection, and Wailea Ike Drive/Pi`ilani Highway/proposed Honua`ula project access road intersection are also proposed.

I. PROJECT OVERVIEW

I. PROJECT OVERVIEW

A. BACKGROUND

The applicants for the proposed widening of Pi`ilani Highway, from Kilohana Drive to Wailea Ike Drive, include the following four (4) entities:

1. Honua`ula Partners, LLC
2. A&B Wailea LLC ("Wailea Resort")
3. Keaka LLC
4. ATC Makena Holdings LLC ("Makena Resort")

These companies, collectively, are collaborating with the State Department of Transportation (SDOT) to design and construct the project in order to address traffic mitigation needs of the Wailea-Makena region of South Maui. Both Honua`ula, LLC and ATC Makena Holdings LLC are engaged in the project in furtherance of conditions of zoning imposed on the Honua`ula and Makena Resort projects. Conditions of zoning pertinent to the Honua`ula project are identified as Condition Nos. 2a, 2c, 2d and 2f, all of which are restated below.

a. *Upgrade Piilani Highway, from Kilohana Drive to Wailea Ike Drive, to four (4) lanes of traffic. The improvements shall be completed prior to the commencement of any construction on the site, with the exception of grading.*

c. *Signalize the Piilani Highway/Okolani Drive/Mikioi Place intersection and provide an exclusive left-turn lane on Okolani Drive prior to occupancy of the first unit in Kihei-Makena Project District 9.*

d. *Modify the Piilani Highway/Wailea Ike Drive intersection into a signalized intersection and provide a free right-turn lane from Piilani Highway to Wailea Ike Drive and a second right-turn lane from Wailea Ike Drive to northbound Piilani Highway prior to occupancy of the first unit in Kihei-Makena Project District 9.*

f. *Modify the Piilani Highway/Kilohana Drive/Mapu Place intersection to provide an exclusive left-turn lane, and the southbound Piilani Highway approach to provide an exclusive right-turn lane into Mapu Place prior to occupancy of the first unit in Kihei-Makena Project District 9.*

With regard to Honua LLC's change in zoning, Condition No. 12 applies, which states:

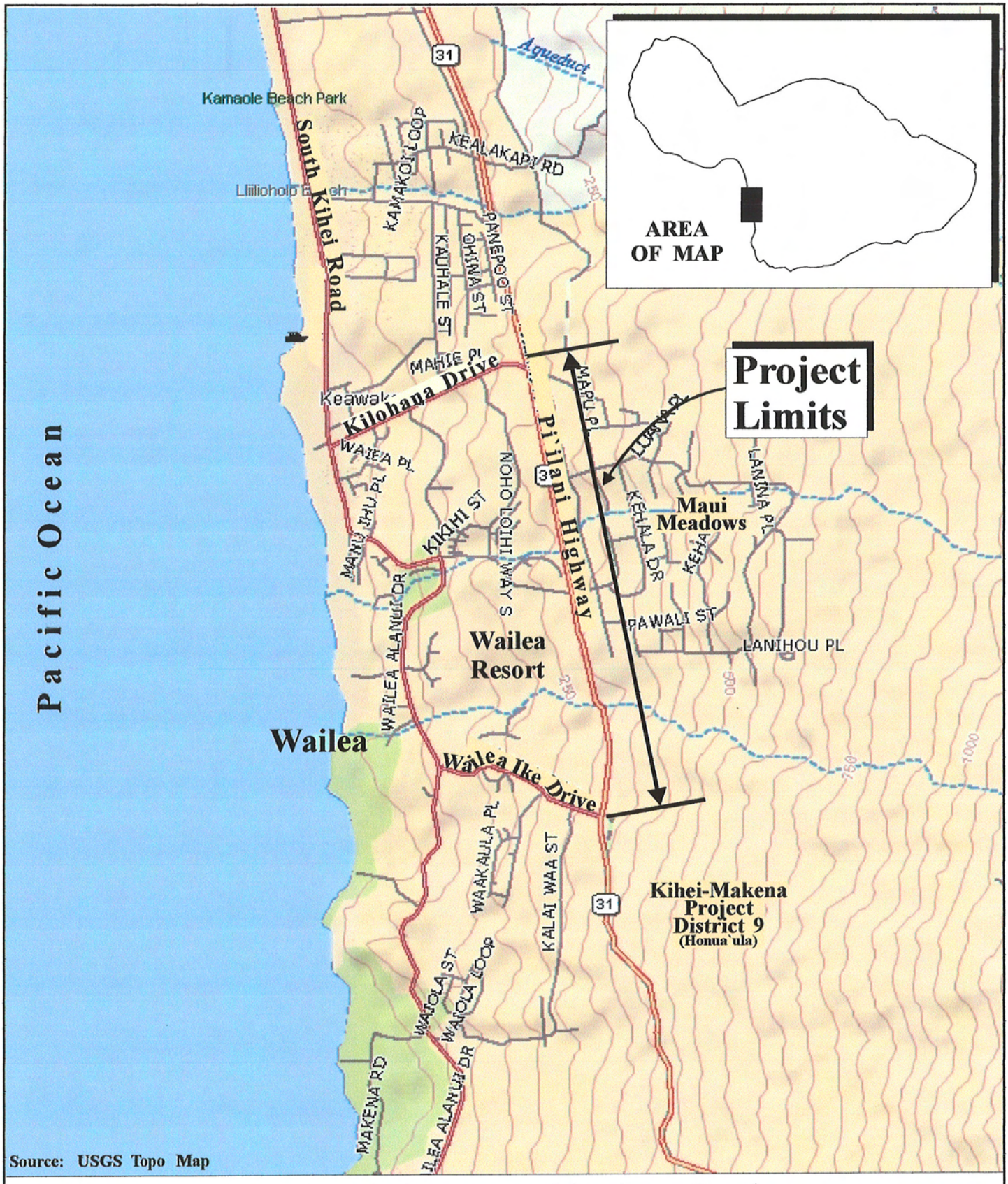
12. *Upon commencement of the first phase of construction, the developer shall pay its pro-rata share to upgrade Pi`ilani Highway from Kilohana Drive to Wailea Ike Drive to four lanes of traffic, and shall cooperate with the State Department of Transportation and other area developers to implement such improvements concurrent with development.*

All four (4) entities are working collaboratively to not only meet the applicable conditions of zoning, but to enable regional traffic conditions to be maintained at acceptable operating levels for residents, employees and guests to this sub-region of South Maui.

B. PROPERTY LOCATION, EXISTING USE, AND LAND OWNERSHIP

Honua`ula Partners, LLC, A&B Wailea LLC, Keaka LLC, and ATC Makena Holdings LLC, in coordination with the State of Hawaii , Department of Transportation, Highways Division (SDOT) propose to implement the construction of two (2) additional lanes and related improvements to a 1.44-mile section of the Pi`ilani Highway approximately 1,000 ft. north of Kilohana Drive to Wailea Ike Drive, in the south, on the island of Maui. See **Figure 1** and **Figure 2**.

Pi`ilani Highway (Route 31) is a four (4) lane principal arterial roadway from Mokulele Highway to Kilohana Drive in Wailea. The highway reduces to two (2) lanes from its intersection with Kilohana Drive to its existing terminus at Wailea Ike Drive. The highway right-of-way along the project corridor ranges from 110 feet to 250 feet. Pi`ilani Highway runs in a north-south direction, with travel lanes separated by a double yellow striped pavement marking. The highway also contains a shared shoulder/bike lane on each side of the roadway, except near the intersections. Pi`ilani Highway provides access to residential and resort areas of Kihei, Wailea and Makena. The posted speed limit is generally 40 miles per hour (mph). The speed limit on Pi`ilani Highway is 45 mph in the northbound direction from Wailea Ike Drive to Kilohana Drive; the southbound speed limit on this segment decreases from 45 mph to 25 mph as it approaches Wailea Ike Drive. There are three (3)



Source: USGS Topo Map

Figure 1 Pi`ilani Highway Widening Project

NOT TO SCALE

Regional Location Map

Prepared for: Honua`ula Partners, LLC, A&B Wailea LLC, Keaka LLC and ATC Makena Holdings LLC

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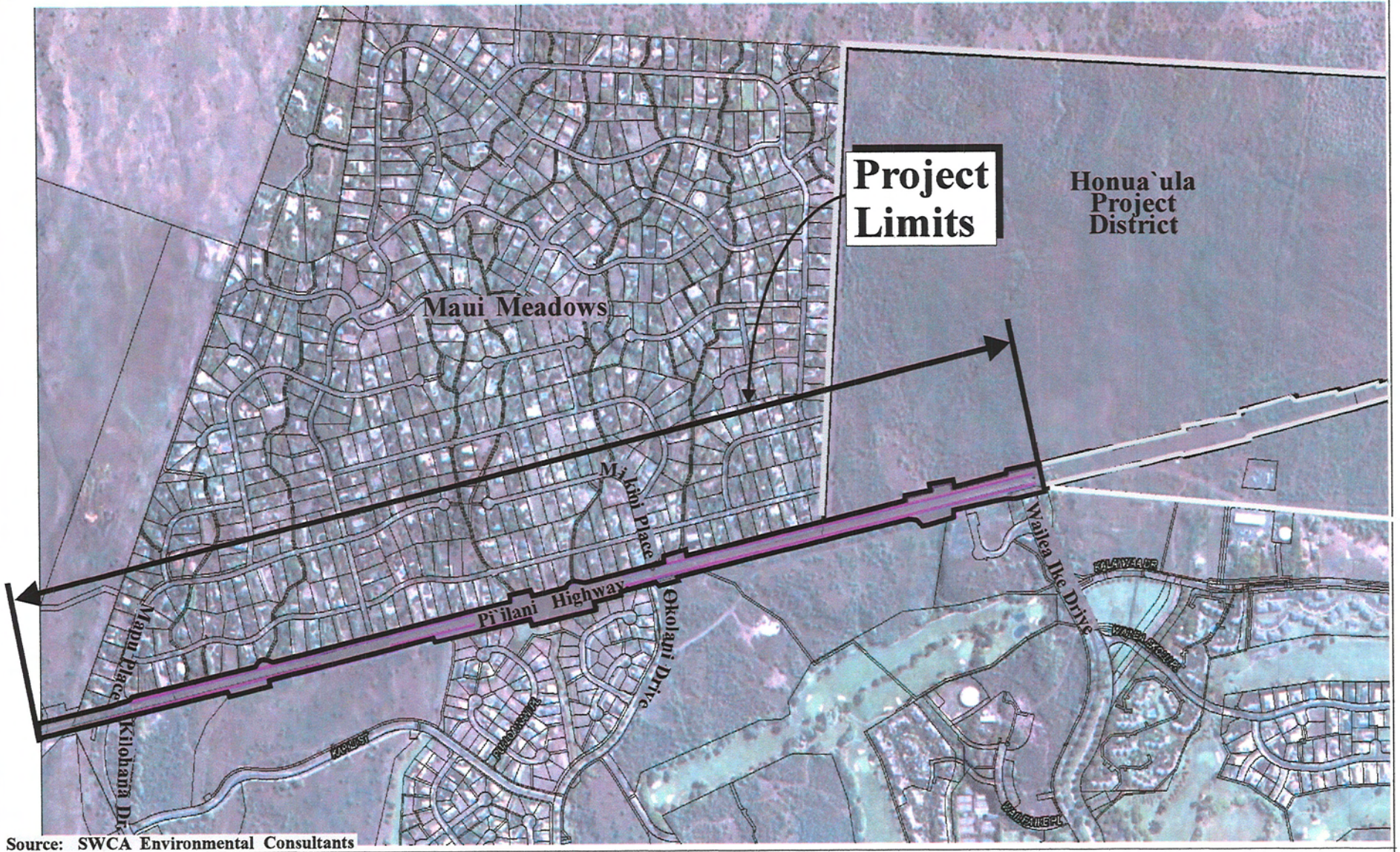

Source: SWCA Environmental Consultants

Figure 2

Pi`ilani Highway Widening Project

Project Limits

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Prepared for: Honua`ula Partners, LLC, A&B Wailea LLC, Keaka LLC and ATC Makena Holdings LLC

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intersections along the proposed project improvement corridor consisting of the Kilohana Drive/Mapu Place/Pi`ilani Highway intersection, Okolani Drive/Mikioi Place/Pi`ilani Highway intersection and Wailea Ike Drive/Pi`ilani Highway intersection. The intersection at Kilohana Drive/Mapu Place/Pi`ilani Highway is signalized.

Within the 1.44-mile project corridor, Pi`ilani Highway traverses lands which are bordered primarily by single-family residences, condominiums, apartment complexes, commercial and retail businesses, public utilities, recreational uses, and agricultural lands.

Proposed improvements to Pi`ilani Highway along this corridor will be conducted essentially within the roadway's existing right-of-way (ROW) except for ancillary improvements north of Kilohana Drive and at Wailea Ike Drive, which will occur on lands owned by the County of Maui and at Okolani Street, where a portion of the improvements are on private property. (As used in this document, "corridor" or "project corridor" shall be defined as the existing Pi`ilani Highway right-of-way and as noted on portions of land owned by the County of Maui and by private property owners on Okolani Street from approximately 1,000 ft. north of Kilohana Drive to Wailea Ike Drive.) A portion of the intersection improvements will be located within the right-of-way of the secondary streets.

Pi`ilani Highway and a portion of Kilohana Drive are owned and maintained by the State of Hawaii . Mapu Place, Okolani Drive, Mikioi Place, and Wailea Ike Drive intersecting Pi`ilani Highway, fall under the ownership of the County of Maui.

C. PROPOSED ACTION

1. Project Purpose and Need

The segment of Pi`ilani Highway that is proposed to be improved begins approximately 1,000 ft. to beginning of taper north of Kilohana Drive and terminates in the south at the intersection of Pi`ilani Highway and Wailea Ike Drive, a distance of approximately 1.44 miles. Within this segment of highway, the roadway right-of-way varies from 110 feet to 250 feet. There are three (3) intersections within this segment of Pi`ilani Highway consisting of the Kilohana Drive/Mapu Place/Pi`ilani Highway intersection, Okolani Drive/Mikioi Place/Pi`ilani Highway intersection, and Wailea Ike Drive/Pi`ilani Highway intersection. Only Kilohana Drive is controlled by a traffic signal.

The Pi`ilani Highway is a key component of the regional transportation system and serves two (2) transportation functions. Primarily, it is an arterial roadway for the communities of Kihei, Wailea and Makena providing the main north-south transportation corridor to Central and West Maui. The Pi`ilani Highway is also used increasingly as an intra-community transportation circulator in certain areas, serving short distance trips of less than one (1) mile for the residents of Kihei, Wailea and Makena.

The need to upgrade the Pi`ilani Highway from two (2) lanes to four (4) lanes has been identified in the following studies:

a. **County of Maui Long-Range Land Transportation Plan**, Final Report, February 1997, published cooperatively by the SDOT, the Maui County Department of Public Works and Waste Management (DPWWM) and the Maui County Department of Planning.

   The Maui Long-Range Land Transportation Plan recommended island-wide highway improvements which include improvement No. S6 for Piilani Highway from Mokulele Highway to Wailea and that it be "widen from two to four lanes".

b. **Kihei Traffic Master Plan**, October 1996, published cooperatively by the SDOT, the County of Maui, DPWWM and the County of Maui, Department of Planning.

   The Kihei Master Plan included a list of long-range improvements proposed for Kihei. Recommended improvement No. 2 states "Widening of Piilani Highway from two to four lanes from Mokulele Highway to south of Kilohana Drive."

c. **Kihei-Makena Community Plan (1998)**, County of Maui Ordinance No. 2641, Bill No. 5 (1998).

   The Kihei-Makena Community Plan Transportation Objectives and Policies state that "Undertake transportation system improvements concurrently with planned growth of the Kihei-Makena region. Require adequate interregional highway capacity; including the widening of Pi'ilani and Mokulele Highways to four lanes, prior to the construction of major projects south of Kilohana Road or mauka of Pi'ilani Highway."

d. **Traffic Study, Wailea 670 Development**, May 2001, and Revised Update Traffic Study for the Honua'ula Development dated June 2005, Parsons Brinckerhoff Quade & Douglas for 670 Wailea Associates, LLC (owners of Wailea 670 property now known as Honua`ula and owned by Honua`ula Partners, LLC).

The traffic studies for Honua'ula identified future improvements to Pi`ilani Highway that would include upgrading the facility to full-standard four-lane configuration and extending the four-lane cross-section to Wailea Ike Drive.

e. **Kihei Traffic Master Plan Study**, September 2003, Parsons Brinckerhoff Quade & Douglas for the County of Maui, DPWWM.

The Kihei Traffic Master Plan Study recommended that the Maximum Pi`ilani Highway Corridor alternative be adopted. In order to achieve this alternative, Pi`ilani Highway in the interim would be widened from two (2) to four (4) lanes. Ultimately Pi`ilani Highway would be widened to six (6) lanes or an alternative parallel roadway would be constructed mauka of Pi`ilani Highway.

f. **Traffic Impact Analysis Report, Wailea Resort, Revised Master Plan-2005**, May 2005, Austin, Tsutsumi & Associates, Inc. for A&B Wailea LLC.

The Wailea Resort Traffic Impact Analysis Report recommended the following widening improvements to Pi`ilani Highway:

- "Widen Piilani Highway to four (4) lanes, two (2) lanes in each direction, from Kilohana Drive to beyond Okolani Drive by Year 2007.

- "Widen Piilani Highway to four (4) lanes, two (2) lanes in each direction, from beyond Okolani Drive to Wailea Ike Drive such that the entire section of Piilani Highway between Kilohana Drive and Wailea Ike Drive is four lanes by Year 2012."

g. **Makena Resort Master Plan Traffic Study**, July 2007, Phillip Rowell and Associates for R. M. Towill Corporation.

The Makena Resort Master Plan Traffic Study assumed by the Year 2017 traffic improvements recommended for the Wailea Resort and Wailea 670

would be in place, such as "Piilani Highway between Kilohana Drive and Wailea Ike Drive has been widened from two to four lanes" and that this widening would be in place by 2012."

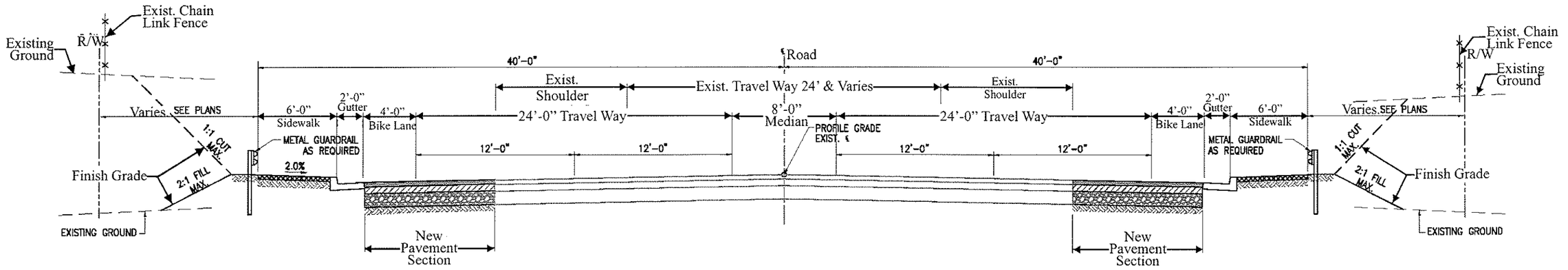
2. Proposed Improvements

The proposed project will widen Pi`ilani Highway from a two-lane highway to a four-lane highway from approximately 1,000 ft. north of Kilohana Drive/Mapu Place up to its existing terminus at Wailea Ike Drive. Proposed improvements include excavation and embankment work, widening of the road with asphaltic concrete pavement, construction of concrete curb, gutters, sidewalks, drainage systems, storm water retention systems, retaining walls, sound attenuation walls, relocation of electrical transmission lines, guard rails, installation of utilities as may be necessary, and adjustments to existing utilities, including as may be necessary the relocation of existing waterlines. Reconstruction of the existing traffic signal at the Kilohana Drive/Mapu Place/Pi`ilani Highway intersection and installation of new traffic signals at Okolani Drive/Mikioi Place/Pi`ilani Highway intersection, as part of the Special Management Area Permit issued to the Kai Malu project in Wailea Resort, and when warranted at Wailea Ike Drive/Pi`ilani Highway/proposed Honua`ula project access road intersection are also proposed. See **Figure 3**.

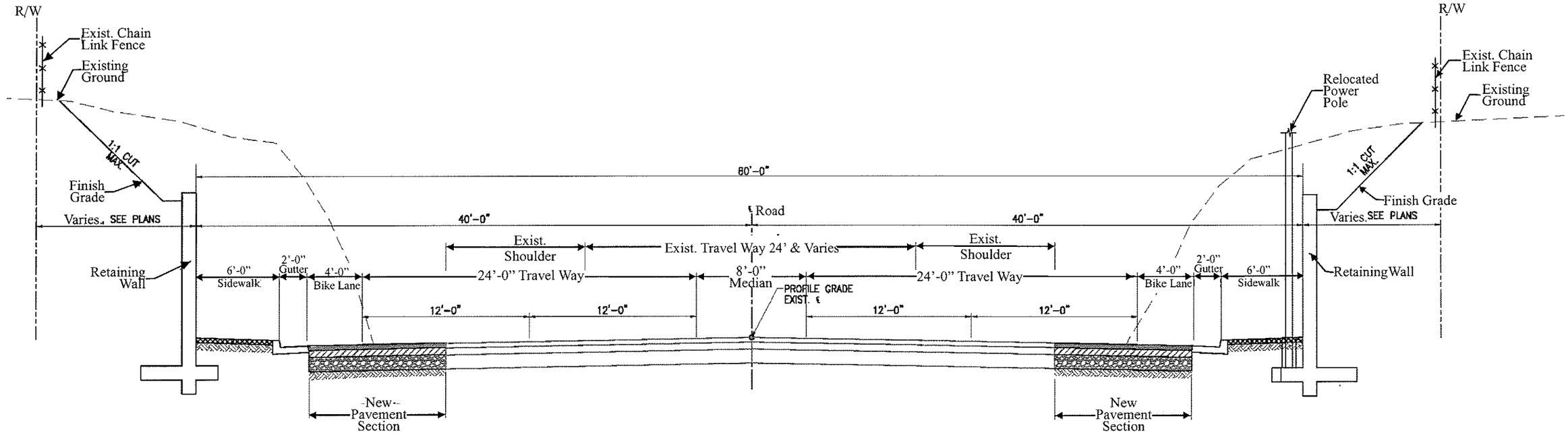
All plans, specifications and estimates shall be in compliance with SDOT requirements. Work being conducted will be within the existing State ROW and County ROW and lands, except for portions of the Okolani Drive/Pi`ilani Highway intersection which is on private land. Preliminary engineering plans for these improvements are contained in **Appendix "A"**.

D. REGULATORY CONTEXT AND CHAPTER 343, REVISED STATUTES

The Pi`ilani Highway widening and related improvements will involve the use of State and County lands. As such, the processing of an Environmental Assessment (EA) pursuant to Chapter 343, Revised Statutes (HRS) will be required. This EA is being prepared pursuant to both HRS, Chapter 343 and Chapter 200 of Title 11, Department of Health Administrative Rules, Environmental Impact Statement Rules. Accordingly, this document (prepared for the approving agency, the SDOT) addresses the project's technical characteristics, environmental impacts and alternatives, and advances findings and conclusions relative to



Typical Road Section



Typical Road Section with Retaining Walls

Source: Austin, Tsutsumi & Associates, Inc.

Figure 3

Pi`ilani Highway Widening Project
Typical Road Sections

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WCPT\PiilaniWidening\Typical Road Sections

the significance of the proposed action.

E. ESTIMATED PROJECT COST AND CONSTRUCTION CONSIDERATIONS

The proposed project will involve the use of State and County lands with design and construction to be undertaken by a collaboration of private sector organizations, namely, Honua`ula Partners, LLC, A&B Wailea LLC, Keaka LLC, and ATC Makena Holdings LLC. It is estimated the proposed construction of the improvements will cost approximately $26.0 million.

Construction of the project will commence upon receipt of applicable regulatory permits and approvals. The construction duration of the project is estimated to be approximately 18 months.

II. DESCRIPTION OF EXISTING CONDITIONS, POTENTIAL IMPACTS AND MITIGATION MEASURES

II. DESCRIPTION OF EXISTING CONDITIONS, POTENTIAL IMPACTS AND MITIGATION MEASURES

A. PHYSICAL SETTING

1. Surrounding Land Uses

a. Existing Conditions

The project corridor is located in the community of Kihei, between 0.5 to 1.0 mile inland from the south Maui shoreline. It runs in a north to south direction for a distance of 1.44 miles commencing at approximately 1,000 ft. north of Kilohana Drive and terminating at Wailea Ike Drive in the south.

The region is known for the resort destinations of Kihei, Wailea and Makena, its magnificent beaches, as well as its residential, retail and commercial developments.

Lands in the region are primarily occupied by single-family residences, condominium and apartment complexes, retail and commercial developments, golf course, public utilities, recreational uses and agricultural lands. Notable uses along the project corridor include the Maui Meadows Subdivisions and the Wailea Resort.

b. Potential Impacts and Mitigation Measures

The proposed action is intended to address existing traffic capacity constraints, as well as projected increases in volume along the project corridor anticipated with development of the Honua`ula Project District, and the Wailea and Makena Resorts. Land use patterns along the corridor and beyond are not anticipated to change as a direct result of the proposed action. Land use designations set forth by the Kihei-Makena Community Plan will continue to guide growth and development along the project corridor.

2. Climate

a. Existing Conditions

The Kihei coast is generally sunny, warm and dry the entire year. The average annual temperatures in Kihei range between the low 60's to the low 90's. June through August are historically the warmer months of the year, while the cooler months are January to March.

Average rainfall distribution in the Kihei-Makena region varies from under ten (10) inches per year to twenty (20) inches per year in the higher elevations. The average rainfall in 2008 was 5.84 inches. Rainfall in the Kihei-Makena region is highly seasonal, with most of the precipitation occurring in the winter months (Source: Maui County Data Book, 2009).

Northeast tradewinds prevail approximately 80 to 85 percent of the time. Winds average ten (10) to fifteen (15) miles per hour during afternoons, with slightly lighter winds during mornings and nights.

b. Potential Impacts and Mitigation Measures

The project involving the upgrade of an existing roadway will not impact local climatic conditions within the Kihei-Makena region.

3. Topography and Soils Conditions

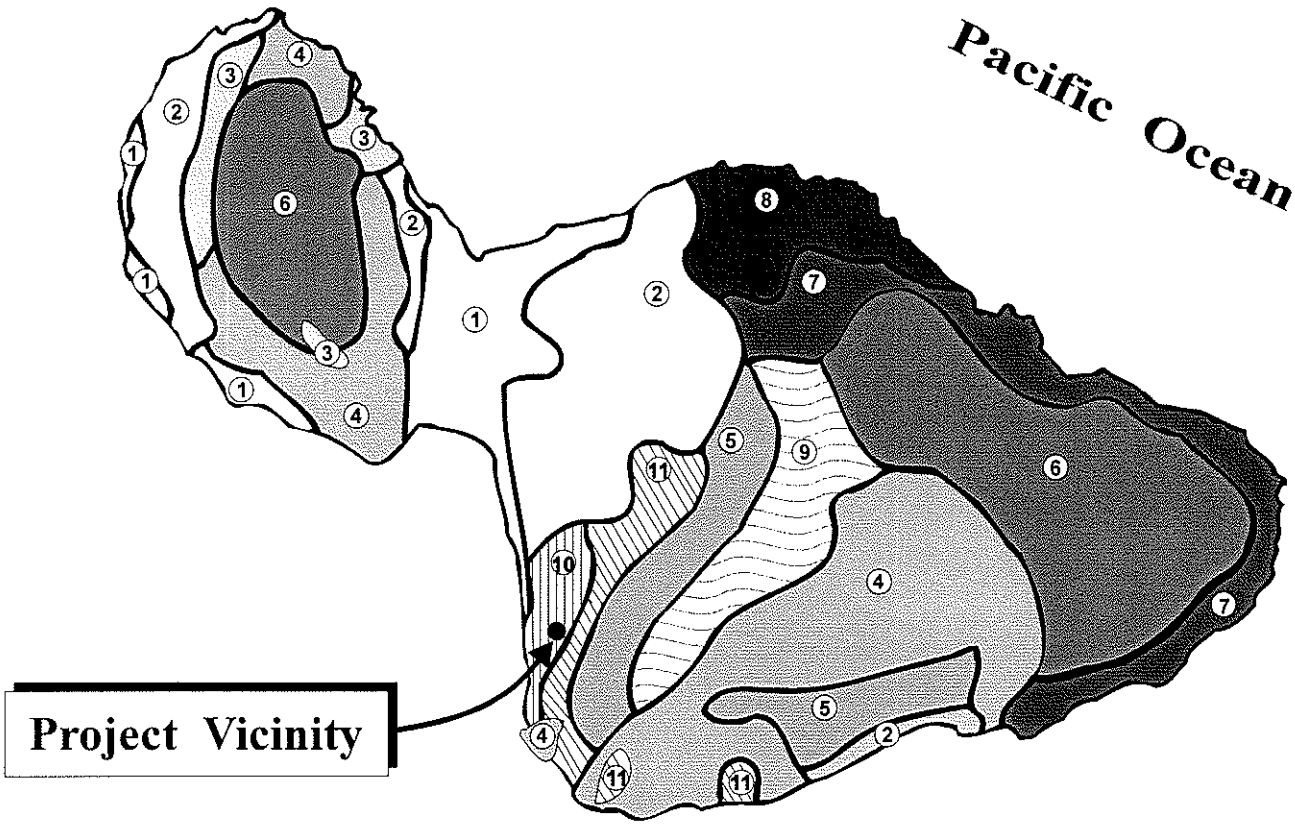
a. Existing Conditions

Underlying the project corridor is the Keawakapu-Makena soil association. See **Figure 4**. The soil survey of the islands of Kauai, Oahu, Maui, Molokai and Lana`i, State of Hawaii characterizes the soils of this association as gently sloping to moderately steep and well drained. The underlying material is fine-textured to medium-textured subsoil and ranges in depth from shallow to deep and is comprised of fragmental A`a lava.

The Soil Survey, prepared by the U.S. Soil Conservation Service, identifies the soils in the project corridor as Makena loam, stony complex, 3 to 15

LEGEND

- ① Pulehu-Ewa-Jaucas association
- ② Waiakoa-Keahua-Molokai association
- ③ Honolua-Olelo association
- ④ Rock land-Rough mountainous land association
- ⑤ Puu Pa-Kula-Pane association
- ⑥ Hydrandepts-Tropaquods association
- ⑦ Hana-Makaalae-Kailua association
- ⑧ Pauwela-Haiku association
- ⑨ Laumaia-Kaipoipoi-Olinda association
- ⑩ Keawakapu-Makena association
- ⑪ Kamaole-Oanapuka association



Source: USDA, Soil Conservation Service

Figure 4 Pi`ilani Highway Widening Project
Soil Association Map

NOT TO SCALE

Prepared for: Honua`ula Partners, LLC, A&B Wailea LLC, Keaka LLC and ATC Makena Holdings LLC

MUNEKIYO & HIRAGA, INC.

WCPT\PiilaniWidening\Soil Association Map

percent slopes (MXC) and Keawakapu exteremely stony silty clay loam, 3 to 25 percent slopes (KNXD). See **Figure 5**.

MXC, is generally found on the lower leeward slopes of Haleakala, between Makena and Kamaole, and consists of Makena loam and stony land. Stony land occurs on the low ridges and makes up to 30 to 60 percent of the complex. Makena loam is a dark brown to dark yellowish brown well drained soil, developed from volcanic ash, and is usually located between the low ridges of stony land. Makena loam is characterized by a relatively high permeability, and a low shrink swell potential. Permeability on stony land is very rapid.

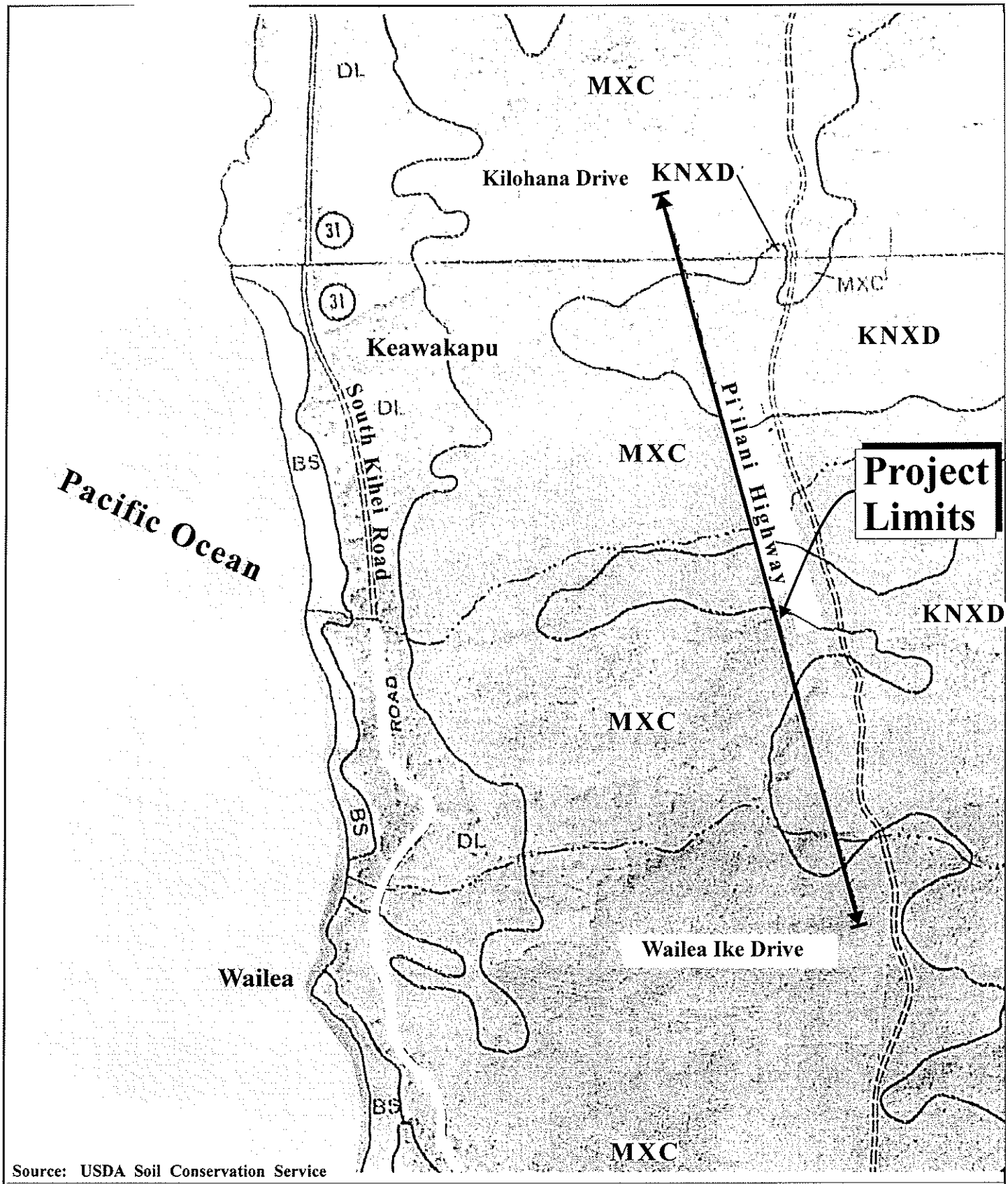
KNXD is generally found on upland areas on the island of Maui. These soils are dark reddish brown in color and were developed in volcanic ash. Keawakapu extremely stony silty clay loam is characterized by moderate permeability, and a low shrink-swell potential.

Highly vesicular basalt with an irregular and spiny surface, referred to as *aa* lava, underlies both soil types at depths of usually less than about five (5) feet. In some areas, outcrops of *aa* lava cover as much as 15 percent of the land.

Pursuant to a visual reconnaissance, the existing roadway appears to be located on both fill and cut areas. The fill and cut areas alternate along the length of the proposed widening. Fill areas appear to consist of the onsite silty clay, mixed with cobbles and boulders. Cut areas generally expose moderately weathered basalt with occasional clinker layers.

b. <u>Potential Impacts and Mitigation Measures</u>

According to a geotechnical analysis by Hirata & Associates, Inc., soil excavations related to the proposed improvements can be accomplished using conventional excavating equipment. Excavations into the basalt may require pneumatic equipment, especially for confined excavation such as trenching. As the proposed widening will be located within the existing roadway ROW, extensive excavation work involving removal of significant quantities of basalt is not anticipated. See **Appendix "B"**.



Source: USDA Soil Conservation Service

Figure 5 Pi`ilani Highway Widening Project

Soil Classification Map

NOT TO SCALE

Prepared for: Honua`ula Partners, LLC, A&B Wailea LLC, Keaka LLC and ATC Makena Holdings LLC

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WCPT\PiilaniWidening\SoilClass

Appropriate measures, such as Best Management Practices (BMPs) to stabilize soils both during and after construction will be included in the construction engineering plans for the project.

4. Flood and Tsunami Hazards

a. Existing Conditions

According to the Flood Insurance Rate Maps, the project corridor is located in flood zone "X", areas determined to be outside the 0.2 percent annual chance floodplain of minimal flooding. See **Figure 6**. Further, the project corridor is located significantly inland from the shoreline and outside of the tsunami inundation zone.

b. Potential Impacts and Mitigation Measures

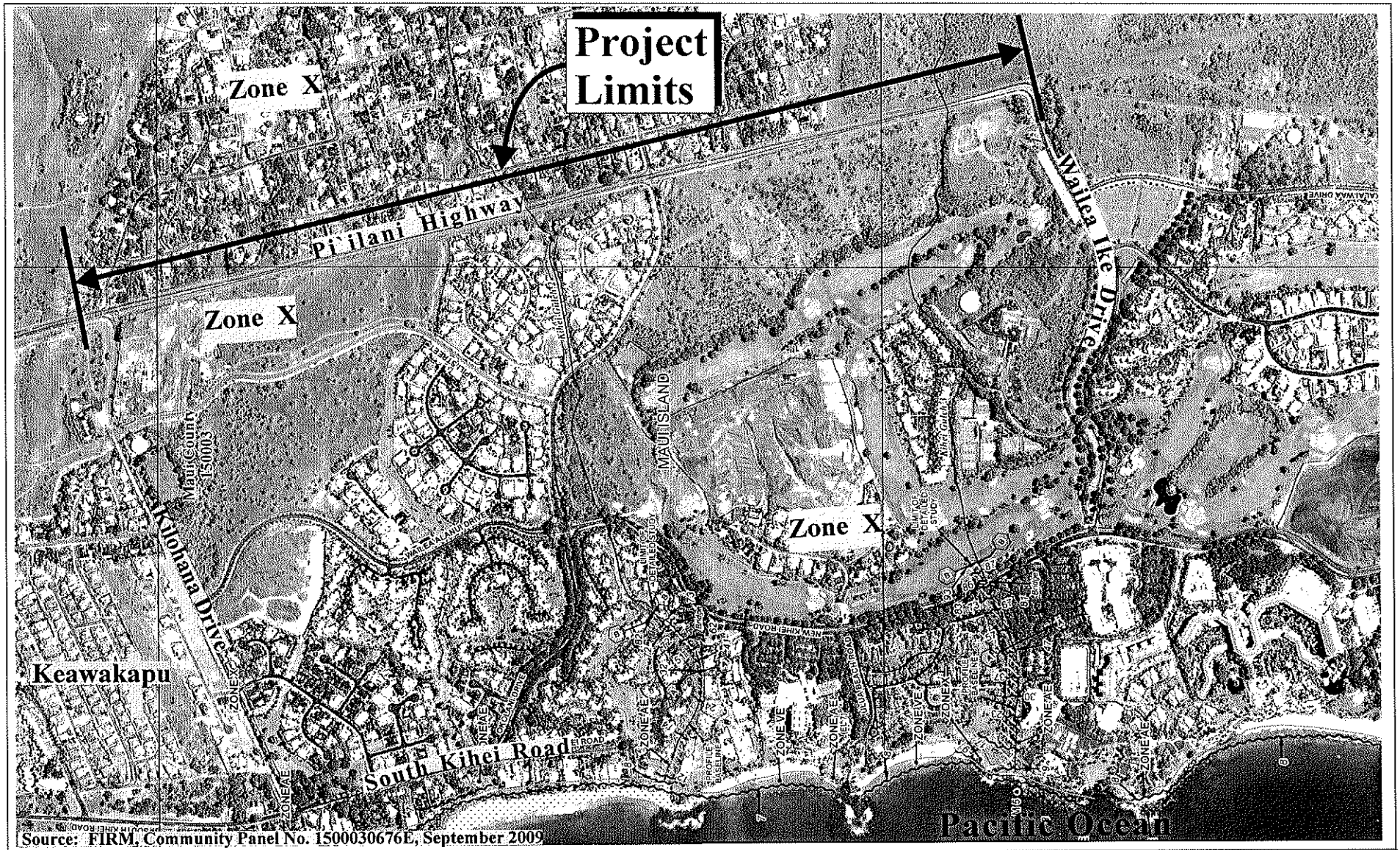
The project corridor is located outside of any flood and tsunami evacuation areas. As such, no impacts on these parameters are anticipated with the project implementation.

5. Flora and Fauna

a. Existing Conditions

(1) Flora

A botanical survey was completed for the project corridor in February 2009. See **Appendix "C"**. No federally listed threatened, endangered, or candidate endangered plant species were observed within the project corridor. No rare native plant species were found during the survey along the highway. A total of 88 plant species were recorded of which three (3) species are native. Two (2) indigenous species, *ʻilima* (Sida fallax) and *uhaloa* (Waltheria indica), were common along both sides of the highway. The third native species, *milo* (Thespesia populnea), was only found at one (1) location adjacent to a homeowner's backyard.



Source: FIRM, Community Panel No. 1500030676E, September 2009

Figure 6

Pi`ilani Highway Widening Project

Flood Insurance Rate Map

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The vegetation along both sides of the project corridor consists primarily of buffel grass grassland. *Kiawe* (Prosopis juliflora) trees and shrubs of *koa haole* (Luceana leucocephala), *slender mimosa* (Desmanthus pernambucanus) *castor* (Ricinus communis), *fuzzy rattle pod* (Crotolaria incana), *hairy abutilon* (Abutilon grandifolium) and *tree tobacco* (Nicotiana glauca) are also common along the project corridor. *Sow thistle* (Sonchus oleraceus), *golden crown beard* (Verbesina enceloides) and *spurge* (Chamaecyse hirta) are some examples of the common herbaceous plants in the project corridor. *Hairy merremia* (Merremia aegyptia) and *wild bean* (Macroptilium lathyroides) are examples of vines commonly found on both sides of the highway. Compared to the east side, the vegetation along the west side of the highway has a higher diversity of introduced weedy species. Monotypic stands of buffel grass were also found along stretches of the project corridor on the east side of the highway. Evidence of fire damage to vegetation was identified on the west side of Pi`ilani Highway. Refer to **Appendix "C"**.

(2) Fauna

A Wildlife Survey as completed for the project corridor in March 2009. See **Appendix "D"**. No endangered species of fauna were identified during the survey of the project corridor. Wildlife species present within the project corridor are found commonly throughout Maui and the main Hawaiian Islands.

Non-native tree tobacco (Nicotiana glauca) is present along the ROW. Though not identified during the fauna survey, it is noted that caterpillars of the Blackburn's sphinx moth have been found on tree tobacco plants elsewhere in Kihei and within the adjacent Honua`ula project district (SWCA 2009). Refer to **Appendix "D"**.

b. Potential Impacts and Mitigation Measures

(1) Flora

The proposed road widening on Pi`ilani Highway will not have a

significant negative impact on the botanical resources in the ROW area north of Kilohana Drive to Wailea Ike Drive. The majority (97%) of the plants observed within this area are introduced species. The native species found within the project corridor are common throughout Maui and the other islands within the state. The lower species diversity found on the eastern side of the highway ROW may be attributed to recent brushfires in the area.

The biological report prepared by SWCA Environmental Consultants recommended the following mitigation measures for the project:

(a) Non-native tree tobacco (Nicotiana glauca) trees found within the project corridor are host plants for the listed endangered Blackburn sphinx moth (Manduca blackburni). The moth has been found on tree tobacco plants elsewhere in Kihei and within the Honua`ula project district. To help insure against the accidental take of individual sphinx moths, each tree tobacco plant should first be screened by a qualified wildlife biologist prior to any land clearing. If sphinx moths or signs of sphinx moths (frass, cut stems or leaves, caterpillars, pupae, or adults) are found on any tree, that tree should be marked and protected against disturbance for the duration of the breeding season.

(b) Landscaping following realignment construction should focus on the use of native plant species normally found in coastal dry shrubland habitats. Suitable species may include: *`ilima* (Sida fallax) *`aki`aki* (Sporobolus virginicus), *pohinahina* (Vitex rotundifolia), *`akia* (Wikstroemia uva-ursi), and *mau`u `aki`aki* (Fimbristylus cymosa). Seeds or seedlings for these native plants may be obtained from various native plant nurseries on Maui such as Ho`olawa Farms or Native Nursery LLC.

(c) The use of plants within the *Solenaceae* (nightshade family) for ROW landscaping should be forbidden so as not to attract endangered Blackburn sphinx moths to the highway where they are at higher risk for injury or death. Refer to **Appendix "C"**.

(2) Fauna

The U.S. Department of the Interior, Fish and Wildlife Service (USFWS), by letter dated March 9, 2009, commented that the threatened *Newell's shearwater* (Puffinus auricularis newelli) and endangered *Hawaiian petrel* (Pterodroma phaeopygia sandwichensis) are known to traverse the area. Both the *Blackburn's sphinx moth* (Manduca blackburni) and the endangered Hawaiian hoary bat (Lasiurus cinereus semotus) are known to occur near the project corridor. The USFWS indicated the following:

(a) Seabirds may traverse the project corridor at night during the breeding season (February 1 through December 15). Any outdoor lighting, particularly when used during each year's peak fledging period (September 15 through December 15), could result in seabird disorientation, fallout, and injury or mortality.

(b) Adult Blackburn's sphinx moth feed on nectar from native plants including *beach morning glory* (Ipomoea pees-caprae), *iliee* (Plumbago zeylanica), *maiapilo* (Capparis sandwichiana), and the larvae feed upon non-native tree tobacco (Nicotiana glauca) and the native (Nothocestrum latifolium). All of these species may occur on the project corridor. It was recommended that a survey of the site for the presence of the moth host plants be undertaken and if found, to contact the USFWS for further assistance. The Botanical Survey completed for the project corridor identified only the non-native tree tobacco. Refer to **Appendix "C"**.

The USFWS cautioned the proposed project is located in a dry area of Maui where wildland fires interdependent with the proposed project, may affect listed upland species. To minimize risks from wildland fires, USFWS recommended coordination with the Maui County Department of Fire and Public Safety Wildland Fire Management specialists.

During construction, every effort will be made to reduce night lighting as much as possible, such as limiting night time construction. During highway operations, lighting shall be installed in accordance with highway standards. Lighting for the project is limited to

relocating existing fixtures. No new lights are planned. Every effort shall be made to shield light fixtures as much as practicable.

Prior to construction, if sphinx moths or signs of sphinx moths (frass, cut stems or leaves, caterpillars, pupae, or adults) are found on any tree, that tree shall be marked and as much as practicable protected against disturbance for the duration of the breeding season. Refer to **Appendix "D"**.

6. Air Quality

a. Existing Conditions

An Air Quality Study dated April 2009 was completed by B. D. Neal & Associates. See **Appendix "E"**. The largest sources of air pollution in the immediate project corridor are most likely agricultural operations and automobile traffic using local roadways. There are no point sources of airborne emissions in the immediate vicinity of the project corridor. The air quality in the Kihei area is considered good and prevailing tradewinds quickly disperse particulates which are generated from these sources.

b. Potential Impacts and Mitigation Measures

The proposed improvements to the Pi`ilani Highway will accommodate existing traffic volumes of traffic and anticipated growth in the Kihei-Wailea-Makena area. According to the Air Quality Study, emissions from vehicular traffic would begin to decrease with the proposed improvements. This is due to the reduction in emission factors with time. Refer to **Appendix "E"**.

Short-term impacts on air quality could potentially occur during project construction from fugitive dust resulting from vehicle movement and soil excavation and exhaust emissions from onsite construction equipment. Indirectly, there also could be short-term impacts from slow-moving construction equipment traveling to and from the project corridor and from the disruption of traffic due to road construction. These emissions are expected to have a negligible impact on regional air quality as the emissions would be relatively small, readily dissipated and temporary.

Adequate fugitive dust control can usually be accomplished through Best Management Practices (BMPs), such as establishment of a frequent watering program, limiting the area disturbed, applying soil stabilizers, mulching, and wind screens. With careful planning and attention to dust control, most potential short-term air quality impacts from project construction can be mitigated.

Long-term air quality impacts after construction are related to emissions from vehicular traffic. A qualitative assessment of the potential impacts from mobile source air toxics (MSATs) indicated that the project would not result in higher MSAT emissions based on the project itself not affecting the volume of traffic using the project roadway. The improved traffic flow due to the project may actually help to reduce MSAT emissions. With Pi`ilani Highway widened to four (4) lanes in the year 2016, the air quality study indicates that overall emissions from vehicular traffic will decrease with the improvements. According to the Air Quality Study, the project is expected to provide a positive impact on air quality, and mitigation for long-term impacts is not warranted based on the analysis of the project. Refer to **Appendix "E"**.

7. Noise Characteristics

a. Existing Conditions

An Accoustic Study was completed by Y. Ebisu & Associates on July 2010. See **Appendix "F"**. Existing traffic noise levels along the project corridor currently exceed the U.S. Federal Highway Administration (FHWA) and State Department of Transportation, Highways Division (HDOT) noise abatement criteria at two (2) residences located north of the Piilani Highway/Okolani Drive/Mikioi Place intersection. The portion of the project corridor most sensitive to noise impacts are existing residences located near the Kilohana Drive/Mapu Place/Pi`ilani Highway intersection. Refer to **Appendix "F"**.

Some existing residences presently benefit from the noise shielding effects of walls which have been constructed along the lot boundary lines, and other residences in the Maui Meadows subdivision on the mauka (east) side of the

highway benefit from the noise shielding effect of the large highway cuts. In general, if the visual lines of sight between the residences are blocked by the walls or the highway cuts, the residences will experience lower traffic noise levels due to the sound attenuation effects of the obstructions. Refer to **Appendix "F"**.

b. Potential Impacts and Mitigation Measures

Potential short term construction noise impacts are possible during the project construction period along the entire project corridor due to the short distances between the existing dwellings from the anticipated construction corridor. However, minimizing these types of noise impacts is possible using standard curfew periods, properly muffled equipment, administrative controls, and construction barriers as required. Refer to **Appendix "F"**.

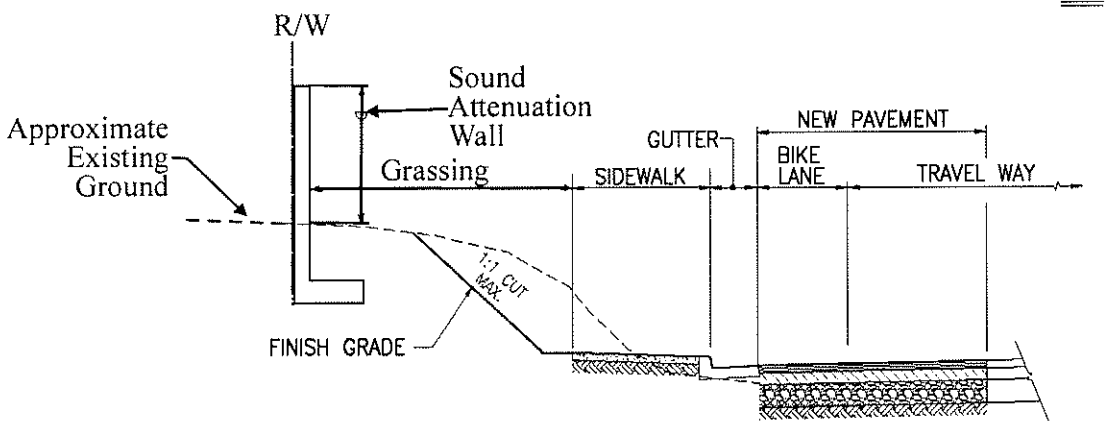
Blasting may be used to fragment and/or dislodge rock during construction. Potential impacts from blasting include airborne noise and ground vibrations. The levels of noise and ground vibrations will be minimized by limiting blasting to five (5) blasts per week and adjusting the charge weights per bore hole (or delays) to relatively small values. These mitigation measures will eliminate any risk of damage to nearby structures. The noise level is expected to be very low, with less than 1.0 percent of the population exposed to this level are expected to be highly annoyed. See **Figure 7**.

The following mitigation measures from blasting is recommended:

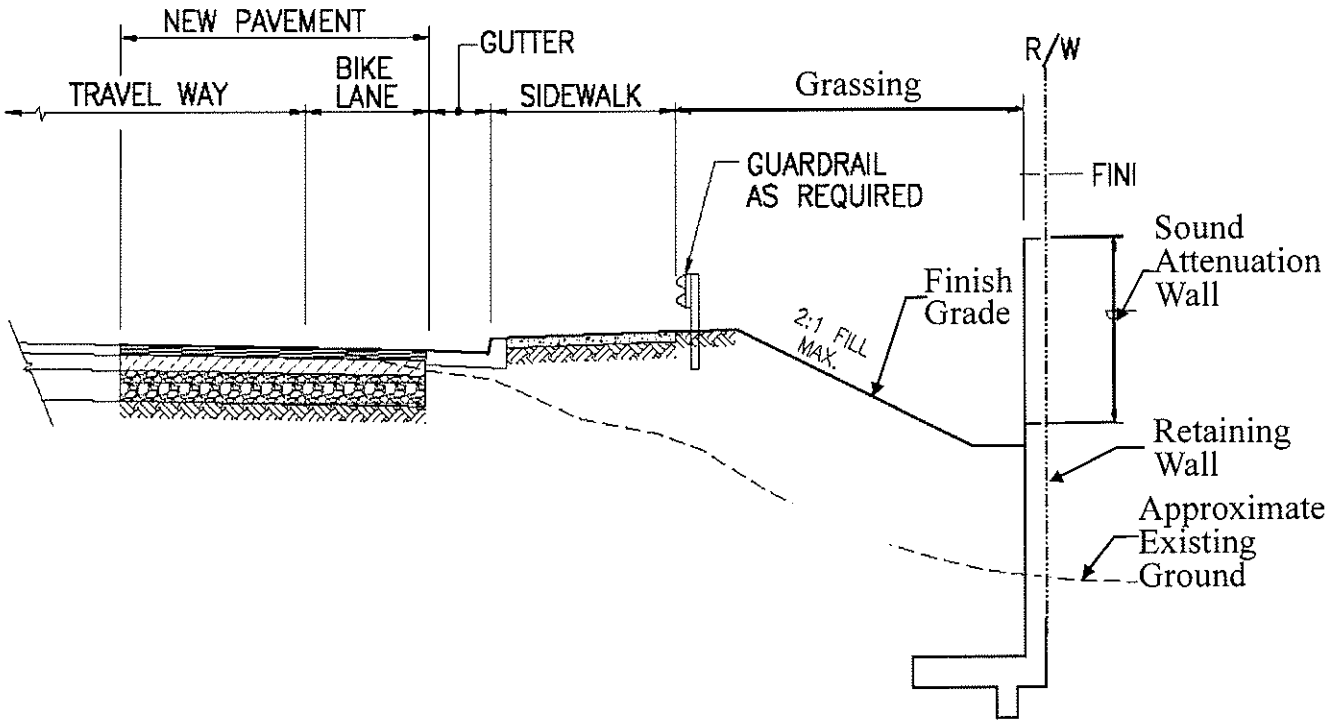
- Regularly monitor air blast and ground vibration levels simultaneously at the closest noise sensitive residence(s) or structure(s) during the blasting operations to develop the data base for the surrounding area.

- For initial blasts, prior to establishment of a data base of ground vibration and air blast levels vs. scaled distance, use the minimum practical charge weight (in equivalent pounds of TNT) per delay, as well as the minimum practical number of bore holes (or delays).

- If practical, reduce maximum air blast levels to less than 110 dBL at



Cut Section with Sound Attenuation Wall



Fill Section with Sound Attenuation Wall

Source: Austin, Tsutsumi & Associates, Inc.

Figure 7 Pi`ilani Highway Widening Project

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Sound Attenuation Wall Sections

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the nearest noise sensitive residences in response to air blast complaints. Possible methods of accomplishing this are: reducing charge sizes; increasing bore hole intervals; increasing hole depth; orienting bore holes to direct the gas ejecting the fill (stemming) material from the hole bored for the explosive charge (Stemming Release Pulse) away from noise sensitive properties; trucking in high quality fill material to minimize fill blowouts; and filling (sandbagging) over the area to be blasted and the detonating chord.

- Schedule actual blasting during the warm periods of the day to minimize the possibility of thermal ducting and focusing of air blast noise at large distances from the blast. If possible, also schedule blasting during fixed time periods, so that the members of the community can also schedule their activities accordingly.

- The most conservative vibration criteria for damage to "Ruins and Ancient Monuments" is 0.15 inch per second. Initial test shots should be structured so as to not exceed this limit at the closest structures, with subsequent shots adjusted to reflect the results of the blast monitoring data.

Without the project, the noise abatement criteria will exceed at 13 existing noise sensitive dwelling units which do not benefit from the noise shielding effects of walls or terrain features. Once construction is completed and the highway is in operation, the noise abatement criteria will exceed at 16 residential structures. At the two (2) commercial buildings at the Wailea Gateway Shopping Center, future traffic noise levels will not exceed the noise abatement criteria for commercial structures. There are no public use structures or park lands affected by the proposed project. Traffic mitigation measures in the form of sound walls at affected residences meeting the HDOT traffic noise abatement policy will be constructed. Walls fronting lots at TMK 2-1-015:015, TMK 2-1-015:013, and TMK 2-1-008:112 have a possibility of being considered as reasonable and feasible under the current HDOT traffic noise abatement policy. See **Appendix "F"** and **Appendix "F-1"**.

Due to the potential visual impacts of the noise barriers and the potential for graffiti, wherever possible, landscaping will be considered on the roadway

side of the barrier. Refer to **Appendix "F"**. In those areas where the walls may exceed six (6) feet in height visible from the adjacent properties additional coordination with the neighboring property owners will be necessary to mitigate visual impacts from the walls.

8. Scenic and Open Space Resource

a. Existing Conditions

In proximity to the project corridor, the lands makai (west) of the Pi`ilani Highway are predominantly developed with residential, commercial/retail and public facility uses, and defined by the built up urban landscape of Wailea. The lands mauka (east) of the project and in the northern portion of the project corridor are characterized by the residential single-family subdivision of Maui Meadows. Further south along the project corridor mauka of the Pi`ilani Highway, the adjacent landscape is characterized by the vacant urban lands of Honua`ula, which is at the southern terminus of the proposed highway improvements.

While the project corridor is bordered by residential, commercial and public/quasi-public uses to the west, the Pacific Ocean and the island of Kahoolawe to the south and West Maui coastline may be visible from selected points along the roadway near its southern terminus. In addition, Haleakala, Upcountry, and the West Maui Mountains comprise the other scenic vistas from the project corridor.

b. Potential Impacts and Mitigation Measures

The proposed improvements within the project corridor will not impinge upon any significant scenic view corridors or open space resources. Retaining and sound walls associated with the proposed project will be confined within the existing highway ROW.

Sound walls on the makai (west) side of Pi`ilani Highway are limited to the Kilohana Drive/Mapu Place/Pi`ilani Highway intersection and retaining walls due to the higher grades along the makai boundary of the highway corridor. Due to the higher grades on portions of the makai properties, views along the

project corridor are limited until the southern terminus at Wailea Ike Drive. Portions of these views will be obstructed with development currently under construction and future development of the vacant parcels.

Along the project corridor, except for the mauka (east) area north of Kilohana Drive, the adjoining properties are located within the Rural and Urban districts and are either developed or planned for future development. Except for Wailea Resort and Honua`ula which includes landscape buffers along the project corridor and existing drainage ways, there are no designated open space resources in the area.

No impacts to scenic and open space resources are anticipated. The proposed project will not create a visual character inconsistent with its present use, nor with surrounding uses. Where possible, consideration will be given to, (a) aesthetic treatment, such as rock facade consistent with local stone, and (b) breakup long stretches with mass plantings that completely screen wall on the roadway side of walls. Due to visual concerns that adjoining property owners may have, every effort will be made to consult with these property owners prior to the initiation of construction.

9. Archaeological Resources

a. Existing Conditions

The land underlying the project corridor was previously disturbed during the construction of the Pi`ilani Highway. Since work is primarily within the existing right-of-way or previously disturbed lands, an archaeological resources inventory has not been required, by the Department of Land and Natural Resources, State Historic Preservation Division (SHPD). SHPD has concurred that an archaeological monitoring plan will be sufficient. An Archaeological Monitoring Plan will be prepared by Aki Sinoto Consulting, Inc. for the project. See **Appendix "G"**.

b. Potential Impacts and Mitigation Measures

The proposed action will not create any new disturbances outside the area which has already been cleared and developed. Based on early consultation

with the SHPD, an archaeological monitoring plan will be submitted to SHPD for review and approval prior to any ground altering activities. These measures will ensure that proper mitigation and consultation will occur to protect any undiscovered archaeological and cultural resources which may be encountered during project development.

10. Historic and Cultural Resources

a. Existing Conditions

A Cultural Impact Assessment was completed by Hana Pono, LLC on April 2009. See **Appendix "H"**. The project corridor is located at the tip of the traditional district of Honua`ula and Southwest district called Kula. For many years, the only way to get to Wailea `Ike and Makena from Kihei was by an ancient walkway starting at the ocean side of Kalama Park. As South Maui continually expanded, the residents found it necessary to find other methods and roadways to reach Makena. Ancient methods of canoeing and coming down from Ulupalakua upon the footpaths continued but walking along the sea coast eventually gave way to horses and ox drawn carts. The path along the shoreline eventually became a dirt road for Model-T cars. The road was covered with sand and oil, as Kupuna Clark cited in his cultural interview, as more developments took place beyond the park.

As Kihei kept growing, it was deemed necessary to build Pi`ilani Highway. With Honua`ula and Makena Resort receiving recent land entitlements, widening this corridor will accommodate projected increases in traffic flow to and from South Maui. Refer to **Appendix "H"**.

b. Cultural Perspectives

As part of the cultural assessment, three (3) informant (kama`aina) interviews were conducted to gain an understanding of likely cultural practices which occurred in the vicinity of the project corridor. Refer to **Appendix "H"**.

(1) Jenavive Monika Kaleilehua Clubb

Jenavive Monika Kaleilehua Clubb was born on Laie, Oahu. Her

maiden name is Ke`aulana. Her ties to Maui is through her mother who was a Mahi and her grandmother Annie Wilcox who was a daughter of William Wilcox who married Princess Maholeokalani. Annie Wilcox owned 80 acres of land in Honu`aula as you come down from Ulupalakua. Ms. Clubb, who has lived in the Maui Meadows area since 1976, recalled that she rode on horseback with Mr. Purdy from Ulupalakua who showed her where the land was located. The land was later sold by her uncle. At the time that she visited the land Kihei, "was nothing, just bald".

Culturally, there were thousands of people living in the area from Pu`u Ōla`i all the way up. According to her grandmother, there were villages from the mountains to the ocean but people had to eventually leave because of the volcano when the lava came down.

According to Ms. Clubb, the word "Makena" has no Hawaiian meaning because Makena was the name of an Irish Captain that owned a ship and the Hawaiian people liked him. She noted that she is not a historian and the Hawaiians related their history by word of mouth and there is nothing on palapala (paper).

Her mother and grandmother talked about Ulupalakua and how they were the gardeners or the ones that had the fruit. They would trade with the fishermen in Makena because Makena was a very progressive fishery. Trade was from the taro patch, the loi's in those days.

Ms Clubb voiced concern that people have developed the area and you cannot travel along the coastline in Makena. There are no public access walkways along the coastline like in the Wailea Resort area. The residential property owners in the area are prohibiting people from crossing the shoreline. Also, culturally, Ms. Clubb felt that the kupuna need to teach the children about their Hawaiian heritage.

(2) <u>Johanna Kuuleilokelani Shin-Amorin</u>

Johanna Kuuleilokelani Shin-Amorin was born on Oahu. Her mother

was pure Hawaiian and her father was pure Korean. Her mother's name was Hannah Kahanahaipule Moses. The family's Hawaiian name was changed into an English name for biblical reasons. She has lived on Maui since 1972 when she married a Maui boy, Howard Amorin. Ms. Shin-Amorin has lived in the Maui Meadows area since December 1973. Her children were raised in the area.

Her memories of the area are linked to the use of the beaches. She remembers riding to Makena Point and checking the scenery at La Perouse Bay and walking among the lava fields. She got to enjoy the beautiful scenery of the area.

Ms. Amorin's concern is that there are problems with inadequate infrastructure. Culturally, the public needs access to the beach.

(3) Eugene C. "Herman" Clark, Sr.

Eugene C. "Herman" Clark, Sr.'s mother was born on Kaua`i and was of Chinese-Hawaiian ancestry and his father was Sergeant Clark who was part of the Hawaiian National Guards back in 1935. Mr. Clark has lived on Maui since 1935 when his family moved here. He went to school at St. Anthony and Maui Vocational School. He married Margaret Mahi from Iao Valley. He is seventy-seven years old and practices reflexology (healing with your hands) through the Chinese-Hawaiian way.

Mr. Clark has lived in the Kihei region when Kenolio Road was the main road in Kihei. The area was all kiawe and boulders at that time. He remembers when Makena was along the beach side and you traveled along a sand and dirt road to La Perouse Bay. Also, the Kula people would come down the Old Ulupalakua Road near the Chang's house.

Mr. Clark's concern is that there is too much development in the Kihei area.

c. Potential Impacts and Mitigation Measures

The proposed highway widening improvements to the Pi`ilani Highway will occur within the existing right-of-way that traverses lands, which in the prehistoric period were used for trails between the mauka and makai settlements and in the period after 1850 was mainly used for cattle ranching. There are no known archaeological resources which will be adversely impacted by the proposed project.

Based on informant information and the existing land use context, there is no evidence of current or recently occurring cultural practices along the project corridor. The cultural assessment undertaken in conjunction with the proposed Pi`ilani Highway widening resulted in finding no significant cultural concerns or impacts associated with the proposed project.

B. SOCIO-ECONOMIC ENVIRONMENT

1. Regional Land Use and Community Character

From a regional standpoint, the project corridor is in the Kihei-Makena Community Plan region which encompasses the area from Ma`alaea to La Perouse Bay. The region includes a diverse range of physical and socio-economic environments. With its dry and mild climate and proximity to recreation-oriented shoreline resources, the visitor-based economy has grown steadily over the past few years. The town of Kihei serves as the commercial and residential center of the region with the master-planned communities of Wailea and Makena serving as the focal point for visitor activities.

It is noted in the updated Kihei-Makena Community Plan (1998) that the community is generally characterized by its friendly, capable and caring residents and is an ethnically diverse community with a strong interest in events or actions which affect the region.

2. Population

a. Existing Conditions

The population of the County of Maui has exhibited a relatively strong

growth in recent years. The resident population increased approximately 12.1 percent in the eight-year span from 2000 to 2008, from 128,241 to 143,691 (Maui County Data Book, 2009). Growth in the County is expected to continue with the baseline resident population projected to 151,300 by 2010 and 162,600 by 2015 (Maui County Planning Department, 2006).

The population of the Kihei-Makena region has increased at greater rates than the County as a whole. In the 10-year span from 1990 to 2000, the population of the Kihei-Makena region grew by 49 percent, from 15,365 to 22,870 people. The regional population is projected to grow to 28,114 in 2010 and 30,597 in 2015 (Maui County Planning Department, 2006).

b. Potential Impacts and Mitigation Measures

The proposed action is not anticipated to have significant adverse impacts on population. As an improvement to an existing roadway system there will be no increase in dwelling units that would generate population growth.

3. Economy

a. Existing Conditions

The economy of Maui is heavily dependent upon the visitor industry. The dependency on the visitor industry is especially evident in Kihei-Makena, which is one of the State's major resort destination areas. The foundation for the region's visitor strength lies in world-class resorts and recreational facilities located in Wailea and Makena. Support for the visitor industry is found in Kihei, where numerous retail commercial centers are found.

According to data from the State Department of Labor and Industrial Relations, of the 76,550 civilian labor force, 69,950 individuals were employed in Maui County in 2009. Approximately 6,600 individuals, comprising of 8.6 percent of the labor force, were unemployed in 2009. Maui island had a civilian labor force of 72,400 individuals of which approximately 6,150 individuals comprising 8.5 percent of the labor force were unemployed in 2009. The unemployment rate in June 2010 was 8.5 percent for Maui County and 8.4 percent for Maui island, a decrease in unemployment figures

from June 2009 of 0.9 and 0.7 percent, respectively (Department of Labor and Industrial Relations, July 2010).

b. Potential Impacts and Mitigation Measures

On a short-term basis, the proposed action will support construction and construction-related employment. Over the long term, the proposed project will provide for the more efficient movement of people and goods throughout the Kihei-Wailea-Makena area and thereby improve business production and operation levels. Equally important, the improvements to the Pi`ilani Highway will provide a key component to the orderly development of the regional transportation network in South Maui.

C. PUBLIC SERVICES

1. Police and Fire Protection

a. Existing Conditions

The County of Maui's Police Department is headquartered in Wailuku at its Mahalani Street facility. The Maui Police Department (MPD) consists of several patrol, investigative and administrative divisions. The MPD's Kihei Patrol covers the Kihei-Makena region. The department's Kihei Substation is located at the Kihei Town Center northwest of the project corridor. A new Kihei Police Station is proposed mauka of Pi`ilani Highway near Kanani Road.

Fire prevention, suppression and protection services are offered by the County's Department of Fire Control. The department's Kihei Station, which services the Kihei-Makena region is located on South Kihei Road near Kalama Park, while the Wailea Fire Station is located off of Kilohana Drive, just makai (west) of its intersection with Pi`ilani Highway.

b. Potential Impacts and Mitigation Measures

The widening of Pi`ilani Highway to provide an additional travel lane in each direction will be a positive benefit to the service capabilities of police, fire

and emergency medical operations by reducing emergency response time in the area.

During project construction, appropriate coordination will be undertaken with emergency services to ensure that response requirements for such services are not adversely impacted due to delays which may be attributed to construction work.

2. Medical, Recreational, and Educational Facilities

a. Existing Conditions

Maui Memorial Medical Center, the only major medical facility on the island, services the Kihei-Makena region. Acute, general and emergency care services are provided by this facility, which is licensed for 201 beds and is situated in Wailuku, in the vicinity of Mahalani Street and Maui Lani Parkway (Maui Memorial Medical Center, 2010). Privately operated medical/dental offices are located in the Kihei area to serve the region's residents and visitors. There are ambulance stations located in north Kihei, at the former Kihei Elementary School, as well as a temporary station in the Maui Meadows subdivision. In addition, a new ambulance station is proposed adjacent to the Wailea Fire Station site.

Diverse recreational opportunities are available in the Kihei-Makena region. Recreational facilities near the project corridor include Kilohana Park, the Wailea Blue, Gold and Emerald Golf Courses and various beach parks in Wailea Resort. Shoreline recreation includes swimming, fishing, picnicking, snorkeling, and windsurfing.

The 12.9-acre Kilohana Park is located at the corner of Kilohana Drive and Kapili Street west of the project corridor. This park has an athletic field for soccer, picnic areas, and restrooms.

The Makena resort area to the south offers additional opportunities for golf, tennis and ocean-related activities.

In addition, the County's Kihei Community Center complex located near

Lipoa Street, provides a community center, swimming pool, and athletic playfields. There are various other athletic fields and shoreline parks in the Kihei-Makena region. The South Maui Community Park is proposed to be built off of Liloa Drive south of Lokelani Intermediate School.

The State Department of Education (DOE) operates three (3) schools in the Kihei area. Kihei Elementary School and Kamali`i Elementary School cover grades K to 5, with 2009-2010 enrollments of approximately 870 and 660 students, respectively. Lokelani Intermediate School includes grades 6 to 8, with a 2009-2010 enrollment of approximately 569 students. Public school students in grades 9 through 12 attend Maui High School in Kahului with a 2009-2010 enrollment of 1,815. The Kihei Charter School also services the Kihei-Makena region with a 2009-2010 enrollment of 436 (Department of Education, 2009-2010 school year).

b. Potential Impacts and Mitigation Measures

The proposed action is not considered a direct population generator, but rather infrastructure services which will provide for an improved regional transportation network. As such, the proposed improvements will not place any new demand on medical, recreational, and educational facilities.

3. Solid Waste

a. Existing Conditions

Single-family residential solid waste collection service is provided by the County of Maui on a weekly basis. Residential solid waste collected by County crews are disposed at the County's Central Maui Landfill located 4.0 miles southeast of the Kahului Airport. In addition to County-collected refuse, the Central Maui Landfill accepts commercial waste from private collection companies. Privately owned facilities, such as the Maui Demolition and Construction Landfill and the Pohakulepo Concrete Recycling Facility accept solid waste and concrete from demolition and construction activities. These facilities are located about 9 miles to the northwest of the project corridor, near Honoapi`ilani Highway's junctions with North Kihei Road and Kuihelani Highway. A privately operated green

waste recycling facility, Maui Earth Compost Company, is situated at Pulehu and Hansen Road, while Eko Compost is operated at the Central Maui Landfill.

b. Potential Impacts and Mitigation Measures

Construction waste will not be transported to the County landfill. Instead, alternative sites, such as the Maui Demolition and Construction Landfill and Pohakulepo Concrete Recycling Facility, will be utilized. The proposed action is not anticipated to adversely impact the County's solid waste disposal facilities.

D. INFRASTRUCTURE

1. Roadway System

a. Existing Conditions

A Traffic Impact Analysis Report (TIAR) prepared by Austin, Tsutsumi & Associates was completed on July 21, 2009. See **Appendix "I"**.

Pi`ilani Highway (between Mokulele Highway and Kilohana Drive) - is a four-lane, undivided, north/south State arterial highway providing access to Kihei and Wailea from areas north of Kihei. The highway begins at Mokulele Highway and ends at its intersection with Wailea Ike Drive, with provisions to extend the highway to the south. Pi`ilani Highway narrows to a two-lane highway at its intersection with Kilohana Drive/Mapu Place until its terminus at Wailea Ike Drive. Left-turn storage lanes are generally provided at major intersections on Pi`ilani Highway. The posted speed limit on Pi`ilani Highway is generally 40 miles per hour (mph). The speed limit on Pi`ilani Highway is 45 mph in the northbound direction from Wailea Ike Drive to Kilohana Drive; the southbound speed limit on this segment decreases from 45 mph to 25 mph as it approaches Wailea Ike Drive.

Pi`ilani Highway is currently classified as an Urban Principal Arterial. The segment of highway under this project scope is currently an existing two-lane asphalt concrete paved roadway with one (1) lane of traffic in each direction.

Kilohana Drive - is a two-lane, undivided, east/west roadway that connects South Kihei Road with Pi`ilani Highway, intersecting Pi`ilani Highway across Mapu Place, which provides the north access to Maui Meadows residential subdivision. Kilohana Drive is currently a private roadway owned by A&B Wailea LLC from South Kihei Road to Kapili Street and a State roadway from Kapili Street to Pi`ilani Highway. The posted speed limit on Kilohana Drive is 25 mph.

Mapu Place - is a two-lane, undivided, east/west County roadway that provides one (1) of two (2) access points from Pi`ilani Highway, across Kilohana Drive, to the Maui Meadows residential subdivision. The posted speed limit on Mapu Place is 25 mph.

Okolani Drive - is a four-lane, divided, east/west County collector roadway between South Kihei Road and Wailea Alanui Drive. Okolani Drive narrows to a two-lane undivided roadway east of Wailea Alanui Drive to its intersection with Pi`ilani Highway directly across of Mikioi Street. The posted speed limit on Okolani Drive is 30 mph.

Mikioi Place - is a two-lane, undivided, east/west roadway owned by the County of Maui that provides one (1) of two (2) access points from Pi`ilani Highway, across Okolani Drive, to the Maui Meadows residential subdivision. The posted speed limit on Mikioi Place is 25 mph.

Wailea Ike Drive - is a four-lane, divided, east/west County collector roadway that narrows to a two-lane roadway just before its connection to Pi`ilani Highway at its eastern terminus. Wailea Ike Drive is the main entrance to the Wailea Resort and connects Pi`ilani Highway with Wailea Alanui Drive. Its vertical alignment is a relatively steep grade with a posted speed limit of 30 mph. Refer to **Appendix "I"**.

b. Potential Impacts and Mitigation Measures

The proposed widening of Pi`ilani Highway north of Kilohana Drive to its terminus at Wailea Ike Drive, is required as a condition in the change in zoning approval for both Honua`ula and Makena Resort. The design and construction of the highway widening will be shared by Honua`ula Partners,

LLC, A&B Wailea LLC, Keaka LLC and ATC Makena Holdings LLC. The proposed road improvements will widen Pi`ilani Highway from approximately 45 feet to 80 feet by adding 12-foot wide travel lanes, 4-foot wide bike lanes, concrete curb, gutter and 6-foot wide sidewalk to both sides of the highway. An 8-foot wide striped median is also proposed. Refer to **Figure 3**.

The early consultation comments of the Police Department, SDOT, and Maui Meadows Neighborhood Association expressed concerns regarding construction impacts to traffic circulation in the project corridor and adjoining streets. Concerns include detouring of traffic and/or temporary closure of Pi`ilani Highway and potential impacts on neighboring residential streets, especially in the Maui Meadows and Wailea Resort neighborhoods, due to detours and road closures. Prior to the initiation of construction consultation with the Police Department, SDOT and adjoining property owners will be initiated to develop measures to mitigate potential construction traffic impacts.

The TIAR evaluated the potential projects to be developed at Honua`ula, Wailea Resort and Makena Resort within the year 2022 timeframe. The TIAR recommended the following lane configurations with the widening of Pi`ilani Highway at the study intersections:

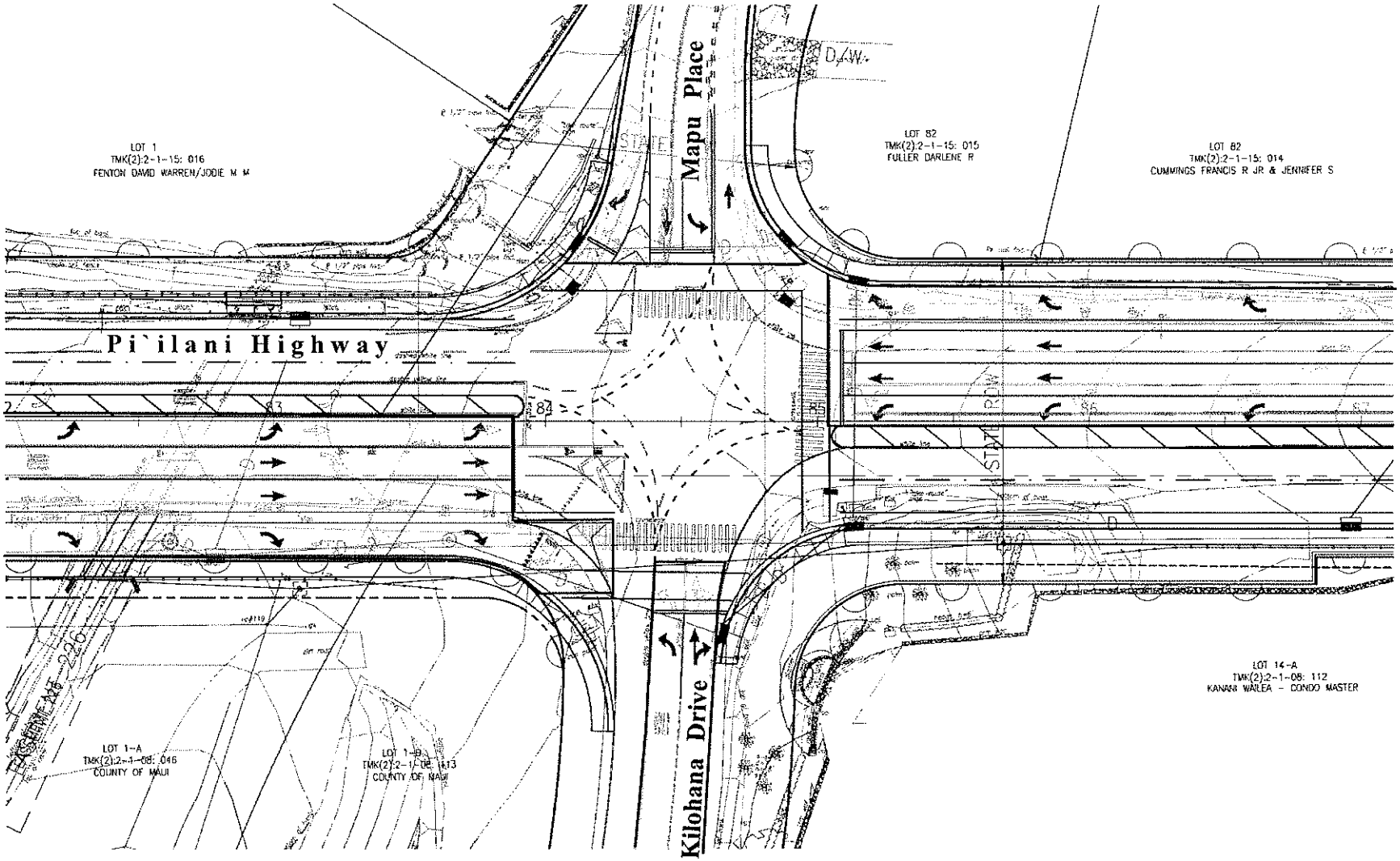
Pi`ilani Highway/Kilohana Drive/Mapu Place

- Northbound Approach: Provide an exclusive left-turn lane (with a protected left-turn signal phase), two (2) exclusive through lanes, and an exclusive right-turn lane. See **Figure 8**.

- Southbound Approach: Provide an exclusive left-turn lane (with a protected left-turn signal phase), two (2) exclusive through lanes, and an exclusive right-turn lane. Refer to **Figure 8**.

- Eastbound Approach: Remain as an exclusive left-turn lane and a shared through/right-turn lane (with a permissive signal phase). Refer to **Figure 8**.

- Westbound Approach: Provide a shared left-turn/through lane and an exclusive right-turn lane (with a permissive signal phase). Refer to **Figure 8**.



Source: Austin, Tsutsumi & Associates, Inc.

Figure 8

Pi`ilani Highway Widening Project

Pi`ilani Highway/Kilohana Drive/Mapu Place Intersection

NOT TO SCALE

Prepared for: Honua`ula Partners, LLC, A&B Wailea LLC, Keaka LLC and ATC Makena Holdings LLC

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Pi`ilani Highway/Okolani Drive/Mikioi Place

- Northbound and Southbound Approaches: Provide an exclusive left-turn lane (with a protected left-turn signal phase), an exclusive through lane, and a shared through/right-turn lane. See **Figure 9**.

- Eastbound Approach: Provide an exclusive left-turn lane and a shared through/right-turn lane (with a permissive signal phase). Refer to **Figure 9**.

- Westbound Approach: Remain as a shared left turn/through/right-turn lane (with a permissive signal phase). Refer to **Figure 9**.

Pi`ilani Highway/Wailea Ike Drive

Without implementation of Honua`ula, intersection controls will not be required and the following lane configuration is recommended:

- Southbound Approach: Provide an exclusive free right-turn lane. See **Figure 10**.

- Eastbound Approach: Provide an exclusive free left-turn lane. Refer to **Figure 10**.

By Year 2016 or when access to Phase I of Honua`ula is constructed:

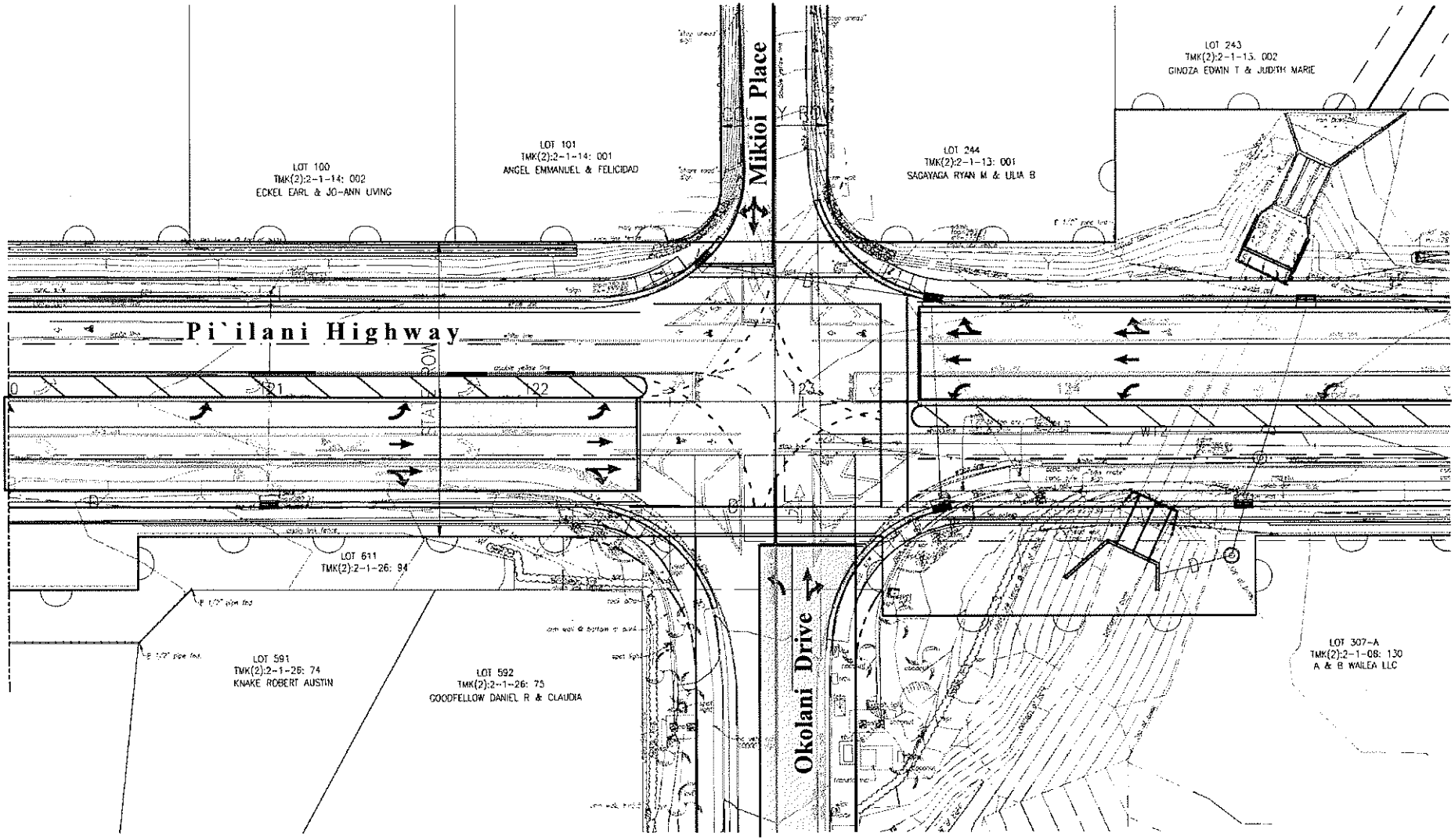
- With projected traffic volumes, the intersection will warrant a traffic signal.

- Southbound Approach: Provide an exclusive left-turn lane and an exclusive right-turn lane. Provide the Pi`ilani Highway southbound right-turn as a free turning movement by providing an exclusive westbound receiving lane on Wailea Ike Drive. See **Figure 11**.

- Eastbound Approach: Provide two (2) exclusive left-turn lanes (with a protected left-turn signal phase) and an exclusive through lane. Refer to **Figure 11**.

- Westbound Approach: Provide an exclusive through lane, and an exclusive right-turn lane. Refer to **Figure 11**.

By Year 2022 or when Pi`ilani Highway is extended into Honua`ula:



Source: Austin, Tsutsumi & Associates, Inc.

Figure 9

Pi`ilani Highway Widening Project

Pi`ilani Highway/Okolani Drive/Mikioi Place Intersection

NOT TO SCALE

Prepared for: Honua`ula Partners, LLC, A&B Wailea LLC, Keaka LLC and ATC Makena Holdings LLC

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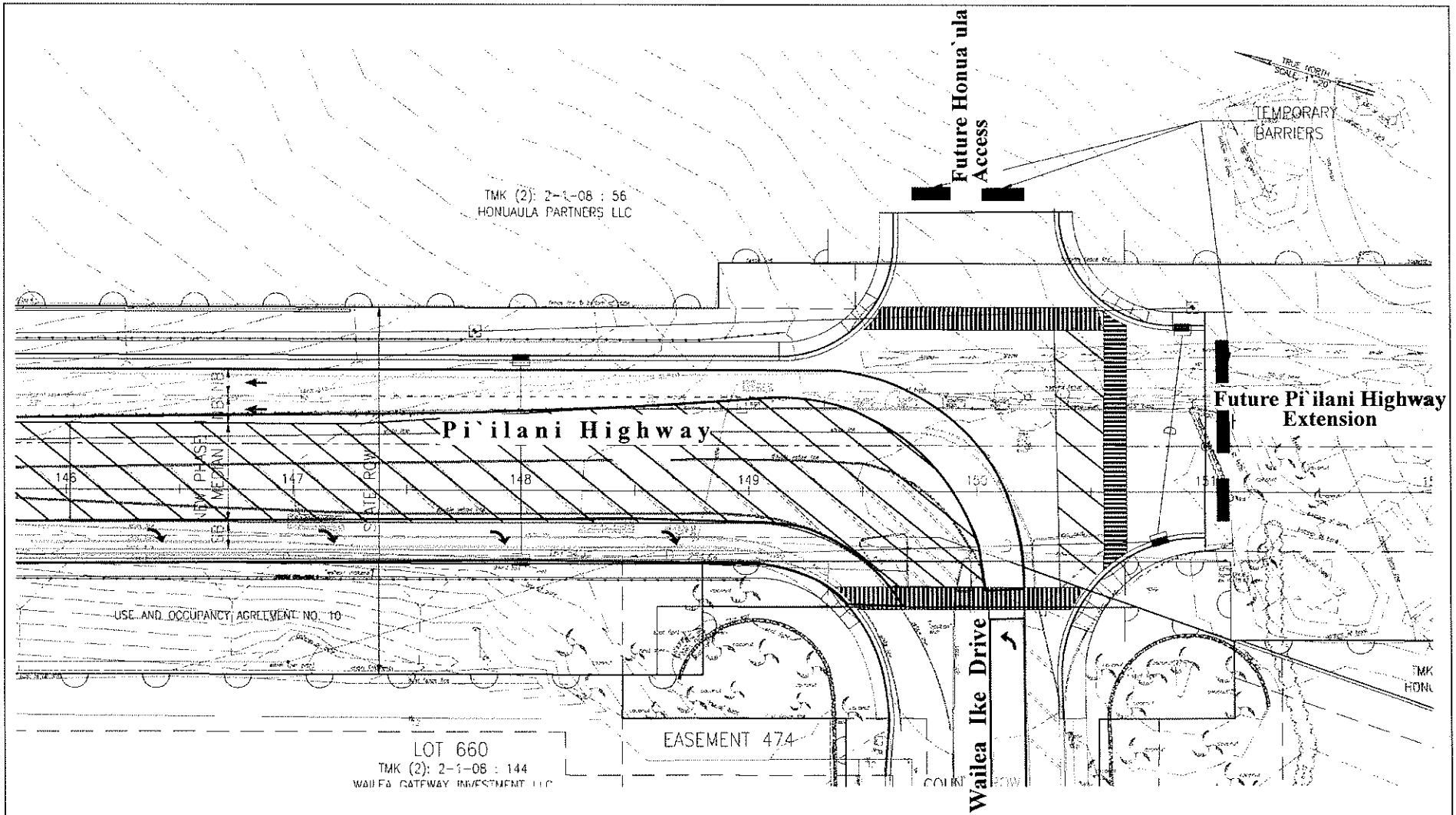

Source: Austin, Tsutsumi & Associates, Inc.

Figure 10 Pi`ilani Highway Widening Project

NOT TO SCALE

Pi`ilani Highway/Wailea Ike Drive Intersection - Phase 1

Prepared for: Honua`ula Partners, LLC, A&B Wailea LLC, Keaka LLC and ATC Makena Holdings LLC

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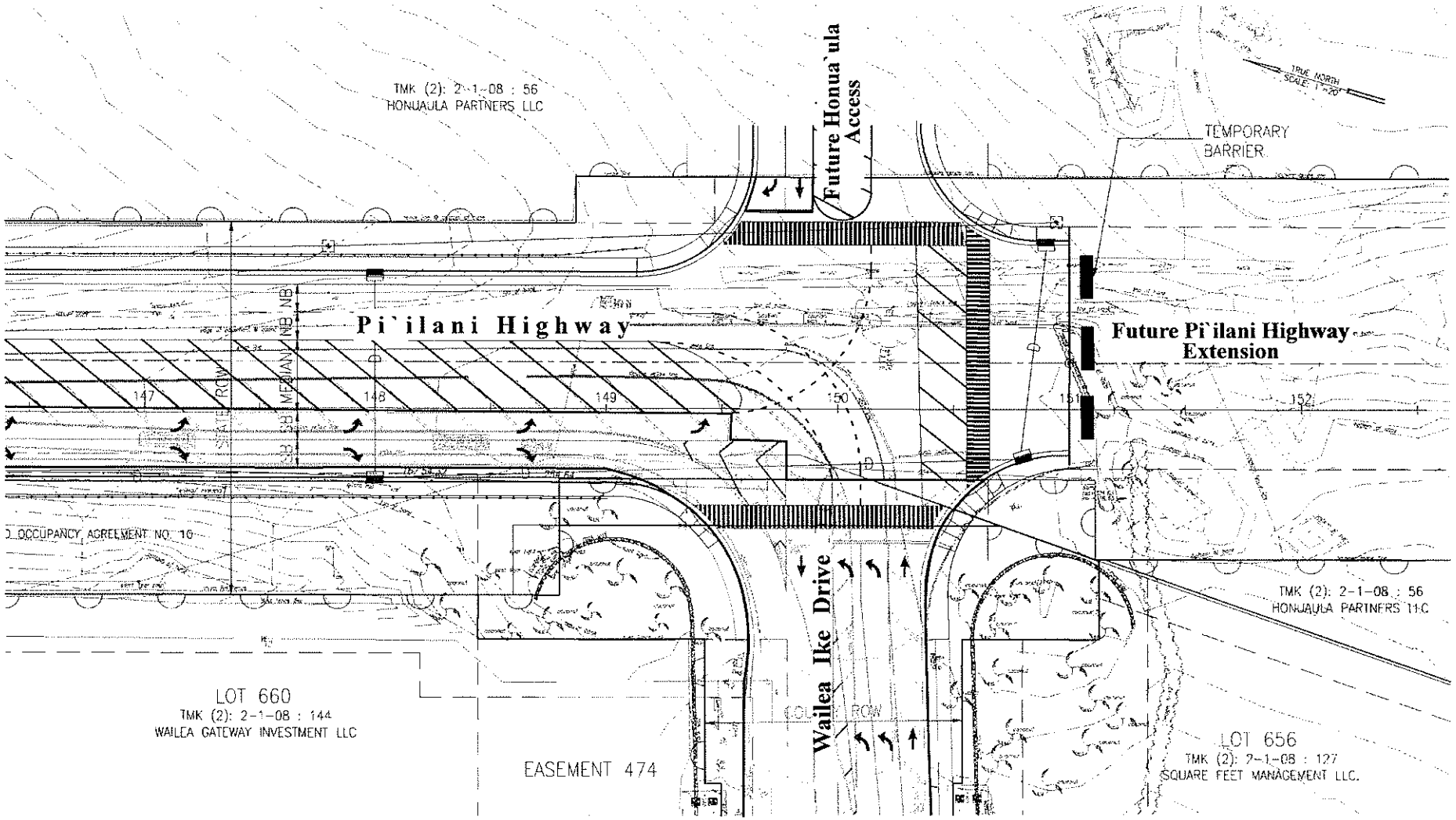
WCPT\PiilaniWidening\Phase1



Source: Austin, Tsutsumi & Associates, Inc.

Figure 11 Pi`ilani Highway Widening Project

NOT TO SCALE

Pi`ilani Highway/Wailea Ike Drive Intersection - Phase 2

Prepared for: Honua`ula Partners, LLC, A&B Wailea LLC, Keaka LLC and ATC Makena Holdings LLC

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WCPT\PiilaniWidening\Phase2

- Northbound Approach: Provide an exclusive left-turn lane (with a protected left-turn signal phase), two (2) exclusive through lanes, and an exclusive right-turn lane. See **Figure 12**.

- Southbound Approaches: Provide two (2) exclusive left-turn lanes (with a protected left-turn signal phase), an exclusive through lane, and an exclusive right-turn lane. Also, it is recommended that the Pi`ilani Highway southbound right-turn be a free turning movement by providing an exclusive westbound receiving lane on Wailea Ike Drive. Refer to **Figure 12**.

- Eastbound Approach: Provide two (2) exclusive left-turn lanes (with a protected left-turn signal phase) and a shared through/right-turn lane. Refer to **Figure 12**.

- Westbound Approach: Provide an exclusive left-turn lane (with a protected left-turn signal phase), an exclusive through lane, and an exclusive right-turn lane. Refer to **Figure 12**.

2. Bike Route System

a. Existing Conditions

The existing ten (10) foot shoulder along the outer edges of the existing Pi`ilani Highway roadway provides for a bicycle route from North Kihei Road to Wailea Ike Drive in the south, a distance of approximately seven (7) miles. This route is part of a Kihei-Wailea bike route system initiative started by the County in 1991 and designed to circumscribe Kihei by connecting with South Kihei Road and to provide cyclists safe access to Honoapi`ilani Highway via North Kihei Road. This bike route is also part of the SDOT's Bike Plan Master Plan.

b. Potential Impacts and Mitigation Measures

The widening of the Pi`ilani Highway to create two (2) additional lanes will include construction of a dedicated bike lane on the makai (west) side of the right-of-way and a shared shoulder/bike lane on the mauka (east) side which will provide safe access for bicyclists.

Source: Austin, Tsutsumi & Associates, Inc.

Figure 12

Pi`ilani Highway Widening Project

Pi`ilani Highway/Wailea Ike Drive Intersection - Phase 3

NOT TO SCALE

Prepared for: Honua`ula Partners, LLC, A&B Wailea LLC, Keaka LLC and ATC Makena Holdings LLC

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3. Water System

a. Existing Conditions

A Preliminary Engineering Report (PER) was completed by Austin, Tsutsumi & Associates on June 1, 2009. The Kihei-Makena region is served by the Central Maui Water System. The Central Maui Water System is served by the Iao Aquifer which includes the Mokuhau wells located in Wailuku. See **Appendix "J"**.

Two (2) segments of waterlines are located within the project corridor. The first segment is an existing 12-inch cast iron waterline which crosses Pi`ilani Highway north of Kilohana Drive/Mapu Place intersection. The second 12-inch waterline crosses Pi`ilani Highway south of Okolani Drive/Mikioi Place and branches off in the southerly direction within Wailea Resort. Refer to **Appendix "J"**.

b. Potential Impacts and Mitigation Measures

Two (2) segments of existing waterlines within the project corridor will need to be relocated as part of the widening work. A portion of the existing 12-inch cast iron waterline north of Kilohana Drive, which provides service to the Maui Meadows Subdivision, will need to be relocated to allow installation of the proposed drain lines. A portion of the existing 12-inch waterline south of Okolani Drive will also need to be relocated to allow installation of the proposed drainline and drain manholes. Refer to **Appendix "J"**.

4. Wastewater System

a. Existing Conditions

The service area for the County's Kihei Wastewater Reclamation System extends from North Kihei to Wailea. The system consists of a number of pump stations and force mains which convey wastewater through the County's transmission lines. The combined flows are transported to the Kihei Wastewater Reclamation Facility, which is located adjacent to the Elleair

Golf Course. The existing design capacity of the Kihei Wastewater Reclamation Facility is 8.0 million gallons per day (MGD). Refer to **Appendix "J"**.

b. Potential Impacts and Mitigation Measures

The proposed improvements are not expected to adversely impact the wastewater collection system and associated infrastructure.

If necessary, relocation or adjustment to wastewater system improvements will be coordinated with the Department of Environmental Management. Refer to **Appendix "J"**.

5. Drainage

a. Existing Conditions

The PER evaluated the existing and future drainage for the project. Refer to **Appendix "J"**. According to the PER, the Kihei watershed is on the western slope of Mount Haleakala on a curved band that extends from North Kihei to approximately eight (8) miles to the south in Wailea. The mountain slopes in this watershed are drained by 32 gulches, ravines, and gullies. There are well defined watercourses which flow in a westerly direction traversing Pi`ilani Highway at various points.

There are nine (9) existing culvert crossings spanning the section of Pi`ilani Highway within the project corridor. The culverts were designed based on a 50-year, 1-hour storm recurrence interval in accordance with SDOT Design Criteria for Highway Drainage dated May 15, 2006. Existing culvert capacity and drainage calculations are based on a drainage report titled "Hydrology Report for Pi`ilani Highway" (1977), prepared by Trans-Meridian Engineers & Surveyors, Inc. for the SDOT Highways Division. Currently, the roadway drainage systems consist of concrete swales, curb/gutter, catch basins/grated drain inlets and 24-inch diameter drain pipes at certain segments of the highway, primarily in the vicinity of the three (3) affected intersections. These systems drain to the existing culverts and then to the gulches. No retention systems currently exist within the project corridor. Offsite flows are

currently intercepted by a concrete drainage ditch located along the eastern boundary of the project corridor and are conveyed to the existing culverts. Existing flows within the project limits were calculated to be approximately 65.2 cubic feet per second (cfs) based on a 25-year, 1-hour storm recurrence interval in accordance with SDOT Design Criteria for Highway Drainage (2006). Refer to **Appendix "J"**.

b. Potential Impacts and Mitigation Measures

The project will require excavation and embankment in order to widen the existing highway. These areas will be graded to maintain the existing highway grades and south to north drainage pattern. Retaining walls will be required in order to attain the proposed roadway grades.

Offsite runoff mauka of the project corridor will be intercepted by concrete trapezoidal ditches located within the mauka boundary of the project corridor, in the same manner as the existing concrete interceptor ditches. The offsite runoff will be conveyed into the existing culverts using the same drainage routing concept as existing conditions.

The proposed widening improvements will increase the impervious surfaces by approximately 5.8 acres, thus increasing the post-development runoff rates from approximately 65.2 cfs (existing) to approximately 76.8 cfs (proposed), a difference of 11.6 cfs.

Proposed onsite drainage system improvements will include grated drain inlets, catch basins, manholes, underground drainlines, surface retention basins and subsurface retention systems, and extension of existing culverts and construction of new inlet and outlet structures to accommodate the widened road section. The 11.6 cfs increase in runoff will be retained via the surface retention systems in accordance with SDOT Storm Water Permanent Best Management Practices Manual (2007). Coordination with the Army Corp of Engineers, Department of Health and Department of Land and Natural Resources will be undertaken during the planning and design of the project to address applicable additional permitting requirements for the culvert modification work.

In addition to reducing peak flow rates, the proposed stormwater system will reduce the discharge of pollutants to the maximum extent practicable in accordance with the SDOT Storm Water Permanent Best Management Practices Manual (2007).

SDOT Design Criteria for Highway Drainage (2006) and SDOT Storm Water Permanent Best Management Practices Manual (2007) requires retention of the increase in storm water runoff between the post-development flows and pre-development flows and retention of the water quality design volume. The project storm water management plan and drainage system will be designed to meet these standards.

A National Pollutant Discharge Elimination System (NPDES) permit for discharge of stormwater associated with construction activities will be obtained and the requirements of the approved NPDES permit and Best Management Practices (BMPs) plan will be adhered to during construction. At a minimum silt fences, diversion berms, gravel egress, truck wash down areas and dust screens will be included in the BMP plan for the project. Monitoring of the BMPs during construction will be the responsibility of the selected contractor with general oversight by SDOT or their designated representative. Refer to **Appendix "J"**.

6. Electrical, Telephone and Cable Television Systems

a. Existing Conditions

Electrical, telephone, and cable television (CATV) services in the Kihei-Wailea-Makena area are provided by Maui Electric Company, Hawaiian Telcom, and Oceanic Time Warner Cable, respectively. Refer to **Appendix "J"**.

b. Potential Impacts and Mitigation Measures

Relocation of poles, utility boxes and transmission lines will be a necessary component of the project. This work will be coordinated with Maui Electric Company, Hawaiian Telcom and Oceanic Time Warner Cable, as necessary. The proposed project is not anticipated to adversely impact electric, telephone, and CATV services. Refer to **Appendix "J"**.

E. CUMULATIVE AND SECONDARY IMPACTS

Cumulative impacts are defined as impacts on the environment which result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions.

The proposed project is to construct needed roadway infrastructure to keep pace with existing development and future growth planned for the Kihei-Makena region. In particular, the proposed action is considered an appropriate mitigation measure to address traffic impacts associated with Honua`ula, Makena Resort and Wailea Resort projects. There are no other infrastructure projects anticipated within the project context. The scope of the proposed project is limited to the construction of the Pi`ilani Highway road widening.

Secondary impacts are those which have the potential to occur later in time or farther in distance, but are still reasonably foreseeable. They can be viewed as actions of others that are taken because of the presence of the project. The secondary impacts associated with the proposed action relates to the future implementation of land uses for Honua`ula, Makena Resort, and Wailea Resort. Such impacts relate to infrastructure requirements, as well as public service and environmental elements which may be affected by new development in these areas. Each project, Honua`ula, Makena Resort, and Wailea Resort, however, is master planned and will be implemented in a phased and orderly fashion which ensures concurrent development of infrastructures and service systems, including the proposed Pi`ilani Highway widening project. Conditions of zoning, as well as conditions of Special Management Area (SMA) Permit approvals for those actions falling within the SMA, support the notion that applicable mitigation measures must be addressed prior to or concurrent with each phase of project development. In this regard, there are no secondary impacts associated with the Pi`ilani Highway Widening project which are considered adverse in the context of regulatory and statutory requirements, and common practice mitigation measures.

III. RELATIONSHIP TO LAND USE PLANS, POLICIES, AND CONTROLS

III. RELATIONSHIP TO LAND USE PLANS, POLICIES, AND CONTROLS

A. STATE LAND USE DISTRICTS

Chapter 205, Revised Statutes, relating to the Land Use Commission, establishes the four (4) major Land Use Districts in which all lands in the State are placed. The Districts are classified "Urban", "Rural", "Agricultural", and "Conservation". The project corridor traverses lands located along the "Urban", "Agricultural" and "Rural" districts. See **Figure 13**. Public roadways are permissible within these districts.

B. STATE PLAN

Chapter 226, HRS, also known as the State Plan, is a long-range comprehensive plan which serves as a guide for the future long-range development of the State by identifying goals, objectives, policies, and priorities, as well as implementation mechanisms. The objectives and policies which contribute to the implementation rationale for the proposed project include the following:

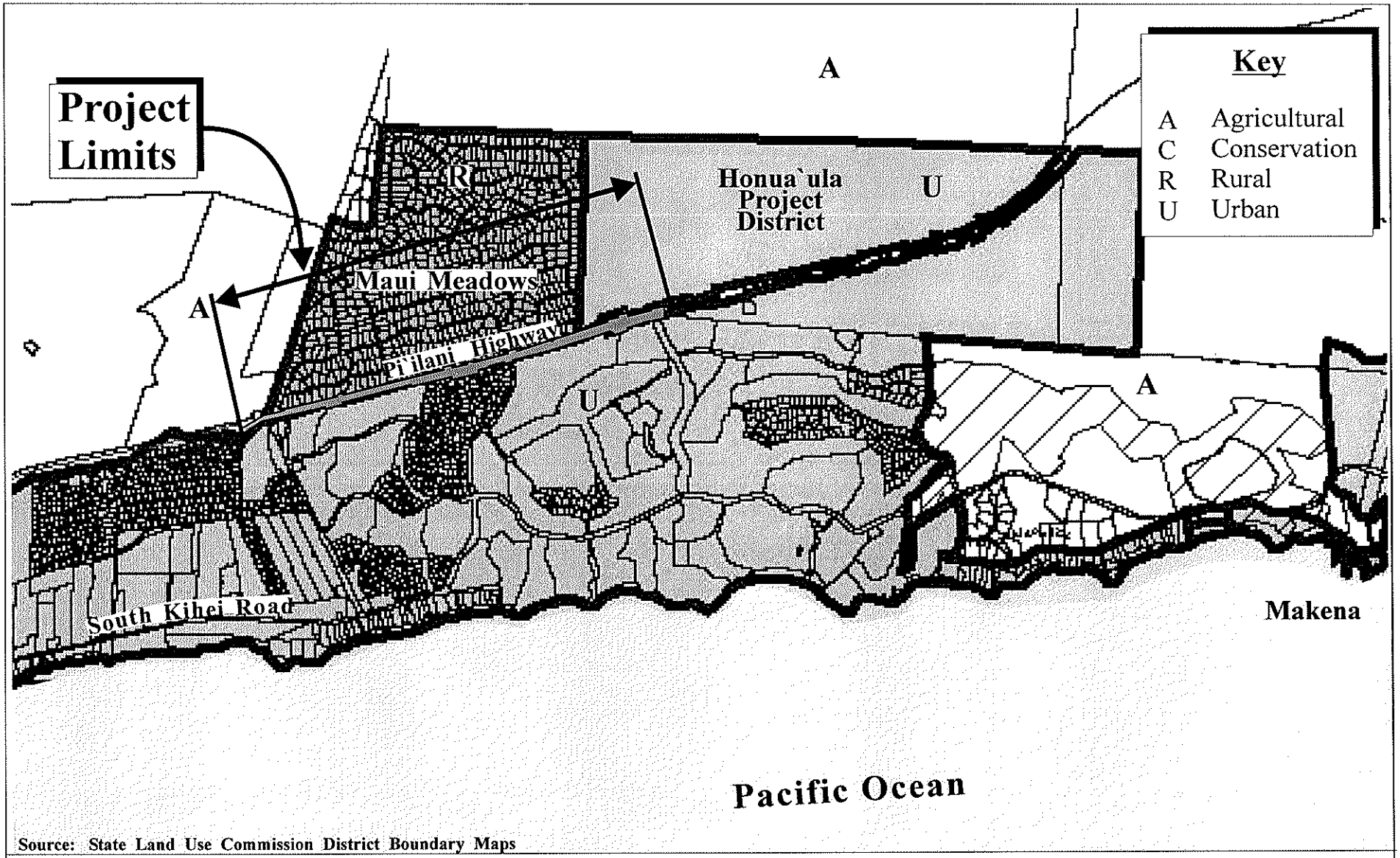
Sec. 226-14 Objective and policies for facility systems - in general.

Objective (a) Planning for the State's facility systems in general shall be directed towards achievement of the objective of water, transportation, waste disposal, and energy and telecommunication systems that support statewide social, economic, and physical objectives.

Policy (b) (1) Accommodate the needs of Hawaii's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans.

Sec. 226-17 Objectives and policies for facility systems - transportation.

Policy (b) (2) Coordinate state, county, federal, and private transportation activities and programs toward the achievement of statewide objectives.



Source: State Land Use Commission District Boundary Maps

Figure 13

Pi`ilani Highway Widening Project

State Land Use District Classification

NOT TO SCALE

Prepared for: Honua`ula Partners, LLC, A&B Wailea LLC, Keaka LLC and ATC Makena Holdings LLC

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Policy (b) (6) Encourage transportation systems that serve to accommodate present and future development needs of communities.

Policy (b) (10) Encourage the design and development of transportation systems sensitive to the needs of affected communities and the quality of Hawaii's natural environment.

The proposed project will promote the public health and safety by providing roadway sections which accommodate vehicles and pedestrians in keeping with current design and safety standards.

C. TRANSPORTATION STUDIES

The proposed project supports the long range traffic implementation plan for SDOT identified in the Kihei Traffic Master Plan, October 1996 and the County of Maui Long-Range Land Transportation Plan, Final Report, February 1997, both published in cooperation with County of Maui, Department of Public Works and Waste Management (DPWWM) and County of Maui, Planning Department. In these reports, implementation of a plan to widen the Pi`ilani Highway from two (2) to four (4) lanes in Kihei from Mokulele Highway to Wailea was identified. The Kihei Traffic Master Plan Study, September 2003, prepared for the County of Maui, DPWWM also identifies widening of Pi`ilani Highway from two (2) to four (4) lanes.

D. MAUI COUNTY GENERAL PLAN

As stated in the County of Maui Charter, the purpose of the general plan shall be to:

> *"... indicate desired population and physical development patterns for each island and region within the County; shall address the unique problems and needs of each island and region; shall explain the opportunities and the social, economic, and environmental consequences related to potential developments; and shall set forth the desired sequence, patterns, and characteristics of future developments. The General Plan shall identify objectives to be achieved, and priorities, policies, and implementing actions to be pursued with respect to population density, land use maps, land use regulations, transportation systems, public and community facility locations, water and sewage systems, visitor destinations, urban design, and other matters related to development."*

Chapter 2.80B of the Maui County Code, relating to the General Plan and Community Plans, implements the foregoing Charter provision through enabling legislation which calls for a Countywide Policy Plan and a Maui Island Plan. The Countywide Policy Plan was adopted as Ordinance No. 3732 on March 24, 2010. The Maui Island Plan is currently in the process of review and formulation by the Maui County Council.

With regard to the Countywide Policy Plan, Section 2.80B.030 of the Maui County Code states the following.

> The countywide policy plan shall provide broad policies and objectives which portray the desired direction of the County's future. The countywide policy plan shall include:
>
> 1. A vision for the County;
> 2. A statement of core themes or principles for the County; and
> 3. A list of countywide objectives and policies for population, land use, the environment, the economy, and housing.

Core principles set forth in the Countywide Policy Plan are listed as follows:

1. Excellence in the stewardship of the natural environment and cultural resources;
2. Compassion for and understanding of others;
3. Respect for diversity;
4. Engagement and empowerment of Maui County residents;
5. Honor for all cultural traditions and histories;
6. Consideration of the contributions of past generations as well as the needs of future generations;
7. Commitment to self-sufficiency;
8. Wisdom and balance in decision making;
9. Thoughtful, island appropriate innovation; and
10. Nurturance of the health and well-being of our families and our communities.

Congruent with these core principles, the Countywide Policy Plan identifies goals, objectives, policies and implementing actions for pertinent functional planning categories, which are identified as follows:

1. Natural environment
2. Local cultures and traditions
3. Education
4. Social and healthcare services
5. Housing opportunities for residents
6. Local economy
7. Parks and public facilities
8. Transportation options
9. Physical infrastructure
10. Sustainable land use and growth management
11. Good governance

With respect to the Pi`ilani Highway Widening Project, the following goals, objectives, policies and implementing actions are illustrative of the project's compliance with the Countywide Policy Plan.

DIVERSIFY TRANSPORTATION OPTIONS

Goal: Maui County will have an efficient, economical, and environmentally sensitive means of moving people and goods.

Objective:

Provide an effective, affordable, and convenient ground-transportation system that is environmentally sustainable.

Policies:

Execute planning strategies to reduce traffic congestion.

Ensure that roadway systems are safe, efficient, and maintained in good condition.

Preserve roadway corridors that have historic, scenic, or unique physical attributes that enhance the character and scenic resources of communities.

Design new roads and roadway improvements to retain and enhance the existing character and scenic resources of the communities through which they pass.

Objective:

Improve and expand the planning and management of transportation systems.

Policies:

Require new developments to contribute their pro rata share of local and regional infrastructure costs.

In summary, the Pi`ilani Highway Widening Project is consistent with the themes and principles of the Countywide Policy Plan.

E. KIHEI-MAKENA COMMUNITY PLAN (1998)

The project corridor is located in the Kihei-Makena Community Plan region which is one (1) of nine (9) Community Plan regions established in the County of Maui. Planning for each region is guided by the respective Community Plans, which are designed to implement the Maui County General Plan. Each Community Plan contains recommendations and standards which guide the sequencing, patterns and characteristics of future development in the region.

The lands adjoining the project corridor include the following uses identified by the Community Plan land use map: Single Family and Multi-Family Residential (SF, MF), Project District (PD), Business (B), Public (P), Agriculture (AG), Rural (R), and Open Space

(OS). See **Figure 14**.

1. Community Plan Theme

In 1998, the County of Maui completed its comprehensive update of the Kihei-Makena Community Plan. One of the underlying themes which provides the basis or rationale affecting a broad spectrum of functional areas is the "provision of needed public facilities and infrastructure". The plan states:

> *"The County of Maui in general, and Kihei-Makena in particular, witnessed significant growth in the 1980s and early 1990s. In many instances, however, public facility and infrastructure improvements lagged behind development in the region. As such, a significant upgrade and expansion of existing public facilities and infrastructure is necessary."*

The proposed improvements to the Pi`ilani Highway is supportive of this basic theme and will help upgrade the transportation infrastructure in the Kihei-Makena area prior to development of Honua`ula and ongoing development in Wailea Resort and Makena Resort.

2. Community Plan Land Use Goal

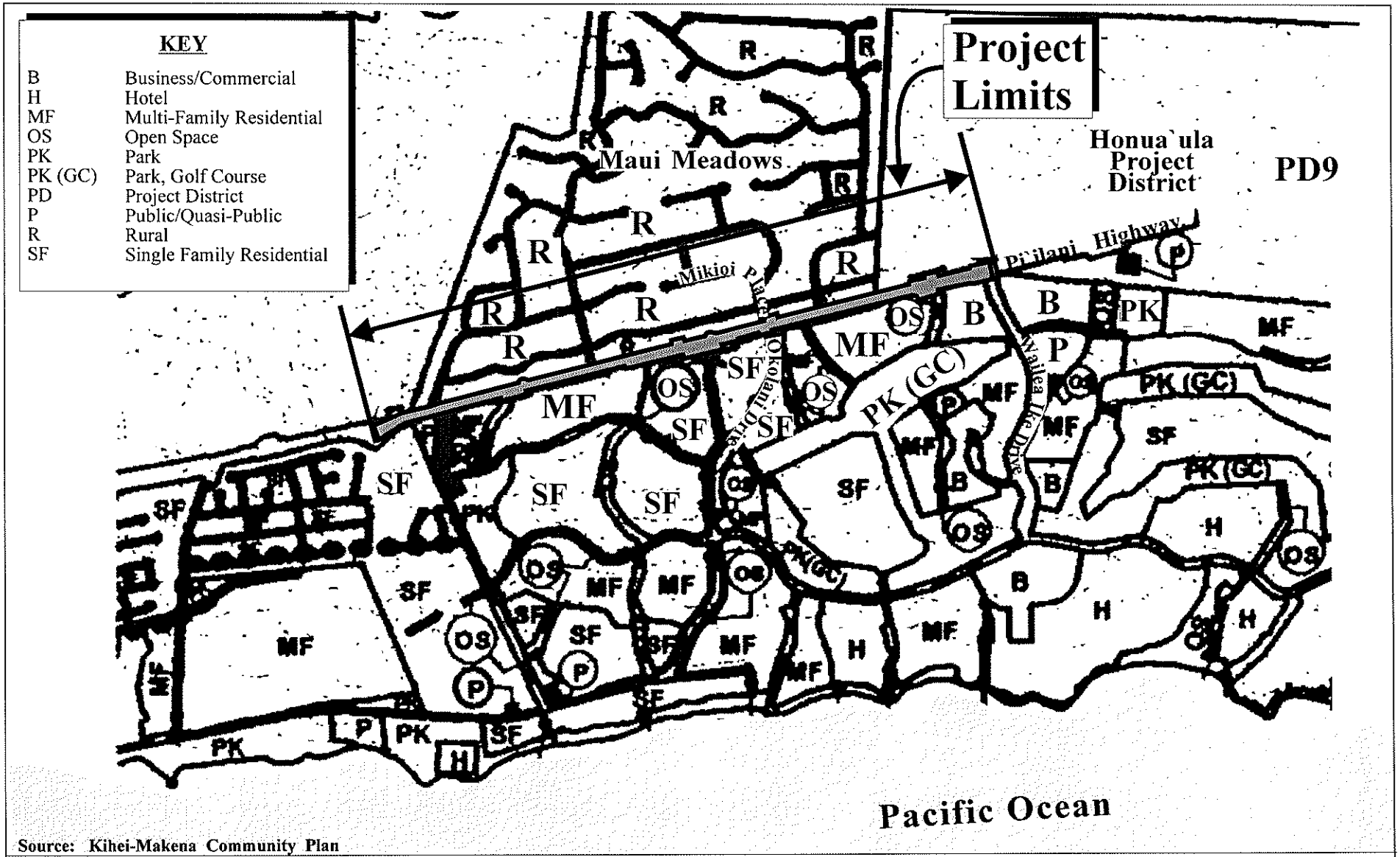
A goal in the Community Plan related to land use states:

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

The Pi`ilani Highway widening project is considered a response to this goal by providing timely transportation infrastructure to address community needs.

3. Transportation Objectives and Policies

Further, the transportation objectives and policies of the community plan, include the following:



Source: Kihei-Makena Community Plan

Figure 14 Pi`ilani Highway Widening Project

Kihei-Makena Community Plan Designation Map

NOT TO SCALE

Prepared for: Honua`ula Partners, LLC, A&B Wailea LLC, Keaka LLC and ATC Makena Holdings LLC

MUNEKIYO & HIRAGA, INC.

WCPT\PiilaniWidening\CPLUD

- Undertake transportation system improvements concurrently with planned growth of the Kihei-Makena region. Require adequate interregional highway capacity, including the widening of Pi`ilani and Mokulele Highways to four (4) lanes, prior to the construction of major projects south of Kilohana Road or mauka of Pi`ilani Highway.

- Encourage joint public/private participation in the planning, design and construction of roadway improvements, especially those identified in this plan.

The proposed project implements the transportation objectives and policies by widening the last segment of Pi`ilani Highway to four (4) lanes, prior to planned development of Honua`ula, as well as future developments in Wailea and Makena Resorts. Further, the planning, design and construction of the roadway is a joint public/private effort in which Honua`ula Partners, LLC, A&B Wailea LLC, Keaka LLC, and ATC Makena Holdings LLC in coordination with SDOT and will plan, design and construct the Pi`ilani Highway widening improvements as recommended in the community plan.

4. Community Plan Implementing Actions

Three (3) transportation implementing actions set out in the Kihei-Makena Community Plan are:

1. Widen Pi`ilani Highway, between Mokulele Highway and Wailea Ike Drive, to four (4) lanes;

2. Provide clear signage with adequate lighting along Pi`ilani Highway to indicate Kihei access points; and

3. Provide left turn storage lanes and acceleration/deceleration lanes on Pi`ilani Highway, and traffic signals at important intersections along South Kihei Road.

The proposed project supports these implementing actions.

F. COUNTY ZONING

Both Kihei Land Zoning Map No. 5 and Wailea Land Zoning Map No. 511 delineates Pi`ilani Highway from Kilohana Drive to Wailea Ike Drive as a parallel roadway to South

Kihei Road. Pursuant to Chapter 19, Maui County Code, 1980 as amended, roadways are permitted in all zoning districts.

G. COASTAL ZONE MANAGEMENT OBJECTIVES AND POLICIES

According to the County of Maui, Department of Planning, the boundary of the Special Management Area (SMA) is the makai boundary of the highway right-of-way. Improvements within the Pi`ilani Highway ROW is outside of the SMA. Incidental work makai of the highway ROW is located within the SMA. This section addresses the project's relationship to applicable coastal zone management considerations, as set forth in Chapter 205A and the Rules and Regulations of the Maui Planning Commission. SMA clearance will be obtained prior to initiation of construction.

(1) Recreational Resources

Objective:

Provide coastal recreational opportunities accessible to the public.

Policies:

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

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

(i) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;

(ii) Requiring replacement of coastal resources having significant recreational value including, but not limited to, surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the state for recreation when replacement is not feasible or desirable;

(iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;

(iv) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

(v) Ensuring public recreational uses of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;

(vi) Adopting water quality standards and regulating point and non-point sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;

(vii) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and

(viii) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting such dedication against the requirements of Section 46-6, HRS.

Response: The proposed action is not anticipated to affect existing coastal recreational resources. Access to the shoreline areas will remain unaffected by the proposed roadway improvements.

(2) Historic Resources

Objective:

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

Policies:

(A) Identify and analyze significant archeological resources;

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

(C) Support state goals for protection, restoration, interpretation, and display of

historic resources.

Response: Work will be confined to the existing highway ROW within the project corridor and adjacent previously disturbed lands. An archaeological monitoring plan will be submitted to SHPD and an archaeological monitor will be present during ground altering activities. As a result, the proposed project will not affect historic resources.

(3) **Scenic and Open Space Resources**

Objective:

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

Policies:

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

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

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

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

Response: The proposed project is not expected to impact coastal and scenic open space resources. Sound walls on the makai (west) side of Pi`ilani Highway are limited to the Kilohana Drive/Mapu Place/Pi`ilani Highway intersection and retaining walls due to the higher grades along the makai boundary of the highway corridor. Due to the higher grades of the makai properties views along the project corridor are limited until Pi`ilani Highway's southern terminus at Wailea Ike Drive. The project corridor in the southern terminus is higher than the makai properties. Vertical development in this area is limited to retaining walls below the highway grade and guard rails. Views at the southern terminus will not be affected by the road widening project.

(4) **Coastal Ecosystems**

Objective:

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

Policies:

(A) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;

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

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

(D) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and

(E) Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.

Response: The proposed roadway improvements are not expected to adversely impact coastal ecosystems.

(5) **Economic Uses**

Objective:

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

Policies:

(A) Concentrate coastal dependent development in appropriate areas;

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

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

(i) Use of presently designated locations is not feasible;

(ii) Adverse environmental effects are minimized; and

(iii) The development is important to the State's economy.

Response: The project will support short-term construction and construction-related jobs. The project corridor does not affect coastal development necessary to the State's economy.

(6) Coastal Hazards

Objective:

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

Policies:

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

(B) Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint pollution hazards;

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

(D) Prevent coastal flooding from inland projects.

Response: The project corridor is located within Zone "X", areas determined to be outside the 0.2 percent annual chance floodplain of minimal flooding. It is noted that

changes in drainage patterns are not anticipated with the construction of the proposed improvements and no adverse drainage impacts to surrounding properties are anticipated.

(7) **Managing Development**

Objective:

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

Policies:

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

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

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

Response: The proposed project shall be reviewed and processed pursuant to Chapter 343, Revised Statutes (HRS). Public review will be coordinated through this process. A public informational meeting was held at the Kihei Community Center on April 16, 2009. Although the Wailea Community Association, Kihei Community Association, and Maui Meadows Homeowners Association were invited, no one attended the community information meeting. See **Appendix "K"**.

(8) **Public Participation**

Objective:

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

Policies:

(A) Promote public involvement in coastal zone management processes;

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

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

Response: As noted above, opportunity for public awareness, education and participation pertaining to significant resource attributes of the coastal zone is provided through Chapter 343, HRS procedures.

(9) Beach Protection

Objective:

Protect beaches for public use and recreation.

Policies:

(A) Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion;

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

(C) Minimize the construction of public erosion-protection structures seaward of the shoreline.

Response: The proposed project will not impact shoreline activities. No adverse impact to beach processes is anticipated.

(10) Marine Resources

Objective:

Promote the protection, use, and development of marine and coastal resources to assure their sustainability.

Policies:

(A) Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;

(B) Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;

(C) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;

(D) Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and

(E) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

Response: The improvements proposed for Pi`ilani Highway will not adversely impact ocean resources. Construction activities will be limited to the existing highway ROW.

In addition to the foregoing objectives and policies, SMA permit review criteria pursuant to Act 224 (2005) provides that:

> *No special management area use permit or special management area minor permit shall be granted for structures that allow artificial light from floodlights, uplights, or spotlights used for decorative or aesthetic purposes when the light:*

(1) Directly illuminates the shoreline and ocean waters; or

(2) Is directed to travel across property boundaries toward the shoreline and ocean waters.

Response: The proposed project is not located on or near the shoreline. The preliminary plans for the project will be designed to ensure that any relocated light fixtures are not directed across property boundaries towards the shoreline. To the extent practicable, efforts will be made to shield any relocated light fixtures.

IV. ALTERNATIVES TO THE PROPOSED ACTION

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A. PREFERRED ALTERNATIVE

The proposed project represents the preferred alternative. The widening and related improvements to intersections will improve vehicular traffic flow along the 1.44-mile segment of Pi`ilani Highway north of Kilohana Drive to Wailea Ike Drive in Kihei. The proposed improvements will accommodate present and future traffic flows along the project corridor.

B. CONTRAFLOW ALTERNATIVE

A "contraflow" alternative would include restriping the highway to three (3) lanes and reversing the flow in the third lane during the peak period. This alternative would require that the added lane be provided northbound in the AM peak period and southbound in the PM peak period. Widening to provide two (2) through lanes across each signalized intersection would still be required and merging areas would be needed. Adequate traffic control through merging areas during contraflow operations would be difficult to achieve.

C. IMPROVING ALTERNATE ROADWAYS

The Pi`ilani Highway in the project corridor is a two-lane arterial roadway that provides regional mobility to the Kihei-Wailea-Makena areas. Another north-south access in the area is provided by South Kihei Road. This road is largely a two-lane collector road providing north-south mobility and property access within the Kihei community. Regionally, the North-South Collector Road (aka Liloa Drive) has been an integral part of Kihei planning, however, it has been implemented incrementally as development warrants and is not yet completed.

Widening South Kihei Road to accommodate more traffic to lessen the volume on Pi`ilani Highway is an alternative that would have considerably greater impacts and costs due to the urban and commercial build up along this roadway. Additionally, as a collector facility,

improvements to South Kihei Road would not replace or improve Pi`ilani Highway's arterial function to Wailea Ike Drive.

D. NEW HIGHWAY ALIGNMENT ALTERNATIVE

This alternative would involve a new highway alignment mauka of the existing Pi`ilani Highway. The transportation planning process includes many tiers of evaluation, including regional plans (Maui Long Range Transportation Plan, 1997), sub-regional plans (Kihei Traffic Master Plan, 1996) and project plans, such as the current effort for Pi`ilani Highway. Each tier narrows the scope and each subsequent tier builds upon information from the studies of the broader area. The timeframe associated with a new highway alignment is beyond the regional and sub-regional plans which identified projects for implementation to the year 2022. From a planning and evaluation process perspective, consideration of a new highway alignment is not deemed a prudent alternative in light of the current capacity constraints which require a timely response as provided by the proposed action.

E. NO ACTION ALTERNATIVE

In light of the established need for the proposed improvements, the "no action alternative" does not represent a responsible option toward improving traffic circulation for the Kihei-Wailea-Makena area since traffic flow and circulation requirements will persist. It is noted that the public/private partnership opportunity for planning, design and construction would be removed under this alternative.

F. DEFERRED ACTION ALTERNATIVE

A "deferred action" alternative will have similar consequences as a "no action" alternative as problems relating to traffic congestion will continue to persist and potentially increase. Deferring the development of the proposed improvements may also result in higher implementation costs in the future due to inflation.

V. SUMMARY OF ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

V. SUMMARY OF ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

The proposed project will result in impacts as described in Chapter III, Potential Impacts and Mitigation Measures.

Potential effects include noise-generated impacts occurring from construction activities. In addition, impacts will result in increased traffic congestion during construction. These impacts will be temporary and not expected to create long-term adverse environmental effects.

In the long term, traffic noise levels will increase as a result of increased traffic along the project corridor. This increase in traffic is expected to occur with or without the project. With the project, predicted increases in future traffic noise levels between 2016 and 2022 can be mitigated through the construction of sound walls, in accordance with HDOT's June 1997 Noise Analysis and Abatement Policy.

Further, with Pi`ilani Highway widened to four (4) lanes in the year 2016, the air quality study indicates that overall emissions from vehicular traffic will decrease with the improvements and the project is expected to provide a positive impact on air quality.

The proposed project is intended to improve roadway operating conditions along Pi`ilani Highway and improve the flow of traffic from the intersection at Kilohana Drive to Wailea Ike Drive. From a long-term perspective, there are no significant adverse environmental effects anticipated which cannot be mitigated as a result of the proposed highway improvements.

VI. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

VI. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The design and implementation of the proposed Pi`ilani Highway Widening Project will involve the commitment of certain material and fiscal resources required to maintain the improvements. The future commitment of resources for the project is consistent with the need to provide an appropriate level of transportation service for the region. Impacts relating to the use of these resources should be weighed against the expected positive benefits to be derived from the project versus the consequences of taking no action.

VII. FINDINGS AND CONCLUSIONS

VII. FINDINGS AND CONCLUSIONS

The portion of Pi`ilani Highway in the project corridor is currently a two-lane arterial roadway under the jurisdiction of the State of Hawaii . The proposed project will involve the construction of two (2) additional travel lanes and related improvements to an approximately 1.44 mile segment of Pi`ilani Highway that extends from Kilohana Drive in the north to Wailea Ike Drive in the south. The proposed project will enhance accessibility and traffic circulation in the area. The proposed improvements will be conducted within the roadway's existing ROW.

Since the proposed action is on State and County lands, an Environmental Assessment (EA) has been prepared pursuant to Chapter 343, Revised Statutes (HRS), and Chapter 200 of Title 11, Administrative Rules of the State Department of Health.

Every phase of the proposed action, expected consequences, both primary and secondary, and the cumulative as well as the short-term and long-term effects of the action have been evaluated in accordance with the Significance Criteria of Section 11-200-12 of the Administrative Rules. Based on the analysis, the proposed project is not anticipated to result in any significant impacts. Discussion of project conformance to the criteria is noted as follows:

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

   Flora occupying undeveloped parcels bordering the project corridor generally consists of kiawe, koa haole, buffelgrass and scrub vegetation, while developed properties are vegetated with landscaping typical of single-family and multi-family residential developments and ornamental landscaping, such as hibiscus and palms. No wetlands will be impacted by the proposed action. No threatened or endangered species are located within the project corridor. Recommendations of the Biological Study and USFWS will be implemented to mitigate any impacts on the tree tobacco which is a known habitat of the Blackburn's Sphinx moth.

   From an archaeological standpoint, the lands underlying and immediately surrounding the project corridor have been previously altered by existing development of the highway. The proposed work will be carried out within the existing ROW. An archaeological monitoring plan will be submitted to SHPD for

review and approval prior to construction. An onsite archaeologist will monitor construction activity to ensure the proposed project will not adversely impact archaeological resources.

The area in the vicinity of the project corridor has not been used for cultural gatherings, nor has it been cultivated using traditional Hawaiian practices. The proposed project is not anticipated to adversely impact cultural resources.

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

The roadway segment encompassed by the proposed project traverses lands which are designated for urban and rural uses. The proposed action is not anticipated to have a significant effect on beneficial uses of the environment.

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

The State Environmental Policy and Guidelines are set forth in Chapter 344, HRS. The proposed action is in consonance with the following policies and guidelines:

Environmental Policy:

Enhance the quality of life by:

(A) Establishing communities which provide a sense of identity, wise use of land, efficient transportation, and aesthetic and social satisfaction in harmony with the natural environment which is uniquely Hawaiian.

Guidelines:

Transportation:

(A) Encourage transportation systems in harmony with the lifestyle of the people and environment of the State.

4. **Substantially affects the economic welfare, social welfare, and cultural practices of the community or State.**

The proposed project will directly benefit the local economy by providing construction and construction-related employment. The proposed project will also have a beneficial effect upon the socio-economic fabric of the community by providing for the safe, convenient and efficient movement of traffic in the Kihei-Wailea-Makena area. By improving roadway conditions, the proposed project will promote the public welfare by providing vehicular facilities which meet current design and safety standards.

5. **Substantially affects public health.**

No adverse impacts to the public's health and welfare are anticipated. Suitable mitigation measures will be implemented to address anticipated noise impacts in the area, resulting from the proposed improvements. Further, it is anticipated that the proposed improvements will enhance traffic flow through the corridor which should reduce fumes from idling vehicles. The improvements are expected to have a positive long-term impact on air quality.

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

No significant population changes are anticipated as a result of the proposed project. The project involves the provision of additional travel lanes and related intersection modifications to improve the level of service along the 1.44 mile section of the Pi`ilani Highway from Kilohana Drive in the north to Wailea Ike Drive in the south.

As necessary, Honua`ula Partners, LLC in conjunction with the SDOT will coordinate the relocation of improvements (e.g., waterlines, utility poles) with the appropriate agencies and utility companies to ensure that the proposed road widening activities do not impact their facilities.

The improvements would increase the handling capacity of Pi`ilani Highway and provide the necessary transportation infrastructure for the orderly accommodation of near-term traffic projections for the Kihei-Wailea-Makena area.

Stormwater drainage patterns will not be affected by the proposed project and there

will be no impact to the drainage system that currently serves the project corridor. In addition, the proposed project is not anticipated to have any adverse impacts upon public services and facilities.

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

Construction activities will create temporary short-term nuisances related to noise and dust. Appropriate dust control and noise mitigation measures will be implemented by the contractor to ensure that fugitive dust and noise generated in connection with construction is minimized. As previously noted, noise mitigation measures have also been incorporated into the project scope.

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

The proposed action is part of the SDOT's ongoing effort to upgrade roadways to accommodate current and future vehicular traffic requirements. This action is not expected to result in significant environmental effects as project-related work will be carried out within the existing highway ROW, except for minor ancillary improvements, such as sidewalks, guard rails, and underground utilities.

It is noted that voluntary funding participants for the proposed action include private landowners with plans for future development in the Wailea-Makena subregion. The landowners, Honua`ula Partners, LLC, A&B Wailea LLC (owner of the Wailea Resort lands), Keaka LLC, and ATC Makena Holdings LLC (owner of Makena Resort lands), have plans which have development schedules spanning a number of years. Traffic volumes generated by new developments within these project areas will be accommodated by the proposed Pi`ilani Highway improvements. The project in itself is not a master planned component of the Honua`ula, Wailea Resort and Makena Resort projects. The intent of the proposed widening project is to address current and future capacity constraints attributed to traffic generated within the greater Kihei-Makena region and beyond. In this context, the proposed action is not considered to be a part of a larger action.

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

Rare, threatened or endangered species of flora, fauna, avifauna or their habitats are not expected to be impacted by the proposed project as work will be conducted

within existing roadway rights-of-way and appropriate mitigation measures will be incorporated into the project.

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

Construction activities will result in short-term air quality and noise impacts. Dust control measures, such as regular watering and sprinkling, and erection of dust screens will be implemented to minimize wind-blown emissions. Short-term noise impacts will occur primarily from construction equipment. Equipment mufflers or other noise attenuating equipment, as well as proper equipment and vehicle maintenance, are anticipated to mitigate noise from construction activities.

In the long term, traffic noise levels will increase as a result of increased traffic along the project corridor. This increase in traffic is expected to occur with or without the project. With the project the predicted increases in future traffic noise levels between 2016 and 2022 can be mitigated through the construction of sound walls in accordance with HDOT's criteria. Detrimental impacts on air and water quality is not expected.

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

The project corridor is not located in an environmentally sensitive area. Existing drainage patterns will be maintained. Proposed drainage improvements associated with the project will accommodate the small increase in storm water runoff resulting from the reduction in permeable surfaces. No adverse impacts to environmentally sensitive areas nor to fresh or coastal waters are anticipated.

12. Substantially affects scenic vistas and viewplanes identified in county or state plans or studies.

The proposed project will not affect coastal scenic and open space resources and will not affect scenic view corridors.

13. Requires substantial energy consumption.

The proposed project will involve the commitment of fuel for construction equipment, vehicles, and machinery during construction activities. However, this use

will be short term and is not anticipated to result in a substantial consumption of energy resources.

Based on the foregoing findings, it is concluded that the proposed action is not anticipated to result in any significant impacts. Accordingly, this draft environmental assessment is being processed in anticipation of a Finding of No Significant Impact (FONSI).

VIII. LIST OF PERMITS AND APPROVALS

VIII. LIST OF PERMITS AND APPROVALS

The following approvals will be required prior to the implementation of the project:

Federal

1. Department of the Army Permit, if applicable.

2. Coastal Zone Management Consistency Determination, if applicable.

3. Section 401, Water Quality Certification.

State of Hawaii

1. National Pollutant Discharge Elimination System (NPDES) Permit.

2. Work to Perform Within State Highway Right-of-Way.

3. Disability and Communication Access Board (DCAB) Certification

County of Maui

1. Special Management Area (SMA) Assessment and Determination.

2. Construction Permits, as applicable.

Others

1. Utility Companies.

IX. PARTIES CONSULTED DURING THE PREPARATION OF THE DRAFT ENVIRONMENTAL ASSESSMENT; LETTERS RECEIVED; AND RESPONSES TO SUBSTANTIVE COMMENTS

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The following agencies were consulted during preparation of the Draft Environmental Assessment (EA). Agency comments and responses to substantive comments are included herein.

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Wailuku, Hawaii 96793

24. Deidre Tegarden, Director
County of Maui
Office of Economic Development
2200 Main Street, Suite 305
Wailuku, Hawaii 96793

25. Gen Iinuma, Administrator
Maui Civil Defense Agency
200 South High Street
Wailuku, Hawaii 96793

26. Jeffrey A. Murray, Fire Chief
County of Maui
Department of Fire and Public Safety
200 Dairy Road
Kahului, Hawaii 96732

27. Lori Tsuhako, Director
County of Maui
Department of Housing and Human Concerns
One Main Plaza
2200 Main Street, Suite 546
Wailuku, Hawaii 96793

28. Tamara Horcajo, Director
County of Maui
Department of Parks and Recreation
700 Halia Nakoa Street, Unit 2
Wailuku, Hawaii 96793

29. Jeffrey Hunt, Director
County of Maui
Department of Planning
250 South High Street
Wailuku, Hawaii 96793

30. Thomas Phillips, Chief
County of Maui
Police Department
55 Mahalani Street
Wailuku, Hawaii 96793

31. Milton Arakawa, Director
County of Maui
Department of Public Works
200 South High Street
Wailuku, Hawaii 96793

32. Cheryl Okuma, Director
County of Maui
Department of Environmental Management
One Main Plaza
2200 Main Street, Suite 176
Wailuku, Hawaii 96793

33. Donald Medeiros, Director
County of Maui
Department of Transportation
200 South High Street
Wailuku, Hawaii 96793

34. Jeffrey Eng, Director
County of Maui
Department of Water Supply
200 South High Street
Wailuku, Hawaii 96793

35. Danny Mateo, Council Chair
Maui County Council
200 South High Street
Wailuku, Hawaii 96793

UTILITIES

36. **Hawaiian Telcom**
60 South Church Street
Wailuku, Hawaii 96793

37. Greg Kauhi, Manager, Customer Operations
Maui Electric Company, Ltd.
P.O. Box 398
Kahului, Hawaii 96733

COMMUNITY ORGANIZATIONS

38. **Kihei Community Association**
P. O. Box 662
Kihei, Hawaii 96753

39. Pamela Tumpap, Executive Director
Maui Chamber of Commerce
313 Ano Street
Kahului, Hawaii 96732

40. Sandy Baz, Executive Director
Maui Economic Opportunity
99 Mahalani Street
Wailuku, Hawaii 96793

41. Carol Reimann, Executive Director
Maui Hotel Association
1727 Wili Pa Loop, Suite B
Wailuku, Hawaii 96793

42. Bud Pikrone
Wailea Community Association
555 Kaukahi Street, Suite 214
Wailea, Hawaii 96753-8333

43. Madge Schaefer
Maui Meadows Neighborhood Association
P. O. Box 160
Kihei, Hawaii 96753

MAR 0 9 2009

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, Hawaii 96850

In Reply Refer To:
2009-TA-0121

MAR 0 6 2009

Mr. Mark Roy
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Maui, Hawaii 96793

Subject: Technical Assistance for the Proposed Piilani Highway Widening to Four Lanes, Between Kilohana Drive and Wailea Ike Drive, Wailea, Maui

Dear Mr. Roy:

This letter acknowledges the U.S. Fish and Wildlife Service's February 6, 2009, receipt of your request for comments regarding the proposed lane widening, to four lanes, of Piilani Highway, between Kilohana Drive and Wailea Ike Drive, Wailea, Maui. Based on the project information you provided and pertinent information in our files, the threatened Newell's shearwater (*Puffinus auricularis newelli*) and the endangered Hawaiian petrel (*Pterodroma phaeopygia sandwichensis*) (collectively referred to as seabirds) are known to traverse the project area. The endangered Blackburn's sphinx moth (*Manduca blackburni*) and the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*) are also known to occur near the project site. In addition, the proposed project is located in a dry area of Maui where wildland fires interdependent with the proposed project may affect listed upland species. We recommend the following measures be incorporated into the draft environmental assessment to minimize potential project impacts to listed species:

- Seabirds may traverse the project area at night during the breeding season (February 1 through December 15). Any outdoor lighting, particularly when used during each year's peak fledging period (September 15 through December 15), could result in seabird disorientation, fallout, and injury or mortality. Potential impacts to seabirds can be minimized by shielding outdoor lights associated with the project, avoiding night-time construction, and providing all project staff with information regarding seabird fallout. All project lights should be shielded so the bulb can be seen only from below.

- Blackburn's sphinx moth may occur in the project area. The adult moth feeds on nectar from native plants including beach morning glory (*Ipomoea pes-caprae*), iliee (*Plumbago zeylanica*), maiapilo (*Capparis sandwichiana*), and the larvae feed upon non-native tree tobacco (*Nicotiana glauca*) and the native (*Nothocestrum latifolium*). All of these species may occur on the project site. We recommend you survey the site for the

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presence of Blackburn's sphinx moth host plants and if host plants are found, contact our office for further assistance.

- To minimize impacts to the endangered Hawaiian hoary bat, woody plants suitable for bat roosting should not be removed or trimmed during the bat birthing and pup rearing season (April to August). If this avoidance measure can not be implemented, bat surveys should be conducted and, if this species is found, our office should be contacted for additional assistance.

- Measures to minimize fire risk should be incorporated into the project. The Maui Wildland Fire Coordinating Group is partnering with the Service to coordinate the development of fuelbreaks, water sources for firefighting, fire prevention projects, and an increased fire suppression response to minimize the impact of human-caused wildfires to listed species and critical habitat on Maui. We recommend you coordinate with Maui County Department of Fire and Public Safety wildland fire management specialists to ensure any wildland fire risk, interdependent with the proposed development, is minimized.

- We recommend the use of native plants for landscaping purposes in order to reduce the spread of non-native invasive species. If native plants do not meet your landscaping objectives, we recommend that you choose species that are thought to have a low risk of becoming invasive. The following websites are good resources to use when choosing landscaping plants: Pacific Island Ecosystems at Risk (http://www.hear.org/Pier/), Hawaii-Pacific Weed Risk Assessment (http://www.botany.hawaii.edu/faculty/daehler/wra/full_table.asp) and Global Compendium of Weeds (www.hear.org/gcw).

Implementation of these recommendations does not alleviate your responsibilities pursuant to the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA), if a listed species may be affected by the proposed action. If the proposed project may affect a listed species and the project is funded, authorized, or carried about by a Federal agency, you should request that the Federal agency consult with us under section 7(a)(2) of the ESA. If there is no Federal nexus for the proposed action you should obtain an incidental take permit pursuant to section 10(a)(2)(B) of the ESA if incidental take of a listed species cannot be avoided. If you have questions or would like additional information, please contact Consultation and Technical Assistance Program Fish and Wildlife Biologist, Dawn Greenlee (phone: 808-792-9400; fax: 808-792-9581).

Sincerely,

Christa Russell

for Patrick Leonard
Field Supervisor

MUNEKIYO & HIRAGA, INC.

MICHAEL T. MUNEKIYO
GWEN OHASHI HIRAGA
MITSURU "MICH" HIRANO
KARLYNN FUKUDA

MARK ALEXANDER ROY

August 28, 2009

Patrick Leonard
Field Supervisor
U. S. Department of the Interior
Fish and Wildlife Service
300 Ala Moana Boulevard, Room 3-122
Box 50088
Honolulu, Hawai`i 96850

SUBJECT: Early Consultation on the Draft Environmental Assessment (EA) for the Pi`ilani Highway Widening to Four (4) Lanes North of Kilohana Drive to Wailea Ike Drive, Wailea, Maui, Hawai`i

Dear Mr. Leonard:

We acknowledge receipt of your letter dated March 6, 2009, and have included your comments and recommendation in the Draft Environmental Assessment (EA). The applicants will comply with the applicable provision of the Endangered Species Act of 1973, as amended.

Should you require additional clarification please call me at (808) 244-2015. A copy of the Draft EA will be provided to your office for review and comment.

Very truly yours,

Gwen Ohashi Hiraga
Principal

GOH:yp
cc: Charles Jencks, Honua`ula Partners, LLC
Clyde Murashige, A&B Wailea LLC
Don Fujimoto, Honua LLC
F:\DATA\WCPT\PiilaniWidening\USFWS.ecres.wpd

APR 2 2 2009

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, HONOLULU DISTRICT
FORT SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF:

April 17, 2009

Regulatory Branch

Corps File No. POH-2009-075

Mr. Mark Roy
Project Manager
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, HI 96793

Dear Mr. Roy:

This letter is in response to your request for the U.S. Army Corps of Engineers (Corps) to provide early input on the preparation of your Chapter 343, Hawaii Revised Statutes, draft Environmental Assessment (EA) for the **Pi`ilani Highway Widening to Four Lanes Between Kilohana Drive and Wailea Ike Drive Project** located in Wailea, Maui, Hawaii. According to your letter dated February 4, 2009, as part of the review process for the re-zoning application for the Kihei-Makena Project District 9 (Honua`ula), the County of Maui requires Honua`ula Partners, LLC (the applicant) to improve Pi`ilani Highway to four lanes between Kilohana Drive and Wailea Ike Drive prior to the commencement of any construction work on the site. Our comments are provided pursuant to our authorities under Section 404 of the Clean Water Act (CWA) of 1972 (33 U.S.C. 1344) and Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

The Corps suggests the draft EA include site-specific information pertaining to the occurrence of water resources within the project area, such as perennial, intermittent and ephemeral streams and wetlands. For any non-tidal tributary waters occurring within the project area, the ordinary high water mark must be determined as described at 33 C.F.R. 328.3(e). Similarly, for coastal areas and tidally influenced waters that may occur within the project area, the draft EA (or its supporting technical studies) should clearly demarcate or otherwise identify the mean high water line and high tide line [as described at 33 C.F.R. 328.3(d)]. The boundaries of wetlands that may exist on-site or adjacent to the project site should be delineated by a qualified individual and based on the procedures set forth in the Corps' 1987 *Wetlands Delineation Manual.*

We recommend the draft EA contain or address the following additional information and analyses, as applicable:

- A clear and succinct written project purpose and need statement;
- A plan view drawing that provides a detailed illustration and description of the footprint of disturbance (including temporary and permanent impacts) relative to the boundaries of the Corps' jurisdiction in tidal and non-tidal waters of the U.S., including wetlands;
- Scaled engineering plans of the proposed structure(s) or facility(ies);
- The source and volume of fill material;

- The method and timing for any discharge (placement) of dredged or fill material;
- The location of ingress/egress points and associated features (e.g., access ramps); temporary access and/or haul roads; construction staging areas; disposal sites for any excess excavated materials and/or construction-related debris. If such disposal sites are other than existing landfill operations, the draft EA should also identify impacts associated with the disposal of such materials at those sites;
- An assessment of the functions, values and services of the waters of the U.S. occurring within the project area;
- An evaluation and quantification (area and volume) of the direct, indirect and cumulative effects on the aquatic ecosystem;
- A statement of how impacts to the aquatic ecosystem were avoided or minimized, and a draft conceptual mitigation plan for unavoidable impacts to waters of the U.S.;
- An estimate of the total construction period; and
- A detailed description of the short- and long-term maintenance activities associated with the highway improvements, if any.

In general, the Corps asserts jurisdiction over traditional navigable waters (e.g., Pacific Ocean), wetlands adjacent to traditional navigable waters, non-navigable tributaries that have perennial flow or continuous seasonal flow, and wetlands that directly abut such tributaries. For other types of waters, we must decide on a case-by-case basis using fact-specific analysis what our jurisdiction is, if any, under Section 404 of the CWA. These waters include any non-navigable tributaries that do not have relatively permanent flows and any wetlands adjacent to such tributaries, as well as wetlands that are adjacent to but do not directly abut a relatively permanent non-navigable tributary. In the latter set of circumstances, a "significant nexus evaluation" is required in order to render a final approved jurisdictional determination. We do not, however, generally assert jurisdiction over swales, erosional features or ditches excavated wholly in and draining only uplands and that do not carry a relatively permanent flow of water.

As you prepare the draft EA, we suggest you consider the data needs and permitting requirements outlined above. If you need further assistance, please contact Ms. Susan A. Meyer, Project Manager, by phone at (808) 438-2137 or by electronic mail at susan.s.meyer@usace.army.mil. Please refer to **Corps File No. POH-2009-075** in future correspondence or communications related to this project. Thank you for your cooperation with our regulatory program. Please be advised you can provide comments on your experience with the Corps' Honolulu District Regulatory Branch by accessing our web-based customer survey form at http://www.poh.usace.army.mil/EC-R/forms/ecr-CustomerSurvey.pdf.

Sincerely,

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

MUNEKIYO & HIRAGA, INC.

MICHAEL T. MUNEKIYO
GWEN OHASHI HIRAGA
MITSURU "MICH" HIRANO
KARLYNN FUKUDA

MARK ALEXANDER ROY

August 28, 2009

George P. Young, Chief
Regulatory Branch
Department of the Army
U. S. Army Corps of Engineers
Honolulu District
Fort Shafter, Hawai`i 96858-5440

SUBJECT: Early Consultation on the Draft Environmental Assessment (EA) for the Pi`ilani Highway Widening to Four (4) Lanes North of Kilohana Drive to Wailea Ike Drive, Wailea, Maui, Hawai`i

Dear Mr. Young:

Thank you for your letter dated April 17, 2009, providing early consultation comments on the subject project. Please be advised that the Draft Environmental Assessment (EA) will include site-specific information of the project including scaled preliminary engineering drawings of the roadway improvements. We are aware that a Department of Army permit may be required for the project prior to the initiation of construction.

Should you require additional clarification please call me at (808) 244-2015. A copy of the Draft EA will be forwarded to your agency for review and comment.

Very truly yours,

Gwen Ohashi Hiraga

Gwen Ohashi Hiraga
Principal

GOH:yp
cc: Charles Jencks, Honua`ula Partners, LLC
Clyde Murashige, A&B Wailea LLC
Don Fujimoto, Honua LLC
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FEB 2 0 2009

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

02062PDCL.09

February 17, 2009

Mr. Mark Roy
Project Manager
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Subject: Early Consultation Comments for Environmental Assessment (EA) Preparation for Piilani Highway Widening to Four Lanes Between Kilohana Drive and Wailea Ike Drive, Wailea, Island of Maui, Hawaii

The Department of Health (Department), Clean Water Branch (CWB), acknowledges receipt of your memorandum, dated February 4, 2009, requesting early consultation comments for the EA preparation for the subject project. The CWB has reviewed the memorandum and offers these comments on your project. Please note that our review is based solely on the information provided in the memorandum and its compliance with Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at http://www.hawaii.gov/health/environmental/env-planning/landuse/CWB-standardcomment.pdf.

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

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

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

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

2. You are required to obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55). For the following types of discharges into Class A or Class 2 State waters, you may apply for NPDES general permit coverage by submitting a

Notice of Intent (NOI) form:

a. Storm water associated with construction activities, including excavation, grading, clearing, demolition, uprooting of vegetation, equipment staging, and storage areas 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 start of the construction activities.

b. Hydrotesting effluent.

c. Dewatering effluent.

You must submit a separate NOI form for each type of discharge at least 30 calendar days prior to the start of the discharge activity, except when applying for coverage for discharges of storm water associated with construction activity. For this type of discharge, the NOI must be submitted 30 calendar days before to the start of construction activities. 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.

3. For types of wastewater not listed in Item No. 2 above or wastewater discharging into Class 1 or Class AA waters, you must obtain an NPDES individual permit. Class 1 waters include, but is not limited to, all State waters in natural reserves, preserves, sanctuaries, and refuges established by the Department of Land and Natural Resources under chapter 195, Hawaii Revised Statutes (HRS), or similar reserves for the protection of aquatic life established under Chapter 195, HRS.

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

4. You must also submit a copy of the 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 CWB that SHPD has or is in the process of evaluating your project. Please submit a copy of your request for review by SHPD or SHPD's determination letter for the project along with your NOI or NPDES permit application, as applicable.

5. The EA should specify all types of pollutant discharges to State waters from project construction.

6. All State waters that may be impacted by project construction should be identified in the EA.

7. The EA should also specify if any impacted State waters are listed in the Clean Water Act, Section 303(d) list of impaired water bodies in Chapter IV of the *2006 State of Hawaii Water Quality Monitoring and Assessment Report*.

   Any NPDES permit(s) for discharges into these water bodies will incorporate the requirement for the Permittee to develop and implement a facility/project-specific Waste Load Allocation (WLA) implementation and monitoring plan when a Total Maximum Daily Load (TMDL) which specifies WLAs applicable to the Permittee's project is approved by the U.S. Environmental Protection Agency (EPA). The Permittee shall incorporate and implement the facility/project-specific WLA implementation and monitoring plan as part of the project's Storm Water Pollution Control Plan or Site-Specific Best Management Practices (BMPs) Plan, as appropriate. The facility/project-specific WLA implementation and monitoring plan shall include Data Quality Objectives (DQO) and Quality Assurance (QA) and Quality Control (QC) methods. The purpose and goal of DQO process can be found at http://www.hanford.gov/dqo. Information on the DOH WLA Implementation and TMDLs are available on the DOH Environmental Planning Office website at http://hawaii.gov/health/environmental/env-planning/wqm/wqm.html (see *TMDL Technical Reports and Implementation Plans for approved TMDLs are available here for download in pdf format).*

8. In addition to construction BMPs, post construction BMPs need to be implemented to minimize storm water runoff, to reduce the risk of erosion, and to prevent water quality degradation of State waters downstream of the project site. The EA should include post construction BMPs and a plan to ensure adequate long-term operation and maintenance of the post construction BMPs.

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

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

Sincerely,

Alec Wong

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

DCL:cu

MUNEKIYO & HIRAGA, INC.

MICHAEL T. MUNEKIYO
GWEN OHASHI HIRAGA
MITSURU "MICH" HIRANO
KARLYNN FUKUDA

MARK ALEXANDER ROY

August 28, 2009

Alec Wong, P.E., Chief
State of Hawai`i
Department of Health
Clean Water Branch
P. O. Box 3378
Honolulu, Hawai`i 96801-3379

SUBJECT: Early Consultation on the Draft Environmental Assessment (EA) for the Pi`ilani Highway Widening to Four (4) Lanes North of Kilohana Drive to Wailea Ike Drive, Wailea, Maui, Hawai`i

Dear Mr. Wong:

Thank you for your letter of February 17, 2009, detailing the list of regulations that may be triggered by the proposed project. As the project continues to move forward through the various regulatory requirements we will ensure that compliance with applicable Department of Health regulations are met. We are aware that a National Pollutant Discharge Elimination System (NPDES) permit will be required for the project prior to the initiation of construction.

Should you require additional clarification please call me at (808) 244-2015. A copy of the Draft Environmental Assessment will be forwarded to your agency for review and comment.

Very truly yours,

Gwen Ohashi Hiraga
Principal

GOH:yp
cc: Charles Jencks, Honua`ula Partners, LLC
Clyde Murashige, A&B Wailea LLC
Don Fujimoto, Honua LLC
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FEB 1 8 2009

LINDA LINGLE
GOVERNOR

RUSS K. SAITO
COMPTROLLER

BARBARA A. ANNIS
DEPUTY COMPTROLLER

(P)1054.9

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810

FEB 1 7 2009

Mr. Mark Roy, Project Manager
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Roy:

Subject: Early Consultation on the Piilani Highway Widening to Four Lanes Between Kilohana Drive and Wailea Ike Drive, Wailea, Maui, Hawaii

Thank you for the opportunity to provide early consultation comments on the project to widen Piilani Highway to four lanes between Kilohana Drive and Wailea Ike Drive. The project does not impact any of the Department of Accounting and General Services' projects or existing facilities, and we have no comments to offer at this time.

If you have any questions, please call me at 586-0400 or have your staff call Mr. Clarence Kubo of the Public Works Division at 586-0488.

Sincerely,

RUSS K. SAITO
State Comptroller

//

FEB 2 3 2009

LINDA LINGLE
GOVERNOR

MAJOR GENERAL ROBERT G. F. LEE
DIRECTOR OF CIVIL DEFENSE

EDWARD T. TEIXEIRA
VICE DIRECTOR OF CIVIL DEFENSE

PHONE (808) 733-4300
FAX (808) 733-4287

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE DIRECTOR OF CIVIL DEFENSE
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495

February 20, 2009

Mr. Mark Roy
Project Manager
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Roy:

Early Consultation Request For Pi`ilani Highway Widening to Four Lanes
Between Kilohana Drive and Wailea Ike Drive, Wailea, Maui, Hawaii

Thank you for the opportunity to comment on this development. After review of the letter and map you have sent for this project, we have no early consultation comments to make. The proposed area falls within coverage arcs of existing warning sirens. We will anticipate reviewing the Environmental Assessment when it is completed and make any appropriate comments at that time.

If you have any questions please call Ms. Havinne Okamura, Hazard Mitigation Planner, at 733-4300, extension 556.

Sincerely,

EDWARD T. TEIXEIRA
Vice Director of Civil Defense

MAR 0 4 2009

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

HRD09/4160

February 25, 2009

Mark Roy, Project Manager
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, HI 96813

RE: Request for comments on upcoming Draft Environmental Assessment for the widening of Pi'ilani Highway to four lanes from Kilohana Drive to Wailea Ike Drive, Wailea, Maui, Hawai'i.

Aloha e Mark Roy,

The Office of Hawaiian Affairs (OHA) received the above-mentioned letter dated February 4, 2009. Honua'ula Partners, LLC proposes widening improvements to the Pi'ilani Highway from Kilohana Drive to Wailea Ike Drive to four lanes of traffic. The improvements will be completed prior to the start of construction on the site, with the exception of grading. Improvements will occur in the existing right-of-way, and use lands owned by the State of Hawai'i. OHA has reviewed the project and offers the following comments.

OHA has substantive obligations to protect the cultural and natural resources of Hawai'i for its beneficiaries, the people of this land. The Hawaii Revised Statutes mandate that OHA "[s]erve as the principal public agency in the State of Hawaii responsible for the performance, development, and coordination of programs and activities relating to native Hawaiians and Hawaiians; . . . and [t]o assess the policies and practices of other agencies impacting on native Hawaiians and Hawaiians, and conducting advocacy efforts for native Hawaiians and Hawaiians." (HRS § 10-3)

Chapter 343 of the Hawaii Revised Statues (HRS) requires that the Draft Environmental Assessment (EA) include a Cultural Impact Assessment (CIA). The CIA should include information relating to the traditional and customary practices and beliefs of the affected area's Native Hawaiians, and the community should be involved in this assessment. Consideration must also be afforded to any individuals accessing the project area for constitutionally protected

traditional and customary purposes, in accordance with the Hawai'i State Constitution, Article XII, Section 7.

OHA requests clarification whether an archaeological inventory survey for the project will be submitted to the State Historic Preservation Division for review and approval. If so, OHA should be allowed the opportunity to comment on the criteria assigned to any cultural or archaeological sites identified within the archaeological inventory survey.

We request the applicant's assurances that should iwi kūpuna or Native Hawaiian cultural or traditional deposits be found during the construction of the project, work will cease, and the appropriate agencies will be contacted pursuant to applicable law.

Thank you for the opportunity to comment. We look forward to reviewing your Draft Environmental Assessment and providing additional comments at that time. If you have further questions, please contact Heidi Guth by phone at (808) 594-1962 or e-mail her at heidig@oha.org.

'O wau iho nō me ka 'oia'i'o,

Clyde W. Nāmu'o
Administrator

C: OHA Maui CRC Office

MUNEKIYO & HIRAGA, INC.

MICHAEL T. MUNEKIYO
GWEN OHASHI HIRAGA
MITSURU "MICH" HIRANO
KARLYNN FUKUDA

MARK ALEXANDER ROY

August 28, 2009

Clyde W. Nāmu`o, Administrator
State of Hawai`i
Office of Hawaiian Affairs
711 Kapiolani Boulevard, Suite 500
Honolulu, Hawai`i 96813

SUBJECT: Early Consultation on the Draft Environmental Assessment (EA) for the Pi`ilani Highway Widening to Four (4) Lanes North of Kilohana Drive to Wailea Ike Drive, Wailea, Maui, Hawai`i

Dear Mr. Nāmu`o:

Thank you for your letter dated February 25, 2009. Please be advised that Hana Pono, LLC has prepared a Cultural Impact Assessment to be included in the Draft Environmental Assessment (EA). The Pi`ilani Highway road widening will be located within the existing right-of-way in areas involving fill material or in areas previously disturbed due to construction of the existing highway. Based on early consultation with the Department of Land and Natural Resources, State Historic Preservation Division (SHPD), it was determined that an archaeological inventory survey would not be required, provided an archaeological monitoring plan is submitted to SHPD for review and approval. Aki Sinoto Consulting and Cultural Resources Management has been retained to prepare the monitoring plan.

Further, should iwi kupuna or native hawaiian cultural or traditional deposits be found during the construction of the project, work will cease in the area of the find, and the appropriate agencies will be contacted. Recommended measures shall be followed prior to commencement of further construction work.

Should you require additional clarification please call me at (808) 244-2015. A copy of the Draft EA will be forwarded to your agency for review and comment.

Very truly yours,

Gwen Ohashi Hiraga
Principal

GOH:yp
cc: Charles Jencks, Honua`ula Partners, LLC
Clyde Murashige, A&B Wailea LLC
Don Fujimoto, Honua LLC
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MAR 0 5 2009

LINDA LINGLE
GOVERNOR OF HAWAII

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

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

STATE OF HAWAII
DEPARTMENT OF HEALTH
MAUI DISTRICT HEALTH OFFICE
54 HIGH STREET
WAILUKU, MAUI, HAWAII 96793-2102

March 4, 2009

Mr. Mark Roy
Project Manager
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawai`i 96793

Dear Mr. Roy:

Subject: Early Consultation on the Pi`ilani Highway Widening to Four Lanes between Kilohana Drive and Wailea Ike Drive, Wailea, Maui, Hawai`i

Thank you for the opportunity to comment on this project. The following comments are offered:

1. The noise created during the construction phase of the project may exceed the maximum allowable levels as set forth in Hawaii Administrative Rules, Chapter 11-46 "Community Noise Control". A noise permit may be required and should be obtained before the commencement of work.

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

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

Should you have any questions, please call me at 808 984-8230.

Sincerely,

Patti Kitkowski

Patti Kitkowski
Acting District Environmental Health Program Chief

17

MUNEKIYO & HIRAGA, INC.

MICHAEL T. MUNEKIYO
GWEN OHASHI HIRAGA
MITSURU "MICH" HIRANO
KARLYNN FUKUDA

MARK ALEXANDER ROY

August 28, 2009

Patti Kitkowski
Acting District Environmental
Health Program Chief
State of Hawai`i
Department of Health
Maui District Health Office
54 High Street
Wailuku, Hawai`i 96793-2102

SUBJECT: Early Consultation on the Draft Environmental Assessment (EA) for the Pi`ilani Highway Widening to Four (4) Lanes North of Kilohana Drive to Wailea Ike Drive, Wailea, Maui, Hawai`i

Dear Ms. Kitkowski:

Thank you for your letter dated March 4, 2009. We are aware of the regulatory requirements of the Department of Health and will ensure compliance prior to and during construction of the proposed highway widening improvements.

Should you require additional clarification please call me at 244-2015. A copy of the Draft Environmental Assessment will be forwarded to your agency for review and comment.

Very truly yours,

Gwen Ohashi Hiraga
Principal

GOH:yp
cc: Charles Jencks, Honua`ula Partners, LLC
Clyde Murashige, A&B Wailea LLC
Don Fujimoto, Honua LLC
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MAR 10 2009

LINDA LINGLE
GOVERNOR
THEODORE E. LIU
DIRECTOR
MARK K. ANDERSON
DEPUTY DIRECTOR
ABBEY SETH MAYER
DIRECTOR
OFFICE OF PLANNING

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

OFFICE OF PLANNING

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

Telephone: (808) 587-2846
Fax: (808) 587-2824

Ref. No. P-12466

March 10, 2009

Mr. Mark Roy, Project Manager
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Roy:

Subject: Piilani Highway Widening to Four Lanes Between Kilohana Drive and Wailea Ike Drive, Wailea, Maui, Hawaii
Early Consultation for Environmental Assessment

Thank you for your request for early consultation regarding the Environmental Assessment (EA) for the above referenced proposal within the existing right-of-way in Wailea, Maui. The four-lane widening project is the result of a State Land Use Commission (LUC) condition for Makena Resort Corp. (LUC Docket No. A97-721).

The Office of Planning requests that the Environmental Assessment consider the impacts of the proposed project on the following issues of State concern:

1. **Cultural, Archaeological, and Historic Resources** – Please include an inventory of archaeological and historic sites on the subject property. Please also identify the status of any monitoring and preservation plans being prepared for or approved by the State Historic Preservation Division. Please identify and describe any cultural resources and cultural practices, including visual landmarks, if applicable, on the subject property and within the ahupua`a in which the property is situated. Please discuss the impact of the proposed project on identified cultural resources and practices, alternatives considered, and proposed mitigation measures.

2. **Environmental, Recreational, and Scenic Resources** – Please include an inventory of flora and fauna, including invertebrates, found on or in proximity to the project site and in any lava tubes and caves on the property. Flora and fauna of concern should not be limited to listed threatened or endangered species or those under consideration for listing, and should include those species and ecosystems identified as "rare" by The Nature Conservancy of Hawai`i. The EA should discuss measures to be taken to protect rare, threatened or endangered

species or ecosystems of concern. You should consider in the design of your field observations including both wet and dry season surveys to capture the fullest range of flora and fauna. Please include a description of recreational uses on or near the project site. A description of scenic resources should also be included.

3. **Coastal Zone Management (CZM)** – The State oversees protection of natural, cultural, and economic resources within the coastal zone, which is defined as all lands of the State and the area extending seaward from the shoreline to the limit of the State's police power and management authority, including the United States territorial sea (§205A-1, Hawaii Revised Statutes). Please discuss how the proposed project will balance the competing values of economic development and preservation of coastal resources, including the following CZM objective areas.

   a. **Coastal and Ocean Resources** – The State has an affirmative duty to protect Hawaii's nearshore waters. Please discuss important coastal and marine resources and ecosystems that may be impacted by the proposed project. Please discuss how stormwater and wastewater generated by the project will be prevented from reducing the quality of nearshore waters.

      The EA should discuss the impact of the project on existing site and offsite hydrology and how the project will manage stormwater and runoff. OP recommends the use of best management practices (BMP) that promote onsite infiltration and minimize runoff from storm events. More information on stormwater BMPs can be found at http://hawaii.gov/dbedt/czm/initiative/lid.php.

   b. **Coastal and Other Hazards** – Please describe any hazard conditions that are relevant to the site, such as potential risk or harm from flood, erosion, earthquake, landslide, and point and nonpoint source pollution. Please describe the measures that are proposed to mitigate any hazard impacts.

The Office of Planning looks forward to receiving the EA with the potential impacts and mitigation measures for the above issues addressed. If you have any questions, please call Lorene Maki in the Land Use Division at 587-2888.

Sincerely,

Abbey Seth Mayer
Director

c: Orlando Davidson, LUC
Brennon Morioka, DOT

MUNEKIYO & HIRAGA, INC.

MICHAEL T. MUNEKIYO
GWEN OHASHI HIRAGA
MITSURU "MICH" HIRANO
KARLYNN FUKUDA

MARK ALEXANDER ROY

August 28, 2009

Abbey Seth Mayer, Director
Department of Business,
Economic Development & Tourism
Office of Planning
P. O. Box 2359
Honolulu, Hawai`i 96804

SUBJECT: Early Consultation on the Draft Environmental Assessment (EA) for the Pi`ilani Highway Widening to Four (4) Lanes North of Kilohana Drive to Wailea Ike Drive, Wailea, Maui, Hawai`i

Dear Mr. Mayer:

Thank you for your letter dated March 10, 2009. In response to your comments the following are noted:

1. Pursuant to early consultation with the State Historic Preservation Division (SHPD) it was determined that an archaeological inventory survey would not be required, provided a monitoring plan is reviewed and approved by SHPD. Prior to and during construction a monitoring plan will be submitted to SHPD and implemented during construction.

2. Biological studies were conducted for the project site and have been included in the Draft Environmental Assessment (EA).

3. The majority of the work to be preformed is located outside the Special Management Area (SMA) for the island of Maui with minor appurtenant structures such as extending existing headwalls are located within the SMA. The project has been evaluated pursuant to Chapter 205-A, Hawai`i Revised Statutes.

Should you require additional clarification please call me at (808) 244-2015. A copy of the Draft EA will be forwarded to your agency for review and comment.

Very truly yours,

Gwen Ohashi Hiraga
Principal

GOH:yp
cc: Charles Jencks, Honua`ula Partners, LLC
Clyde Murashige, A&B Wailea LLC
Don Fujimoto, Honua LLC
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MAR 1 0 2009

LINDA LINGLE
GOVERNOR

BRENNON T. MORIOKA
DIRECTOR

Deputy Directors
MICHAEL D. FORMBY
FRANCIS PAUL KEENO
BRIAN H. SEKIGUCHI
JIRO A. SUMADA

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

IN REPLY REFER TO:

STP 8.3152

March 5, 2009

Mr. Mark Roy
Project Manager
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Roy:

Subject: Piilani Highway Widening to Four Lanes Between Kilohana Drive and Wailea Ike Drive – Early Consultation (EC)

Thank you for requesting the State Department of Transportation's (DOT) review of the subject project to widen Piilani Highway from two to four lanes between Kilohana Drive to Wailea Ike Drive. DOT welcomes this consultation process.

DOT understands your firm is working with the DOT Highways Division Planning Branch to arrange a meeting regarding the subject project and the cost-sharing agreement for highway improvements between developers of the three major projects in the Wailea-Makena area. Your firm should continue consultation with the DOT Highways Division Planning Branch and the Highways Division Maui District Office. All plans and designs for the construction of the project should be directed to these offices.

In response to the subject EC and in anticipation of the proposed meeting, the following comments by the DOT Highways Division are offered.

1. The environmental documents related to the proposed widening of Piilani Highway should be submitted to DOT for review and acceptance before being published.

2. The applicant must completely resurface any and all existing highway lanes damaged during the widening of the highway.

3. The design guidelines and/or the basis of design for all widening of Piilani Highway should be included in the Draft Environmental Assessment (DEA).

4. The undergrounding of the existing overhead electric transmission lines should be considered along Piilani Highway.

5. Detouring of traffic and/or a temporary closure of Piilani Highway will most likely be required as the excavation of 40 to 50-feet of the rock embankment is anticipated with this proposed widening project. The potential impacts of such detours and/or road closures on adjacent roadways should be considered and appropriately addressed.

6. A Traffic Impact Assessment Report (TIAR) should be prepared as a part of the DEA. This TIAR should be submitted for DOT's review and acceptance.

7. The DEA should address the acquisition of right-of-way (ROW) necessary to construct the proposed improvements.

8. County zoning requires the developer to extend Piilani Highway to Kaukahi Street along an alignment that includes unimproved State highway ROW. Any such proposed improvements on State highway ROW must be submitted for review and approval by DOT. If an extension is being proposed, then it should also be appropriately addressed in the DEA.

DOT appreciates the opportunity to provide comments and requests that four (4) copies of the project DEA, including the TIAR, be provided. If there are any other questions, please contact Mr. David Shimokawa of the DOT Statewide Transportation Planning Office at (808) 587-2356.

Very truly yours,

BRENNON T. MORIOKA, PH.D., P.E.
Director of Transportation

MUNEKIYO & HIRAGA, INC.

MICHAEL T. MUNEKIYO
GWEN OHASHI HIRAGA
MITSURU "MICH" HIRANO
KARLYNN FUKUDA

MARK ALEXANDER ROY

August 28, 2009

Brennon Morioka, Director
Department of Transportation
869 Punchbowl Street
Honolulu, Hawai`i 96813-5097

SUBJECT: Early Consultation on the Draft Environmental Assessment (EA) for the Pi`ilani Highway Widening to Four (4) Lanes North of Kilohana Drive to Wailea Ike Drive, Wailea, Maui, Hawai`i

Dear Mr. Morioka:

Thank you for your letter dated March 5, 2009. In response to your comments, the following are noted:

1. We will submit the Draft Environmental Assessment (EA) to the Department of Transportation (DOT) for review and acceptance before being published.

2. During construction, any and all existing highway lanes damaged during the widening of the highway will be completely re-surfaced.

3. The engineering and traffic consultant, Austin, Tsutsumi & Associates, Inc. have been in discussion with DOT's Planning and Highway branches to ensure that the design for the highway is compliant with DOT's requirements. The basis of design for the highway is included in the Draft EA under Appendix "I-2".

4. Preliminary plans for the proposed highway widening includes relocation of existing above-ground utility poles. It does not currently include undergrounding the existing overhead electrical transmission lines. Further discussion of this matter will be held with the DOT.

5. Prior to initiation of construction consultation with the Police Department, SDOT and adjoining property owners will be conducted to develop measures to mitigate potential construction traffic impacts, especially from detours and road closures.

6. A Traffic Impact Assessment Report (TIAR) has been prepared by Austin, Tsutsumi & Associates, Inc. and is included in the Draft EA.

305 High Street, Suite 104 · Wailuku, Hawaii 96793 · ph: (808)244-2015 · fax: (808)244-8729 · planning@mhplanning.com · www.mhplanning.com

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7. As currently designed, the majority of the work will be located within the existing highway right-of-way. Minor appurtenant improvements outside of the right-of-way are limited to the extension of an existing drain culvert and headwall north of Kilohana Drive, sidewalks, Americans with Disabilities Act (ADA) curb ramps, installation of guard rails, underground utility lines, traffic signal installation, and lane re-striping.

   Coordination of the work outside of the right-of-way will be implemented with adjoining property owners regarding construction of the improvements and easements or land acquisition that may be necessary for improvements outside of the existing highway right-of-way.

8. We acknowledge that Honua`ula Partners, LLC is required to extend Pi`ilani Highway south of Wailea Ike Drive when fifty (50) percent of the Honua'ula project is developed. The extension of Pi`ilani Highway is not part of the scope of the work for the current Pi`ilani Highway Widening project. Prior to initiation of improvements south of Wailea Ike Drive coordination with SDOT will be initiated

Should you require additional clarification please call me at (808) 244-2015. A copy of the Draft EA will be forwarded to your agency for review and comment.

Very truly yours,

Gwen Ohashi Hiraga
Principal

GOH:yp
cc: Charles Jencks, Honua`ula Partners, LLC
Clyde Murashige, A&B Wailea LLC
Don Fujimoto, Honua LLC
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MAR 1 0 2009

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

March 6, 2009

Munekiyo & Hiraga, Inc.
305 High Street Suite 104
Wailuku, Hawaii 96793

Attention: Mr. Mark Roy, Project Manager

Ladies and Gentlemen:

Subject: Early Consultation on the Pi'ilani Highway widening to Four Lanes Between Kilohana Drive and Wailea Ike Drive

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

Other than the comments from Engineering Division, Division of Aquatic Resources, Land Division-Maui District, the Department of Land and Natural Resources has no other comments to offer on the subject matter. Should you have any questions, please feel free to call our office at 587-0433. Thank you.

Sincerely,

Morris M. Atta
Administrator

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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STATE OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

February 7, 2009

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
__Div. of Forestry & Wildlife
__Div. of State Parks
__Commission on Water Resource Management
_Office of Conservation & Coastal Lands
_x_ Land Division –Maui District Office

FROM: for Morris M. Atta
SUBJECT: Early consultation on the Pi'ilani Highway Widening to four lanes between Kilohana Drive and Wailea Ike Drive
LOCATION: Wailea, Maui
APPLICANT: Munekiyo & Hiraga, Inc.

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by March 5, 2009.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

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

Signed: [signature]
Date: 3/3/09

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/MorrisAtta
Ref.: EarlyConsultPiilaniHWayWidening
Maui.448

COMMENTS

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

(X) **Please take note that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zone C. The Flood Insurance Program does not have any regulations for developments within Flood Zone C.**

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

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

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

( ) Mr. Robert Sumitomo at (808) 768-8097 or Mr. Mario Siu Li at (808) 768-8098 of the City and County of Honolulu, Department of Planning and Permitting.

( ) Mr. Kelly Gomes at (808) 961-8327 (Hilo) or Mr. Kiran Emler at (808) 327-3530 (Kona) of the County of Hawaii, Department of Public Works.

( ) Mr. Francis Cerizo at (808) 270-7771 of the County of Maui, Department of Planning.

( ) Mr. Mario Antonio at (808) 241-6620 of the County of Kauai, Department of Public Works.

( ) The applicant should include water demands and infrastructure required to meet project needs. Please note that projects within State lands requiring water service from the Honolulu Board of Water Supply system will be required to pay a resource development charge, in addition to Water Facilities Charges for transmission and daily storage.

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

( ) Additional Comments: _____

_____

( ) Other: _____

_____

Should you have any questions, please call Ms. Suzie S. Agraan of the Planning Branch at 587-0258.

Signed: _____
ERIC T. HIRANO, CHIEF ENGINEER

Date: 3/3/09

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

February 7, 2009

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
__Div. of Forestry & Wildlife
__Div. of State Parks
__Commission on Water Resource Management
__Office of Conservation & Coastal Lands
x Land Division –Maui District Office

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2009 FEB 12 A 10:25
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII
LAND DIVISION

FROM: for Morris M. Atta
SUBJECT: Early consultation on the Pi'ilani Highway Widening to four lanes between Kilohana Drive and Wailea Ike Drive
LOCATION: Wailea, Maui
APPLICANT: Munekiyo & Hiraga, Inc.

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by March 5, 2009.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

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

Signed:
Date: 2/9/09

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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2009 FEB 19 P 3:

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DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

AQUATIC RESOURCES: 2084

DIRECTOR	
COMM. FISH.	
AQ RES/ENV	
AQ REC	
PLANNER	
STAFF SVCS	
PCUH/UH	
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February 7, 2009

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
__Div. of Forestry & Wildlife
__Div. of State Parks
__Commission on Water Resource Management
__Office of Conservation & Coastal Lands
x Land Division –Maui District Office

RECEIVED
FEB 9 2009
AQUATIC RESOURCES

FROM: Morris M. Atta
SUBJECT: Early consultation on the Pi'ilani Highway Widening to four lanes between Kilohana Drive and Wailea Ike Drive
LOCATION: Wailea, Maui
APPLICANT: Munekiyo & Hiraga, Inc.

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by March 5, 2009.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

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

Signed:
Date: 2/18/09

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

AQUATIC RESOURCES: 2084

DIRECTOR	
COMM. FISH.	
AQ RES-ENV	
AQ REC	
PLANNER	
STAFF SVCS	
ECUH/UH	
STATISTICS	
AFRC/FED AID	
EDUCATION	
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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

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HONOLULU, HAWAII 96809

February 7, 2009

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FEB 9 2009
AQUATIC RESOURCES

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
__Div. of Forestry & Wildlife
__Div. of State Parks
__Commission on Water Resource Management
_Office of Conservation & Coastal Lands
x Land Division –Maui District Office

FROM: Morris M. Atta
SUBJECT: Early consultation on the Piilani Highway Widening to four lanes between Kilohana Drive and Waiteaku Drive
LOCATION: Wailea, Maui
APPLICANT: Munekiyo & Hiraga, Inc.

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by March 5, 2009.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

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

Signed: Skyyy Han
Date: 2/18/09

RECEIVED
Maui
FEB 17 2009
Div. of Aquatic Resources

MUNEKIYO & HIRAGA, INC.

MICHAEL T. MUNEKIYO
GWEN OHASHI HIRAGA
MITSURU "MICH" HIRANO
KARLYNN FUKUDA

MARK ALEXANDER ROY

August 28, 2009

Morris Atta, Administrator
Department of land and
Natural Resources
Land Division
P. O. Box 621
Honolulu, Hawai`i 96809

SUBJECT: Early Consultation on the Draft Environmental Assessment (EA) for the Pi`ilani Highway Widening to Four (4) Lanes North of Kilohana Drive to Wailea Ike Drive, Wailea, Maui, Hawai`i

Dear Mr. Atta:

Thank you for your letter dated March 6, 2009. We acknowledge that the project site is located within Flood Zone C.

Should you require additional clarification please call me at (808) 244-2015. A copy of the Draft EA will be forwarded to your agency for review and comment.

Very truly yours,

Gwen Ohashi Hiraga
Principal

GOH:yp
cc: Charles Jencks, Honua`ula Partners, LLC
Clyde Murashige, A&B Wailea LLC
Don Fujimoto, Honua LLC
F:\DATA\WCPT\PiilaniWidening\DLNR.ecres.wpd

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RUSSELL Y. TSUJI
FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

July 16, 2009

Mr. Mark Roy, Project Manager
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawai'i 96793
planning@mhplanning.com

LOG NO: 2009.0148
DOC NO: 0907PC30
Archaeology

SUBJECT: Chapter 6E-42 Historic Preservation Review – Early Consultation on the Pi'ilani Highway Widening to Four Lanes between Kilohana and Wailea Ike Drive Paeahu Ahupua'a, Makawao District, Island of Maui
TMKs: (2) 2-1-008:046; (2) 2-1-008:113; (2) (2) 2-1-008:130; 2-1-008:131; (2) 2-1-008:999; (2) 2-1-014:999; (2) 2-1-015:999; (2) 2-1-026:094

Thank you for the opportunity to comment on the aforementioned project, correspondence for which we received on February 6 of 2009. Please accept our apologies for the lengthy delay in responding.

Based on the submitted document, the project involves widening improvements to the Pi'ilani Highway between Kilohana Drive and Wailea Iki Drive, as requested by the County of Maui in association with the rezoning application made by Honua'ula Partners, LLC. The proposed areas of effect are all within or immediately alongside an existing County roadway/road right-of-way. The proposed project is also located in an area where numerous isolated and clustered pre-Contact period human burials and other culturally significant deposits have been found. Given the above information, the most reasonable form of mitigation appears to be precautionary archaeological monitoring during all project related ground altering disturbance.

Therefore, upon review of any permit application associated with the proposed project forwarded to us by the County of Maui, we will likely recommend the following:

A qualified archaeological monitor shall be present during *those portions of the project which involve ground altering disturbance* in order to document any historic properties which may be encountered and to provide mitigation measures as necessary. *Please note that ground altering disturbance includes previously disturbed stratigraphy, as culturally significant subsurface deposits are often found in these contexts.*

As per Hawai'i Administrative Rules (HAR) §13-279, this means that prior to the commencement of ground altering disturbance associated with the proposed project, the project developer or developer's agent must submit an appropriately prepared *monitoring plan* to this office for review and acceptance. The plan must contain the following provisions:

1) Specify the kinds of historically or culturally significant sites or remains of sites anticipated and where in the construction area they are likely to be found;
2) Specify how such sites or remains of sites will be documented;
3) Specify how such sites or remains of sites will be treated;
4) Specify that the archaeologist (s) conducting the monitoring has (have) the authority to halt construction in the immediate area of the find in order to carry out the plan;
5) Specify that coordination between the archaeologist and construction crew has been scheduled so that all involved parties are aware of the plan and what it means;
6) Specify what laboratory work will be performed on any cultural sites or remains of sites that might be found in the project area;
7) Specify details concerning the archiving of any collections that are made;
8) Specify a schedule of report preparation and that the report will be submitted within the required 180 days after completion of the proposed undertaking.

A list of those meeting the requirements to perform such work can be obtained on the SHPD's website at http://hawaii.gov/dlnr/hpd/pdfs/2009-Permittee.pdf or by contacting our main office at (808) 692-8015.

If you have any questions or comments regarding this letter, please contact the SHPD's Lead Maui Archaeologist, Ms. Patty Conte (Patty.J.Conte@hawaii.gov).

Aloha,

Nancy A. McMahon

Nancy McMahon, Deputy SHPO/State Archaeologist
State Historic Preservation Division

c: Sinoto Consulting, LLC: akihikosinoto@aol.com
Jeff Hunt, Director, Dept. of Planning, FAX (808) 270-7634

MUNEKIYO & HIRAGA, INC.

MICHAEL T. MUNEKIYO
GWEN OHASHI HIRAGA
MITSURU "MICH" HIRANO
KARLYNN FUKUDA

MARK ALEXANDER ROY

August 28, 2009

Nancy McMahon, Deputy SHPD
State Archaeologist
State Historic Preservation Division
Department of Land and Natural Resources
601 Kamokila Boulevard, Room 555
Kapolei, Hawai`i 96707

SUBJECT: Early Consultation on the Draft Environmental Assessment (EA) for the Pi`ilani Highway Widening to Four (4) Lanes North of Kilohana Drive to Wailea Ike Drive, Wailea, Maui, Hawai`i

Dear Ms. McMahon:

Thank you for your letter of July 16, 2009 and concurrence that due to the scope of the project an archaeological inventory survey is not required. However, an archaeological monitoring plan will be prepared and submitted to the State Historic Preservation Office (SHPO) for review and approval prior to the initiation of any ground altering disturbance.

Should you require additional clarification please contact me at (808) 244-2015 or email colleen@mhplanning.com. A copy of the Draft Environmental Assessment (EA) will be forwarded to your agency.

Very truly yours,

Colleen Suyama
Project Manager

CS:yp
cc: Charles Jencks, Honua`ula Partners, LLC
Clyde Murashige, A&B Wailea LLC
Don Fujimoto, Honua LLC and Keaka LLC
Aki Sinoto, Aki Sinoto Consulting and Cultural Resource Management
F:\DATA\WCPT\PiilaniWidening\SHPD.ecres.wpd

FEB 1 3 2009

CHARMAINE TAVARES
Mayor

TAMARA HORCAJO
Director

ZACHARY Z. HELM
Deputy Director

(808) 270-7230
FAX (808) 270-7934

DEPARTMENT OF PARKS & RECREATION
700 Hali'a Nakoa Street, Unit 2, Wailuku, Hawaii 96793

February 10, 2009

Mr. Mark Roy
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, hawaii 96793

SUBJECT: Early Consultation on the Pi`ilani Highway Widening to Four Lanes Between Kilohana Drive and Wailea Ike Drive, Wailea, Maui, Hawaii

Dear Mr. Roy:

We have reviewed the subject project and have no comments or objections to the proposed project.

Thank you for the opportunity to review and comment on this matter. Please feel free to contact me or Mr. Patrick Matsui, Chief of Parks Planning and Development at 270-7931 should you have any other questions.

Sincerely,

TAMARA HORCAJO
Director of Parks & Recreation

xc: Patrick Matsui, Chief of Parks Planning and Development

TH:PM:do

FEB 1 3 2009

CHARMAINE TAVARES
MAYOR

JEFFREY A. MURRAY
CHIEF

ROBERT M. SHIMADA
DEPUTY CHIEF

COUNTY OF MAUI
DEPARTMENT OF FIRE AND PUBLIC SAFETY
FIRE PREVENTION BUREAU

780 ALUA STREET
WAILUKU, HAWAII 96793
(808) 244-9161
FAX (808) 244-1363

February 10, 2009

Mr. Alexander Roy, Project Manager
Munekiyo & Hiraga, Inc
305 High Street, Suite 104
Wailuku, HI 96793

SUBJECT: EARLY CONSULTATION, Pi'ilani Highway Widening to four lanes from Kilohana Drive to Wailea Ike Drive.

Dear Mr. Roy,

I have had an opportunity to review the early consultation request for the above subject. We do not have any specific concerns at this time. Please feel free to contact us if there are any questions or concerns.

Sincerely,

Valeriano F. Martin
Captain
Fire Prevention Bureau

POLICE DEPARTMENT
COUNTY OF MAUI

CHARMAINE TAVARES
MAYOR

OUR REFERENCE
tj
YOUR REFERENCE

55 MAHALANI STREET
WAILUKU, HAWAII 96793
(808) 244-6400
FAX (808) 244-6411

THOMAS M. PHILLIPS
CHIEF OF POLICE

GARY A. YABUTA
DEPUTY CHIEF OF POLICE

FEB 20 2009

February 17, 2009

Mr. Mark Roy
Project Manager
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, HI 96793

Dear Mr. Roy:

SUBJECT: Early Consultation on the Pi'ilani Highway Widening to Four Lanes Between Kilohana Drive and Wailea Ike Drive

Thank you for your letter of February 4, 2009, requesting comments on the above subject.

We have enclosed a copy of our comments and will defer any further comments and/or recommendations upon our review of the Environmental Assessment.

Very truly yours,

AC Wayne T. Ribao

Assistant Chief Wayne T. Ribao
for: Thomas M. Phillips
Chief of Police

c: Jeffrey Hunt, Planning Department

COPY

CONCUR W/ OFC. HICKLE
AC [illegible]
02/17/09

TO : **THOMAS PHILLIPS, CHIEF OF POLICE, COUNTY OF MAUI**

VIA : **CHANNELS** 712 021309

FROM : **BRAD HICKLE, POLICE OFFICER III, DISTRICT VI KIHEI**

SUBJECT : **EARLY CONSULTATION ON THE PIILANI HIGHWAY WIDENING TO FOUR LANES BETWEEN KILOHANA DRIVE AND WAILEA IKE DRIVE, WAILEA, MAUI, HAWAII**

APPLICANT INFORMATION:

The project manager, Mark ROY of Munekiyo & Hiraga, Inc. is requesting early input as part of the Environmental Assessment (EA) for the Piilani Widening to Four Lanes project.

The portion of Piilani Highway to be widened to four lanes is the area between Kilohana Drive to Wailea Ike Drive. The widening improvements are a portion of a condition in which Honua'lua Partners, LLC must complete prior to the commencement of any construction on the future job site.

POLICE CONCERNS:

The information received by our department didn't specify the time or anticipated length of the highway widening project. Furthermore, the information received did not specify if the highway will be completely closed between Kilohana Drive and Wailea Ike Drive or weather traffic will be diverted around the project during the demolition phase?

The answers to these questions may help to determine the impact to police services and the recommendations we make with regards to the future Environmental Assessment and roadway widening project.

At this time I have no further concerns or comments regarding the early consultation in preparation for the Environmental Assessment. I would however like to review and submit my comments regarding this project when the EA document is completed.

COMMENTS:

SPECIFIC RECOMMENDATIONS WILL BE ADDRESSED UPON ISSUANCE OF THE ENVIRONMENTAL ASSESSMENT.

M. [illegible] 7440
02/12/09

Respectfully Submitted,

Officer B. HICKLE
02/12/09 16:30 hours

MUNEKIYO & HIRAGA, INC.

MICHAEL T. MUNEKIYO
GWEN OHASHI HIRAGA
MITSURU "MICH" HIRANO
KARLYNN FUKUDA

MARK ALEXANDER ROY

August 28, 2009

Gary Yabuta, Chief of Police
County of Maui
Police Department
55 Mahalani Street
Wailuku, Hawai`i 96793

SUBJECT: Early Consultation on the Draft Environmental Assessment (EA) for the Pi`ilani Highway Widening to Four (4) Lanes North of Kilohana Drive to Wailea Ike Drive, Wailea, Maui, Hawai`i

Dear Chief Yabuta:

Thank you for your department's letter dated February 17, 2009. Information on the project will be included in the Draft Environmental Assessment (EA).

Should you require additional clarification please call me at 244-2015. A copy of the Draft EA will be forwarded to your agency for review and comment.

Very truly yours,

Gwen Ohashi Hiraga
Principal

GOH:yp
cc: Charles Jencks, Honua`ula Partners, LLC
Clyde Murashige, A&B Wailea LLC
Don Fujimoto, Honua LLC
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DEPARTMENT OF
HOUSING AND HUMAN CONCERNS
COUNTY OF MAUI

MAR 0 5 2009

CHARMAINE TAVARES
Mayor

LORI TSUHAKO
Director

JO-ANN T. RIDAO
Deputy Director

2200 MAIN STREET • SUITE 546 • WAILUKU, HAWAII 96793 • PHONE (808) 270-7805 • FAX (808) 270-7165
MAILING ADDRESS: 200 SOUTH HIGH STREET • WAILUKU, HAWAII 96793 • EMAIL director.hhc@mauicounty.gov

March 3, 2009

Mr. Mark Roy
Project Manager
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Roy:

SUBJECT: Early Consultation Request on the Pi'ilani Highway Widening to Four Lanes between Kilohana Drive and Wailea Iki Drive, Wailea, Maui, Hawai'i

We have reviewed the Early Consultation Request for the above subject project and would like to inform you that we do not have any comment to offer.

Please call Mr. Wayde Oshiro of our Housing Division at 270-7355 if you have any questions.

Sincerely,

LORI TSUHAKO
Director of Housing and Human Concerns

cc: Housing Division

CHARMAINE TAVARES
Mayor

JEFFREY S. HUNT
Director

KATHLEEN ROSS AOKI
Deputy Director

APR 17 2009

COUNTY OF MAUI
DEPARTMENT OF PLANNING

April 16, 2009

Mr. Mark Roy, Project Manager
Munekiyo & Hiraga, Inc.
305 South High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Roy:

SUBJECT: EARLY CONSULTATION ON THE PI'ILANI HIGHWAY WIDENING TO FOUR LANES LOCATED IN THE RIGHT-OF-WAY BETWEEN KILOHANA DRIVE AND WAILEA IKE DRIVE, WAILEA, MAUI, HAWAII; (EAC 2009/0008)

The Department of Planning (Department) is in receipt of the above-referenced letter, dated February 4, 2009, requesting comment on the above-proposed action. Only a site map was included to comment on. No project details were provided. The Department understands the proposed action includes the following:

- Honua'ula Partners, LLC, as the applicant, proposes to widen to four lanes and improve a portion of the Piilani Highway, between Kilohana Drive and Wailea Ike Drive, Wailea, Maui, Hawaii, from the current two lanes, as required by a condition of the re-zoning application for Kihei-Makena District 9 (Honua'ula).

Based on the foregoing, the Department provides the following comments in preparation of the Draft EA:

1. The Special Management Area (SMA) boundary in the vicinity of this project is determined as all lands makai of the Piilani Highway right-of-way easement. Thus, if the project is totally within the existing right-of-way, the project is located outside of the SMA. If any portion of the highway widening involves lands within the SMA, that is any lands makai of the right-of-way, the action will require a SMA Use Permit;

2. The Applicant must determine who the Accepting Agency will be for the Environmental Assessment;

3. Address social and physical impacts to surrounding neighborhoods, including noise and air pollution. Provide mitigation alternatives to any potential environmental impacts; and

4. Provide mitigation alternatives to ensure that best management practices shall be implemented to insure that water quality and marine resources are protected.

Thank you for the opportunity to comment. Please include the Department on the distribution list for the Draft EA. Should you require further clarification, please contact Staff Planner James Buika by email at james.buika@mauicounty.gov or by phone at (808) 270-6271.

Sincerely,

CLAYTON I. YOSHIDA, AICP
Planning Program Administrator

For: JEFFREY S. HUNT, AICP
Planning Director

xc: James A. Buika, Staff Planner
ZAED
Project File
General File

JSH:CIY:JAB:sg
K:\WP_DOCS\PLANNING\EAC\2009\0008_PiilaniHwyWidening\Comments.DOC

MUNEKIYO & HIRAGA, INC.

MICHAEL T. MUNEKIYO
GWEN OHASHI HIRAGA
MITSURU "MICH" HIRANO
KARLYNN FUKUDA

MARK ALEXANDER ROY

August 28, 2009

Jeffrey S. Hunt, A.I.C.P
Planning Director
Department of Planning
250 South High Street
Wailuku, Hawai`i 96793-2102

SUBJECT: Early Consultation on the Draft Environmental Assessment (EA) for the Pi`ilani Highway Widening to Four (4) Lanes North of Kilohana Drive to Wailea Ike Drive, Wailea, Maui, Hawai`i

Dear Mr. Hunt:

Thank you for your letter dated April 16, 2009, providing early consultation comments on the subject project. We acknowledge the Special Management Area (SMA) boundary in the vicinity of the project is makai of the Pi`ilani Highway right-of-way easement. Coordination will be undertaken with the department to confirm applicable permitting requirements for any work located within the SMA.

Pi`ilani Highway is a State of Hawai`i highway under the jurisdiction of the Department of Transportation and they will be the Accepting Agency for the Environmental Assessment (EA).

The Draft EA will address social and physical impacts to surrounding neighborhoods, including noise and air pollution. Noise and air quality reports will be included in the Draft EA. Appropriate mitigation Best Management Practices will be included in the Draft EA.

Should you require additional clarification please call me at 244-2015. A copy of the Draft EA will be forwarded to your agency for review and comment.

Very truly yours,

Gwen Ohashi Hiraga
Principal

GOH:yp
cc: Charles Jencks, Honua`ula Partners, LLC
Clyde Murashige, A&B Wailea LLC
Don Fujimoto, Honua LLC
F:\DATA\WCPT\PiilaniWidening\PlanningDept.ecres.wpd

MAR 0 9 2009

Maui Electric Company, Ltd. • 210 West Kamehameha Avenue • PO Box 398 • Kahului, Maui, HI 96733-6898 • (808) 871-8461

March 6, 2009

Mr. Mark Roy
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, HI 96793

Subject: Early Consultation on the Piilani Highway Widening to Four Lanes Between Kilohana Drive and Wailea Ike Drive, Wailea, Maui, Hawaii

Dear Mr. Roy:

This is in response to your letter dated February 4, 2009, seeking early input regarding the proposed action.

Maui Electric Company, Limited (MECO) is in receipt of a request to relocate the utility poles affected by this highway widening project. The preliminary plan is to relocate and replace the existing wood poles with steel poles and move them in the makai direction. The work to be performed by MECO is contingent upon various approvals, including but not limited to the Public Utilites Commission, State Department of Transportation and the County's Planning Department.

Should you have any questions, please contact me at 871-2337.

Sincerely,

Randall Nakama
Customer Designer

MUNEKIYO & HIRAGA, INC.

MICHAEL T. MUNEKIYO
GWEN OHASHI HIRAGA
MITSURU "MICH" HIRANO
KARLYNN FUKUDA

MARK ALEXANDER ROY

August 28, 2009

Randall Nakama
Maui Electric Company, Ltd.
P. O. Box 398
Kahului, Hawai`i 96733-6898

SUBJECT: Early Consultation on the Draft Environmental Assessment (EA) for the Pi`ilani Highway Widening to Four (4) Lanes North of Kilohana Drive to Wailea Ike Drive, Wailea, Maui, Hawai`i

Dear Mr. Nakama:

Thank you for your letter dated March 6, 2009. Please be advised that we will coordinate the proposed project with MECO to ensure that all necessary approvals are obtained prior to the relocation of utility poles affected by the highway widening project.

Should you require additional clarification please call me at 244-2015. A copy of the Draft Environmental Assessment will be forwarded to your agency for review and comment.

Very truly yours,

Gwen Ohashi Hiraga
Principal

GOH:yp
cc: Charles Jencks, Honua`ula Partners, LLC
Clyde Murashige, A&B Wailea LLC
Don Fujimoto, Honua LLC
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FEB 1 3 2009

Maui Economic Opportunity, Inc.

P.O. Box 2122
Kahului, HI 96733
808-249-2990
Fax: 808-249-2991
www.meoinc.org

February 11, 2009

Mr. Mark Roy
Project Manager
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Roy,

Maui Economic Opportunity, Inc. has no comment or concern to offer as early consultation regarding the Pi'ilani Highway Widening Project by Honua'ula Partners, LLC. Should you have any questions, please contact me at (808) 249-2990.

Sincerely,

Sandy Baz
Chief Executive Officer

The Promise of Community Action
Community Action changes people's lives, embodies the spirit of hope, improves communities, and makes America a better place to live. We care about the entire community, and we are dedicated to helping people help themselves and each other.

Helping People. Changing Lives. community Action PARTNERSHIP AMERICA'S POVERTY FIGHTING NETWORK

FEB 1 9 2009

Madge Schaefer
Maui Meadows Neighborhood Association
520 Mikioi Place
Kihei, HI 96753

February 16, 2009

Mark Roy, Project Manager
Munekiyo & Hiraga, Inc
305 High Street, Suite 104
Wailuku, HI 96793

RE: Early Consultation on the Pi'ilani Highway Widening to Four Lanes Between Kilohana Drive to Wailea Ike Drive, Wailea, Maui, Hawaii

Dear Mr. Roy:

Maui Meadows subdivision is located adjacent to the proposed widening. On June 12, 2001 we sent a letter to Charles Jencks, owner's representative for the Wailea 670 project, outlining a number of concerns about the project, some relating to the widening of the Pi'ilani Highway. We have provided input to all issues related to this project for many years.

While we understand the need for the widening, we have an obligation to do everything possible to mitigate the impacts to the residents of Maui Meadows. We appreciate this opportunity for early consultation related to our concerns.

The essence of those concerns has not changed. They are reiterated below:

Roadway Configuration
Will the widening include a median or some type of division between north and south bound lanes?

Noise and Traffic

There are 47 Maui Meadows properties that back up directly to Piilani Highway. Highway and construction noise does travel up the hill and directly impacts no fewer than 150 properties located within 500 feet of Piilani Hwy. Most properties have both a main house and an ohana, so at least 250 families would be affected. They already experience the noise generated by traffic.
The last noise study was done in 1993 and appeared in the Proposed Project Application. That noise study was focused mainly on areas of Wailea rather than the closest inhabited area, Maui Meadows.
However, the 1993 study notes that there are four homes already exposed to greater than 65dba in Maui Meadows. Those measurements were taken 101 feet from the centerline. It is

obvious that more traffic, especially the noise of heavy construction equipment will create an unhealthy situation for residents along portions of Akala Drive and adjacent streets.
There must be a new noise study conducted with emphasis on measuring impacts to existing residences along the proposed widening route, along with mitigation measures which would lessen those impacts.

Please address the time of day the widening work would be done. Many times these projects are done at night because of less traffic. That would have tremendous impacts on adjacent homes. Imagine trying to sleep while listening to the incessant back up beeping of heavy equipment all night long for many months. Will construction noise be monitored? Where will the staging area be set up for construction equipment and employee parking?
If the project work is done at night, how will it be lit? What is the power source for those lights and if generators, how will they be muffled to reduce noise levels to adjacent homes?
What is the estimated time for project completion?

Traffic Diversion Plan

What traffic diversion plans will be in place during the entire construction period? We are concerned that the level of traffic would increase dramatically on Akala Drive by drivers wanting to avoid the construction. Where will all that traffic go that starts at 3:00 pm heading north when the workday shift ends in Wailea? We request that a diversion plan be included in the traffic study.

Dust Control

Fugitive dust is a major problem in Kihei. How will dust control be managed during grading and construction? Who will be responsible for seeing that the plan is carried out? Will the neighbors be given a hotline to call if there is a problem?
How will slopes along the route be stabilized?

Landscaping

Will landscaping of easements along the route be landscaped as part of the contract?
Will water be drawn from the recycled water line that is proposed to run under the route?

Sidewalks and Bike paths

Will sidewalks and bike paths be part of the project?

Flood Control

Does the design include flood control improvement? At times of large rains storms, Maui Meadows will get rivers flowing down from the ranch land above, bringing tons of water and debris? Are there design plans that take these storm flows into account?

Street Lighting

If street lighting is to be installed, we would like for it to be shielded so that it does not create a light pollution problem for viewing our beautiful starry sky.

Crosswalks and Traffic Signals

We are aware several pedestrian fatalities at the intersection of the Pi'ilani and Mikioi Place as well as numerous traffic accidents. Will a traffic signal be installed at this intersection? Will cross walks be painted? Will the intersection have street lights?

Blasting

Will blasting be done during construction? If yes, how will residents be notified of blast times? How will the possible collateral damage done to surrounding properties be remedied? Could the geology consultant discuss the effect of blasting on veins of blue rock to adjacent properties?

Utility Lines

Will utilities be undergrounded along the widened route?

Public Meeting

We would request that a public meeting be scheduled for Maui Meadows residents before plans are finalized so that there would be an opportunity for us to be educated as to what will be taking place, the ability to get questions answered and give further input.

Draft EA

We would appreciate receiving three copies of the draft EA on this project. We would also appreciate a copy of the draft also being placed in the Kihei Library.

Again, on behalf of the Board of Directors and the residents of Maui Meadows, we appreciate being included in this project at an early stage. Please contact me at 874-9293 if you have any questions.

Sincerely,

Madge Schaefer, President
Maui Meadows Neighborhood Association

MUNEKIYO & HIRAGA, INC.

MICHAEL T. MUNEKIYO
GWEN OHASHI HIRAGA
MITSURU "MICH" HIRANO
KARLYNN FUKUDA

MARK ALEXANDER ROY

August 28, 2009

Madge Schaefer
Maui Meadows Neighborhood Association
520 Mikioi Place
Kihei, Hawai`i 96753

SUBJECT: Early Consultation on the Draft Environmental Assessment (EA) for the Pi`ilani Highway Widening to Four (4) Lanes North of Kilohana Drive to Wailea Ike Drive, Wailea, Maui, Hawai`i

Dear Ms. Schaefer:

Thank you for your letter dated February 16, 2009. In response to your comments, the following are noted:

1. The Pi`ilani Highway widening will include a median as separation between the travel lanes.

2. The Draft Environmental Assessment (EA) will address noise impacts of the project. A Noise Study specifically for the project was conducted and will be included in the Draft EA. Noise attenuation measures shall be incorporated into the project to mitigate both construction and post-construction noise impacts.

3. As the project continues through the review process more specific mitigative measures and Best Management Practices for construction impacts from noise, fugitive dust, and traffic will be incorporated into the project. Further consultation with the Police Department will be initiated to discuss traffic matters during the construction phase.

4. Prior to the initiation of construction, consultation with the adjacent property owners will be initiated to develop additional measures to reduce impacts from construction activities.

5. Landscaping for the project include measures for dust control and stabilization of soils. Also, where possible, landscaping will be planted on the roadway side of walls to reduce any visual impacts.

6. Sidewalks are limited to the intersections connecting to Pi`ilani Highway between Kilohana Drive and Wailea Ike Drive in order to provide pedestrian crossings. A dedicated bike lane is provided on the makai (west) side of the highway with a shoulder/bike lane on the mauka (east) side of the highway.

7. The existing drainage patterns in the area will not be affected by the proposed project. Runoff from the additional lanes are calculated to be minimal and will be accommodated within proposed drainage improvements associated with the proposed project.

8. The project involves the relocation of existing street lights, as may be necessary. To the extent practicable, efforts will be made to shield any relocated light fixtures.

9. Crosswalks and traffic signals are proposed at the intersecting streets at Kilohana Drive/Mapu Place, Okolani Drive/Mikioi Place, and Wailea Ike Drive. Existing street lights at these intersections will be relocated, as may be necessary.

10. The work will be in the existing right-of-way with limited ground excavation that will require blasting. Based on a geotechnic analysis conducted for the project it is anticipated that pneumatic equipment will be used in ground excavation work.

11. Work is being coordinated with Maui Electric Company, Ltd. to relocate the existing above-ground utility poles.

12. A public community meeting was conducted on April 16, 2009 at the Kihei Community Center. The Maui Meadows Neighborhood Association, Wailea Community Association, and Kihei Community Association were invited to the public meeting which included the consultant team and a representative from the State Department of Transportation.

In accordance with the review process for EAs, a copy of the Draft EA will be forwarded to the Kihei Library. In accordance with your request, we will forward three (3) copies of the Draft EA to the Maui Meadows Neighborhood Association.

Should you require additional clarification please call me at 244-2015.

Very truly yours,

Gwen Ohashi Hiraga
Principal

GOH:yp
cc: Charles Jencks, Honua`ula Partners, LLC
Clyde Murashige, A&B Wailea LLC
Don Fujimoto, Honua LLC
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KCA

Kihei Community Association

"Working together to shape our Community's future."

FEB 2 0 2009

February 18, 2009

Munekiyo & Hiraga
Attn: Mark Roy
305 High St.
Wailuku, HI. 96793

Re: Draft EA Pi'ilani Highway Widening Kilohana to Wailea Ike

Dear Mark,

We at the KCA have nothing to add in opposition to your Draft EA. We have spoken with the developers in the past and are aware of the proposed project and their intentions. We are confident the developer will do what is best for safe smooth traffic flow, the community and abide by the decision brought down by the County Council.

We thank you for keeping us informed at the community level. We look forward to working alongside you and your client now and in the future.

Regards,

Michael C. DiBella

KCA Planning Committee Chairman

cc: Charles Jencks, Honua'ula Partners LLC

P.O. Box 662 – Kihei, HI – 96753 – 808-879-5390 – info@KiheiCommunityAssociation.org

X. REFERENCES

X. REFERENCES

County of Maui, 2030 General Plan - Countywide Policy Plan, March 2010.

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County of Maui, Socio-Economical Forecast, The Economic Projections for the Maui County General Plan 2030, June 2006.

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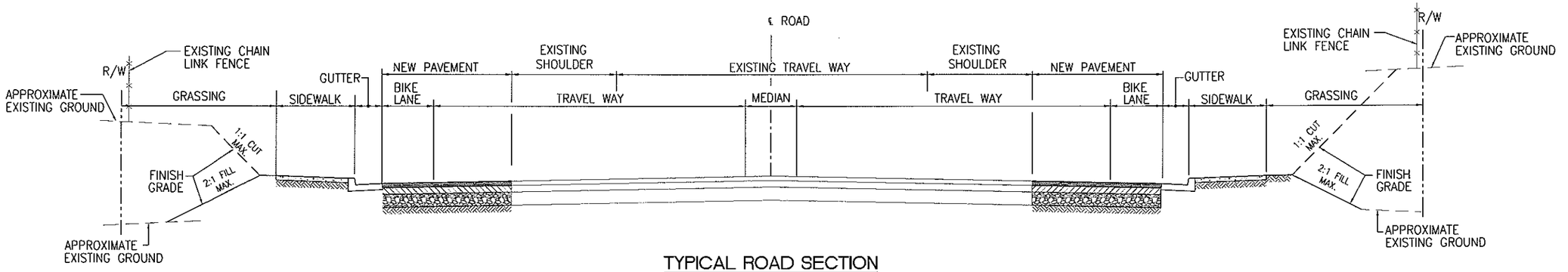
APPENDIX A.

Preliminary Engineering Plans



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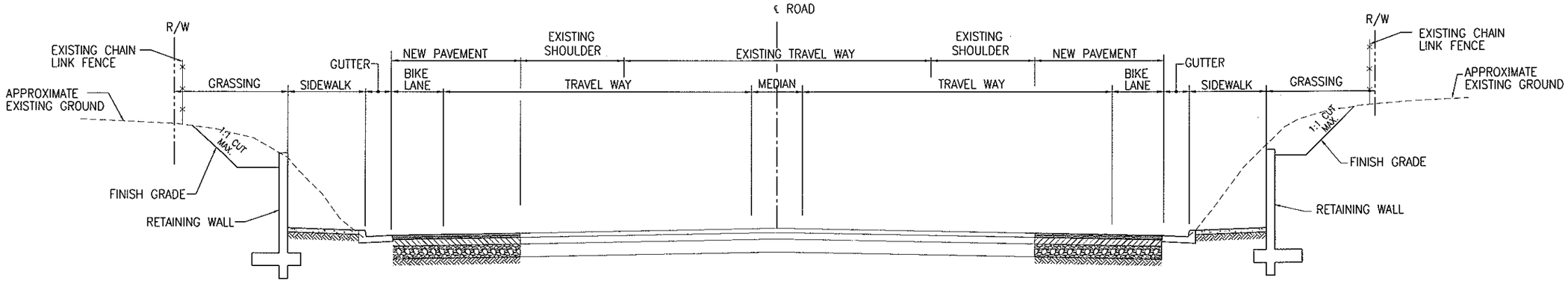
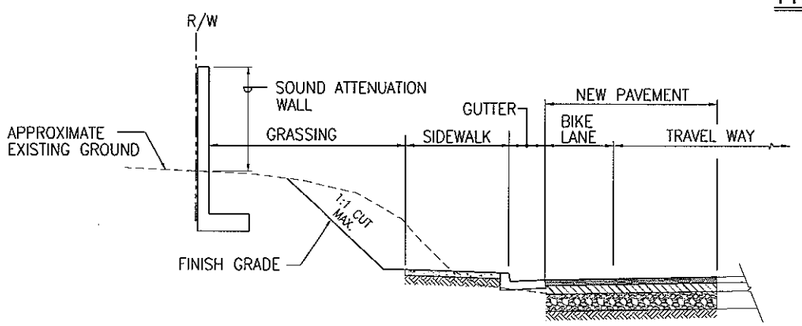


TYPICAL ROAD SECTION WITH RETAINING WALLS



CUT SECTION WITH
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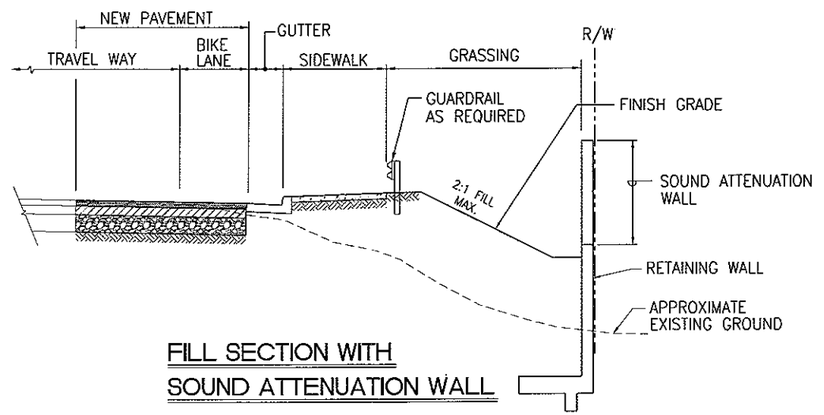

FILL SECTION WITH
SOUND ATTENUATION WALL

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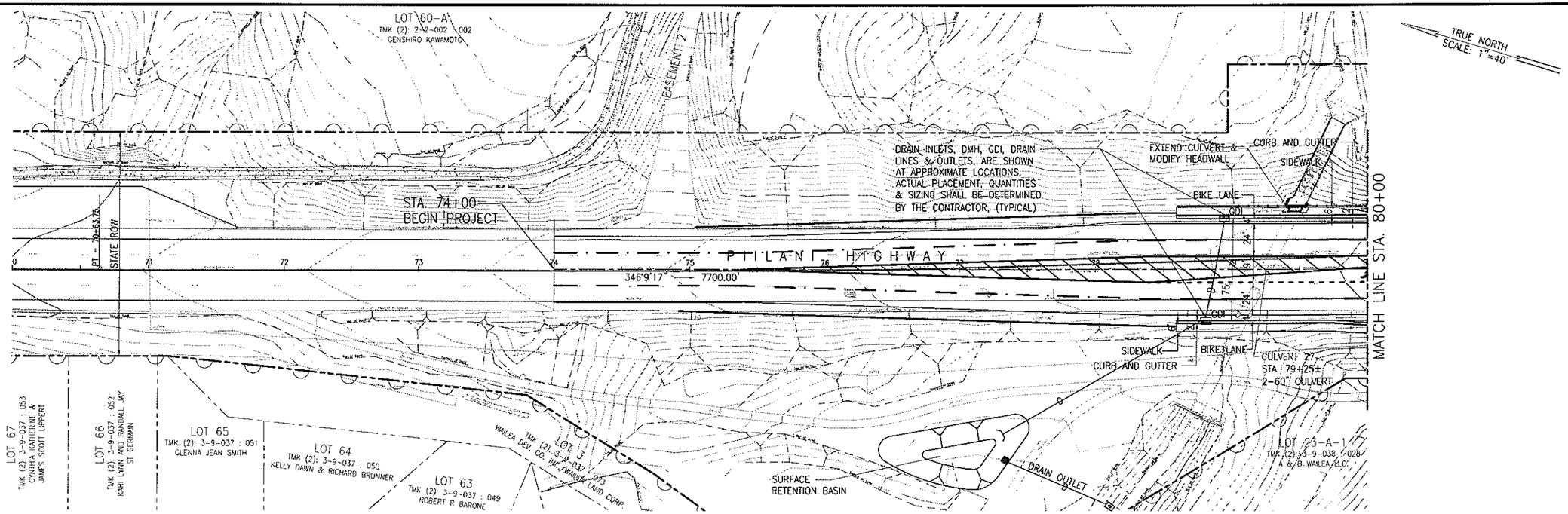

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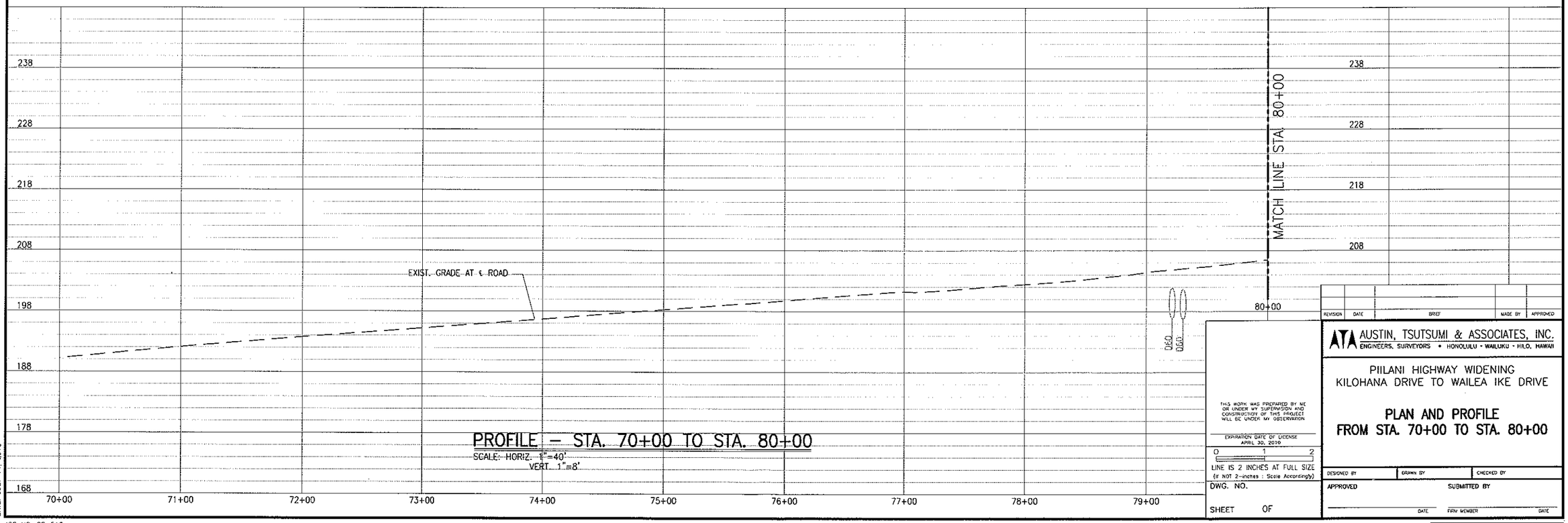

PROFILE – STA. 70+00 TO STA. 80+00

SCALE: HORIZ. 1"=40'
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KILOHANA DRIVE TO WAILEA IKE DRIVE

PLAN AND PROFILE FROM STA. 70+00 TO STA. 80+00

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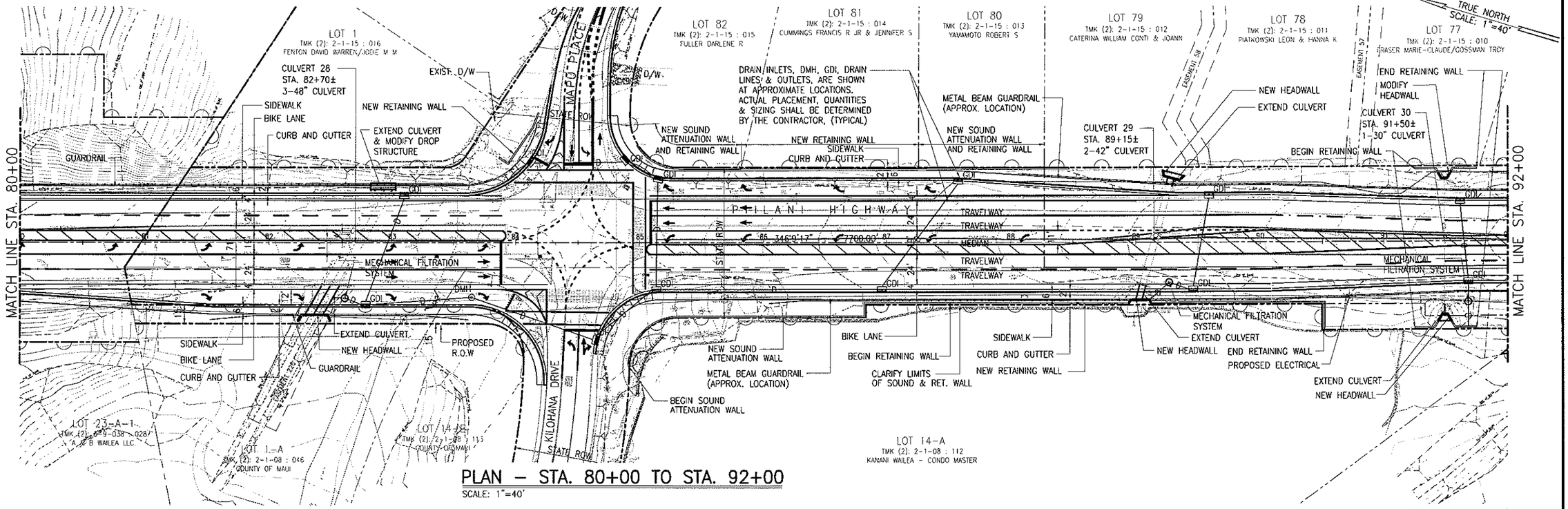

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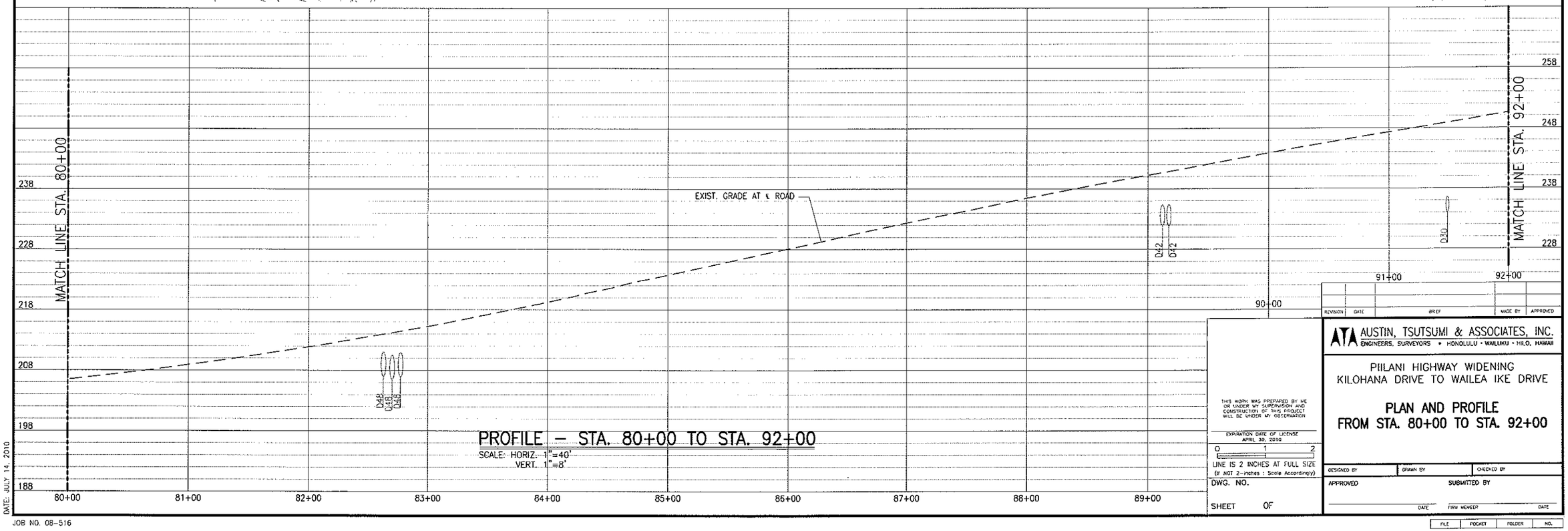

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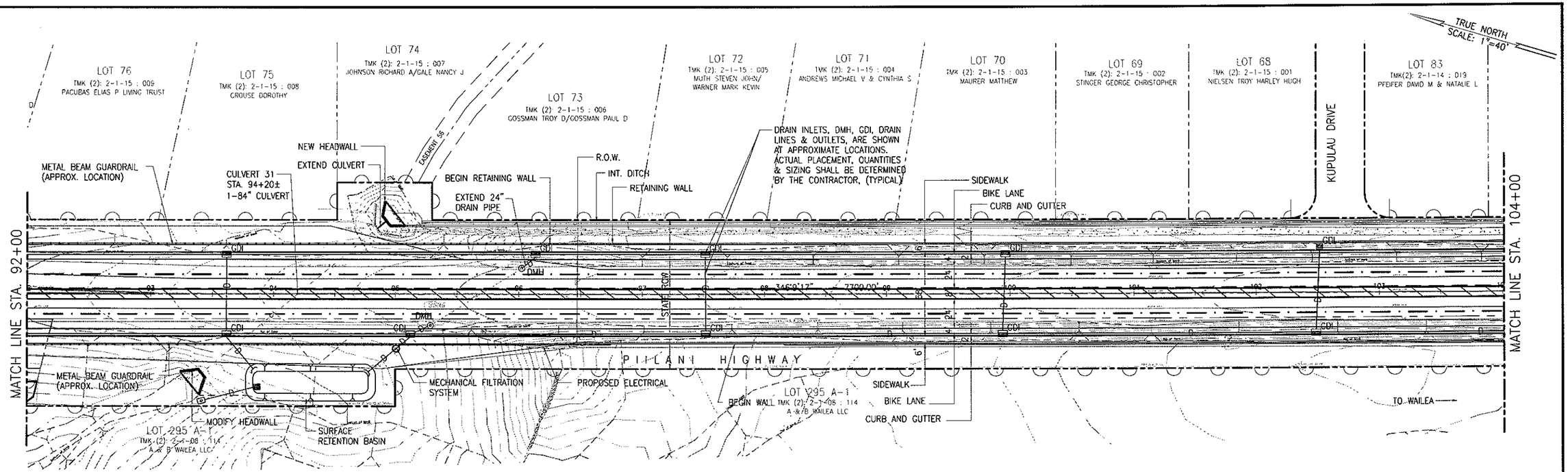

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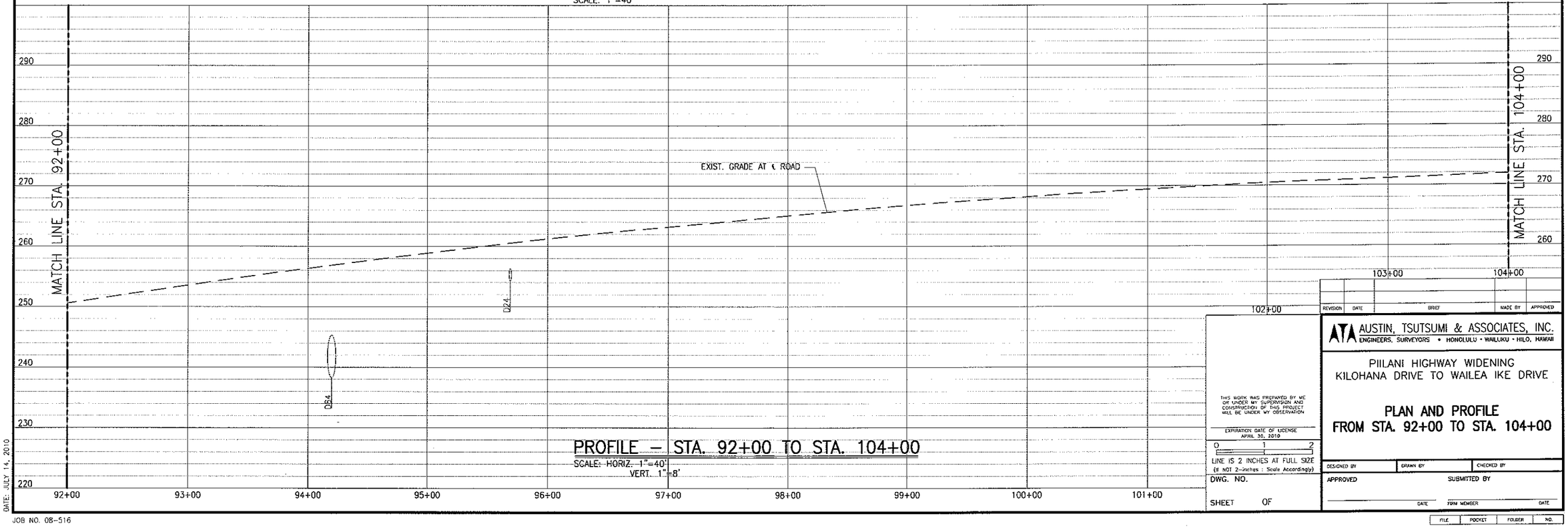

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PLAN AND PROFILE
FROM STA. 92+00 TO STA. 104+00

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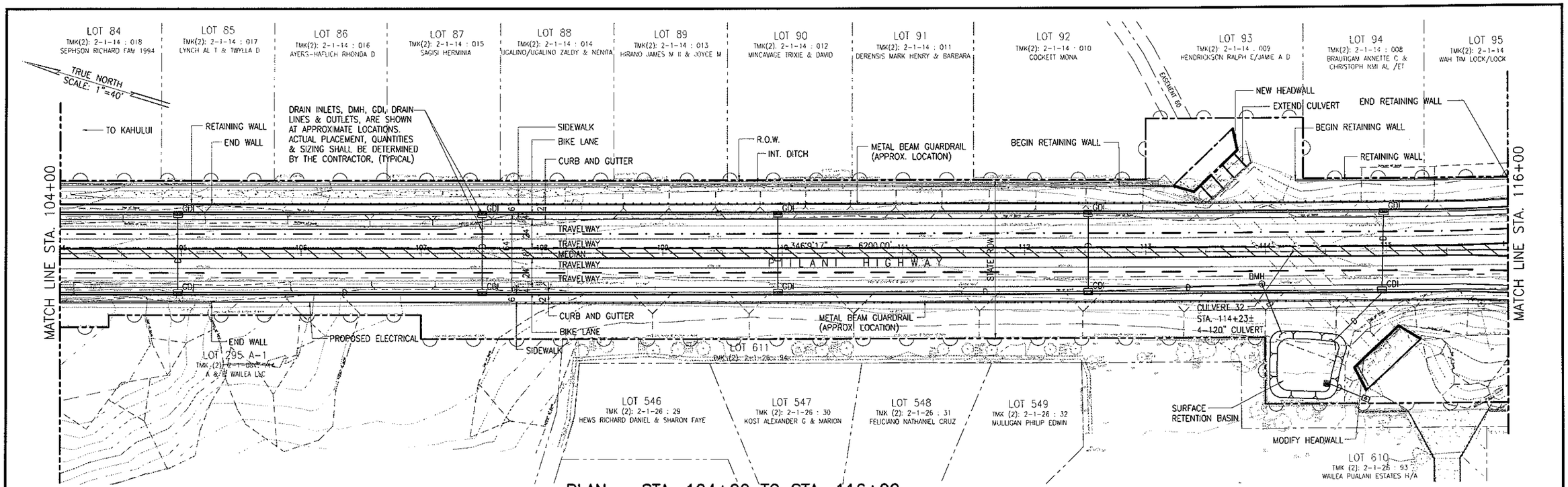

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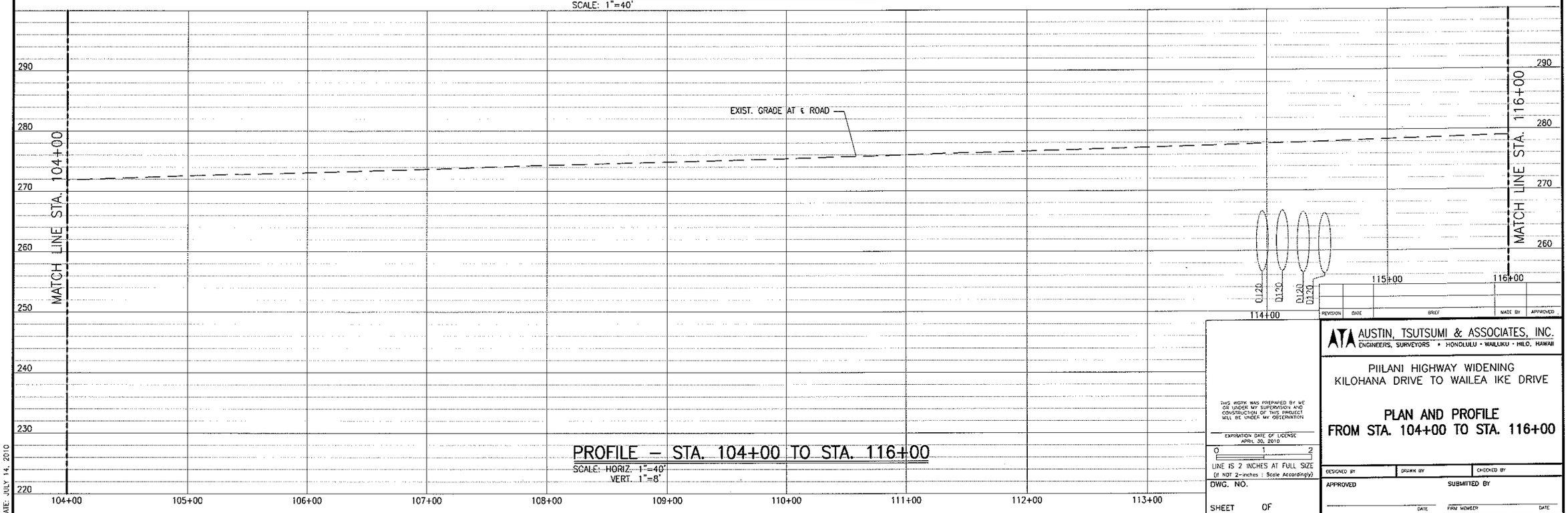

PROFILE – STA. 104+00 TO STA. 116+00

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KILOHANA DRIVE TO WAILEA IKE DRIVE

PLAN AND PROFILE FROM STA. 104+00 TO STA. 116+00

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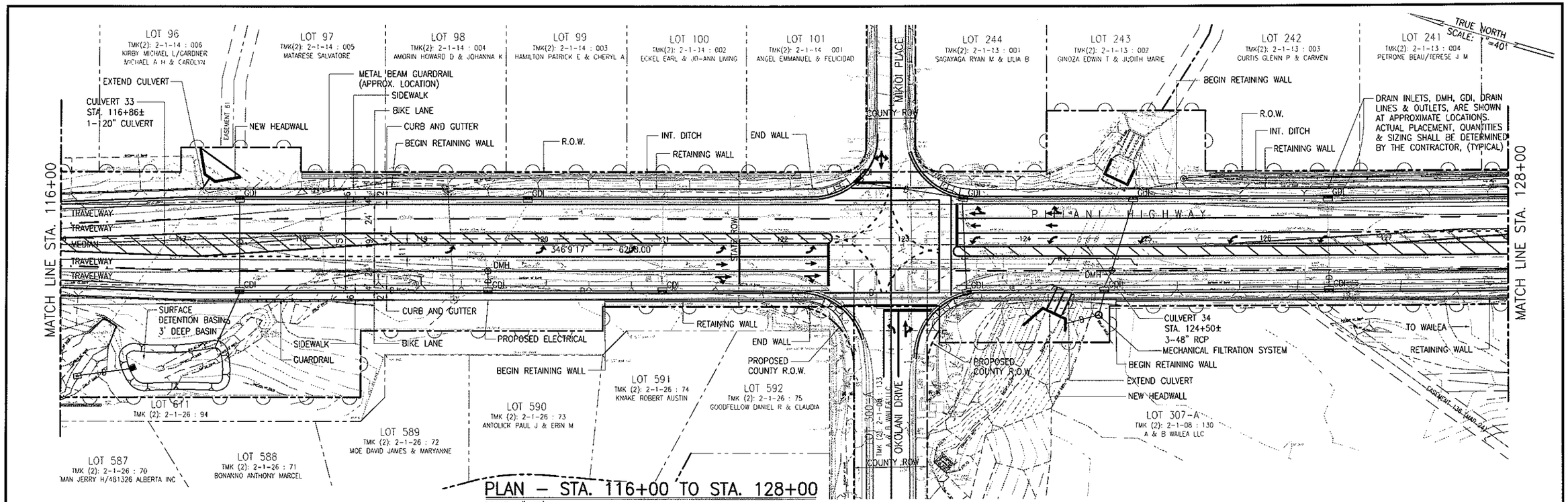

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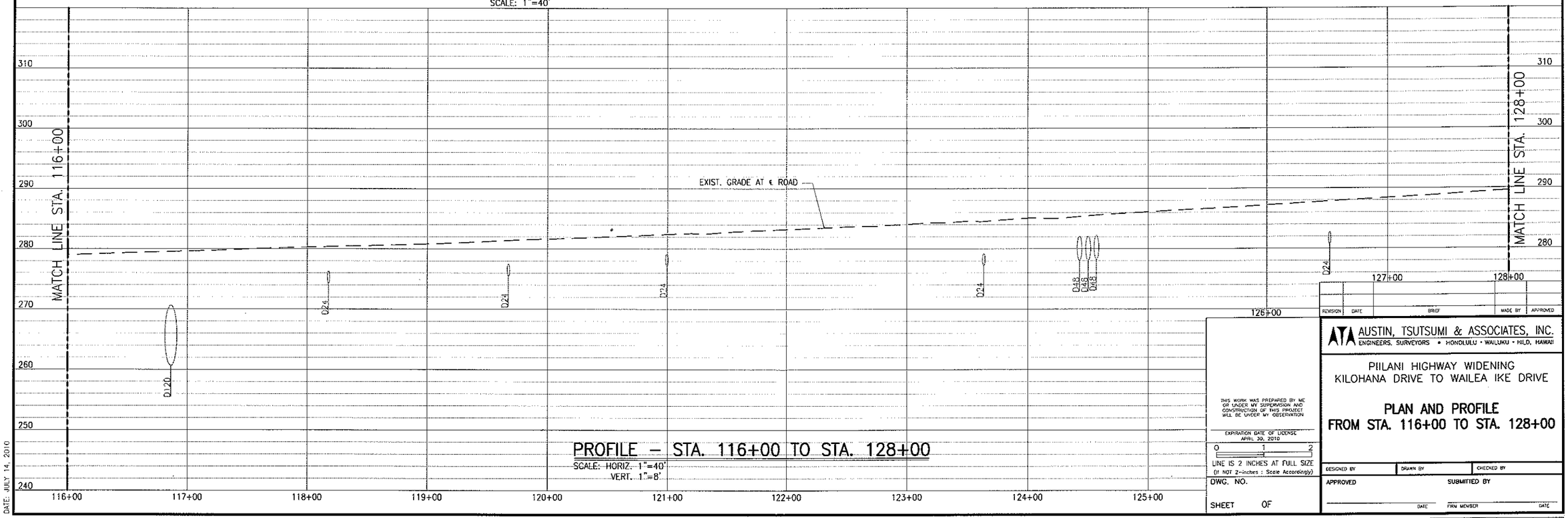

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PIILANI HIGHWAY WIDENING
KILOHANA DRIVE TO WAILEA IKE DRIVE

PLAN AND PROFILE
FROM STA. 116+00 TO STA. 128+00

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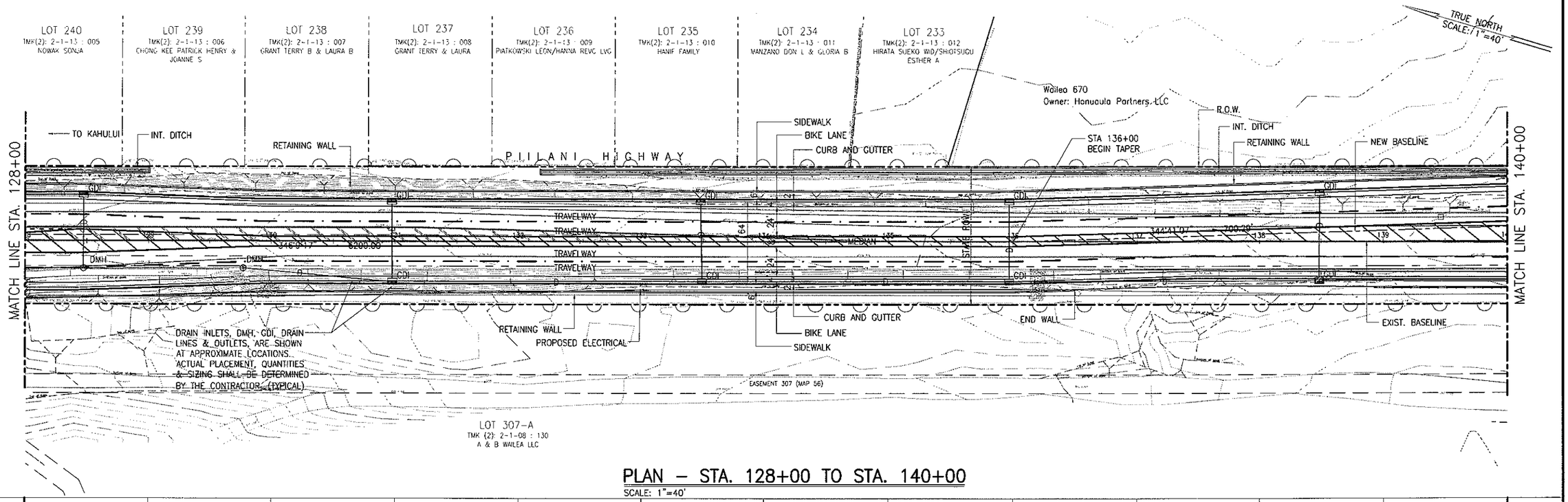

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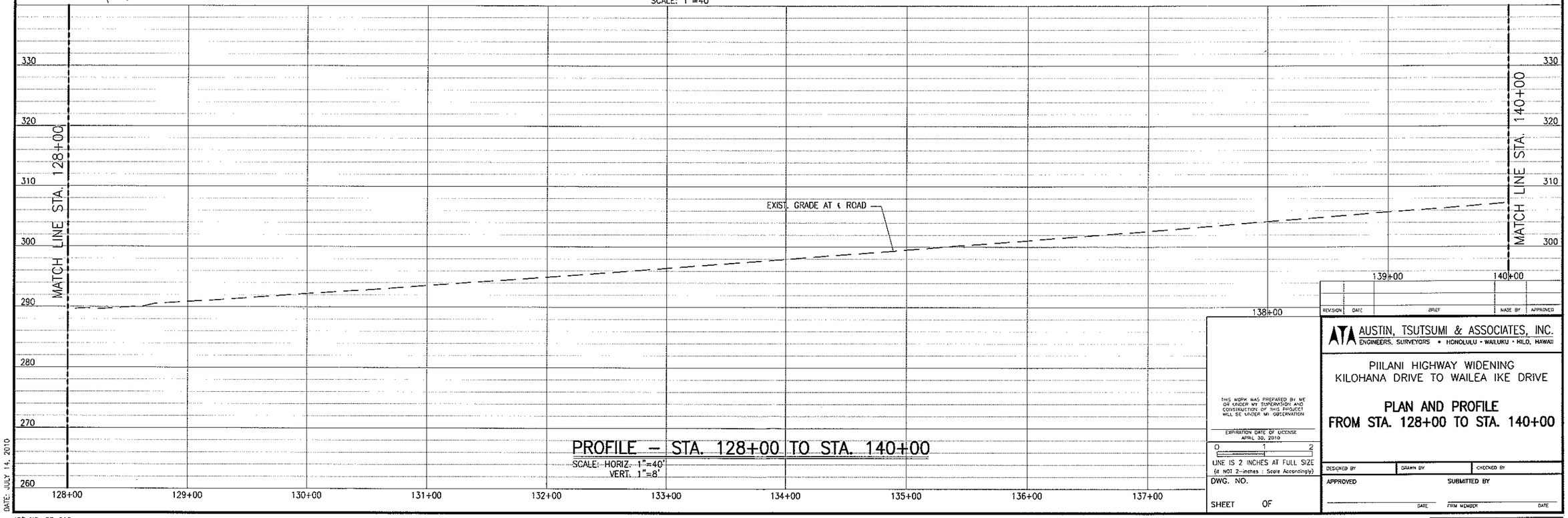

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KILOHANA DRIVE TO WAILEA IKE DRIVE

PLAN AND PROFILE
FROM STA. 128+00 TO STA. 140+00

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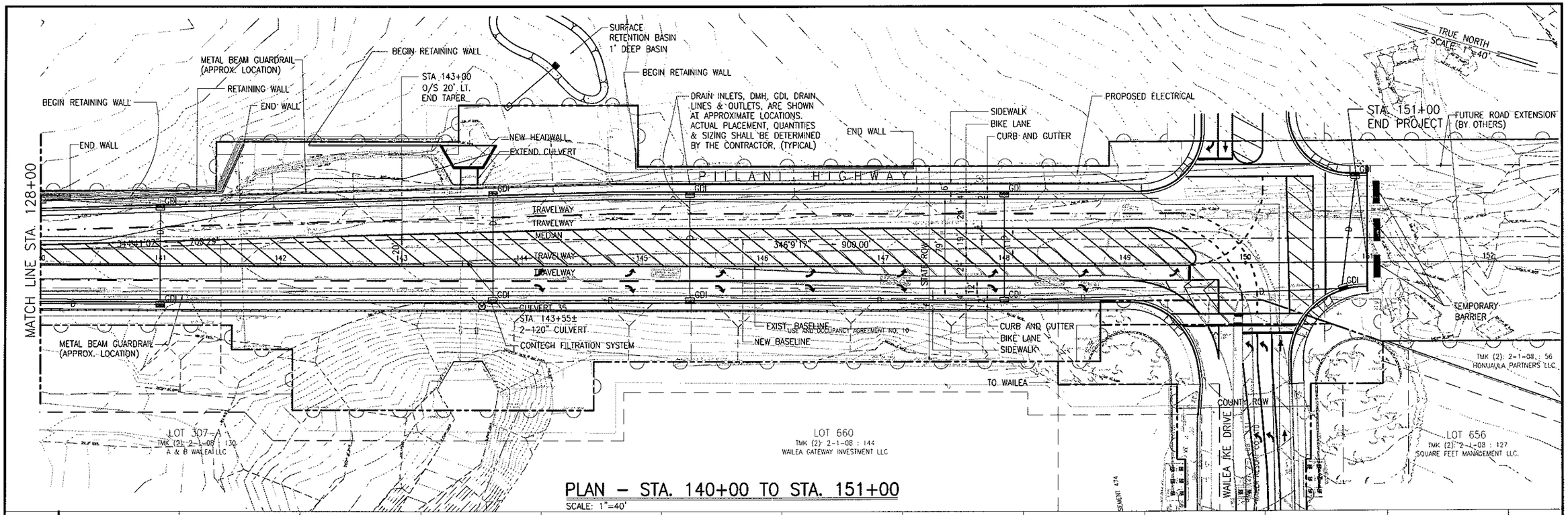

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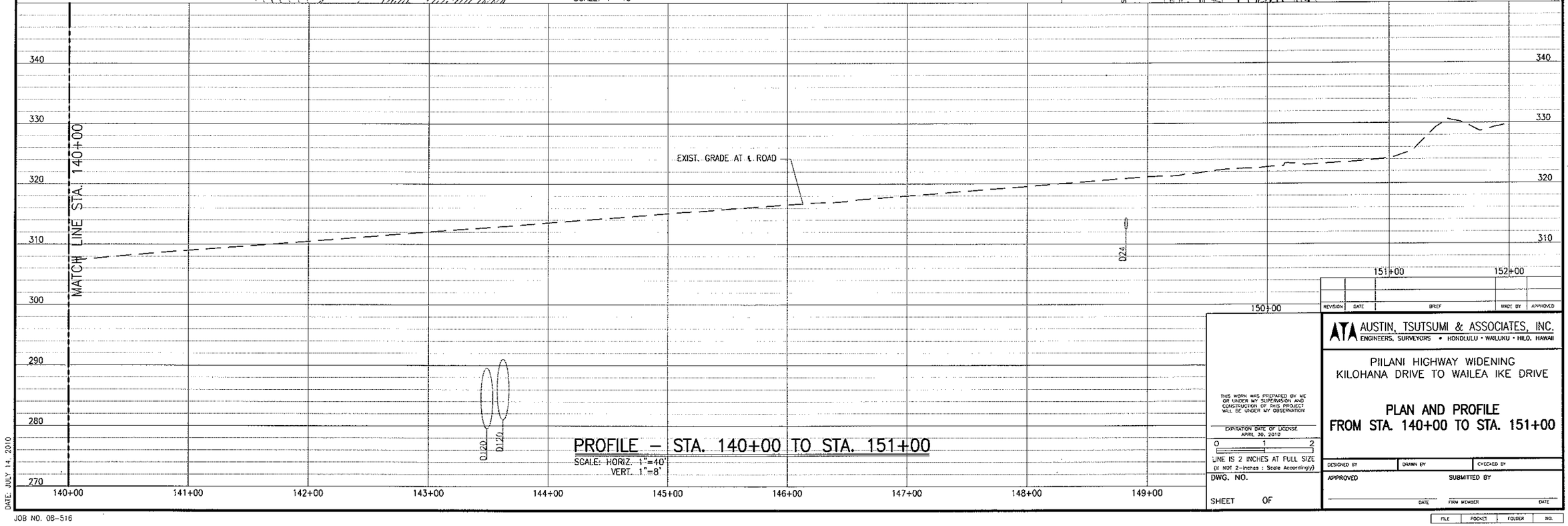

PROFILE – STA. 140+00 TO STA. 151+00

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DATE: JULY 14, 2010

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APPENDIX B.

Hirata & Associates, Inc.
Letter Dated March 30, 2009

Hirata & Associates, Inc.

March 30, 2009
W.O. 09-4715

Mr. Charles Jencks
Honua`ula Partners LLC
P.O. Box 220
Kihei, Hawaii96753

Dear Mr. Jencks:

Re: Geotechnical Consultation Services
Pi`ilani Highway Widening - Revised Letter
Kilohana Street to Wailea Ike Drive
Wailea, Maui, Hawaii

This letter presents our geotechnical findings and opinions in support of the preparation of the Environmental Assessment for the above referenced project. Our findings and opinions are based on a review of available in-house information pertinent to the site, a visual reconnaissance of the site, our past experience in the project area, and a review of preliminary plans.

Project Considerations

The proposed Pi`ilani Highway widening will extend from Kilohana Street to Wailea Ike Drive, a length of approximately 6,610 feet. The existing highway is an AC paved roadway with one lane of traffic in each direction. The proposed widening will consist of creating two lanes of traffic in each direction. Based on the preliminary plans and the existing conditions of the site, it appears that grading will consist of both cuts and fills.

Soils Information

Based on a review of available in-house information, including past projects performed by our firm in the Wailea area, the surface soil in the project area is expected to consist predominantly of brown clayey silt with sand and gravel. Our past experience in the project area also indicates that the onsite clayey silt has a low to moderate expansion potential. Underlying the surface clayey silt at varying depths is weathered basalt ranging from a completely weathered condition to moderately weathered.

The Soil Survey, prepared by the US Soil Conservation Service, identifies the soils in the project area as Makena loam, stony complex, 3 to 15 percent slopes (MXC) and Keawakapu extremely stony silty clay loam, 3 to 25 percent slopes (KNXD). A Soils Map is presented on Plate B1.

Makena loam, stony complex, is generally found on the lower leeward slopes of Haleakala, between Makena and Kamaole, and consists of Makena loam and stony land. Stony land occurs on low ridges and makes up 30 to 60 percent of the complex. Makena loam is a dark brown to dark yellowish brown well drained soil, developed from volcanic ash, and is usually located between the low ridges of stony land. Makena loam is characterized by a relatively high permeability, and a low shrink-swell potential. Permeability on Stony land is very rapid.

Keawakapu extremely stony silty clay loam is generally found on upland areas on the island of Maui. These soils dark reddish brown in color and were developed in volcanic ash. Keawakapu extremely stony silty clay loam is characterized by moderate permeability, and a low shrink-swell potential.

Highly vesicular basalt with an irregular and spiny surface, referred to as *aa* lava, underlies both soil types at depths of usually less than about 5 feet. In some areas, outcrops of *aa* lava cover as much as 15 percent of the land.

Visual Reconnaissance

Our visual reconnaissance indicates that the in-situ soils consist of brown and grayish brown clayey silt with gravel. The existing roadway appears to be located on both fill and cut areas. The fill and cut areas alternate along the length of the proposed widening. Fill areas appear to consist of the onsite clayey silt, mixed with cobbles and boulders. Cut areas generally exposed moderately weathered basalt with occasional clinker layers. The basalt appeared to be in a hard condition.

Our visual reconnaissance generally confirms the Soil Survey and our past experience in the project area.

Geotechnical Issues

Grading - It is our opinion that excavations into the surface soils can be accomplished using conventional excavating equipment. However, excavations into basalt may require pneumatic equipment, especially for confined excavations such as trenching. Temporary excavations into the surface soils should stand at a 1H:1V gradient. However, localized sloughing can be expected as the exposed soil dries out. Temporary excavations into the basalt should stand at a near vertical gradient.

Permanent cut slopes exposing the surface soil, as well as fill slopes, should be designed for gradients of 2H:1V or flatter. Permanent cut slopes into the basalt should generally be stable at gradients of 1H:1V or flatter.

New fill slopes should be continually benched as the fill is brought up in lifts. Fill placed on slopes should be keyed and benched into the existing slope to provide stability for the new fill against sliding. Filling the slope with sliver fills should be avoided. To reduce the potential effects of erosion and weathering, slopes exposing the onsite soils or new fill should be planted as soon as practical.

The onsite soils should be acceptable for re-use in fills and backfills. However, the soil should be tested and its acceptability for re-use as backfill verified as part of the geotechnical investigation conducted during the design phase. We expect that excavated basalt will also be acceptable for use as backfill provided the material is processed or crushed to a well-graded consistency.

Foundations - We expect that conventional shallow foundations bearing directly on either the onsite soils, basalt, or new compacted fill will be allowed for support of new retaining walls and headwalls for drainage structures. Foundation design parameters will be determined upon completion of a geotechnical investigation conducted during the design phase.

Limitations

This letter was prepared specifically for Honua`ula Partners LLC and their consultants in support of the preparation of Environmental Assessment Report for the proposed Pi`ilani Highway Widening. The information and opinions presented in this report are for information purposes only.

The services performed for this project were performed in a manner consistent with that level of care, skill, and competence ordinarily exercised by members of the profession in good standing, currently practicing under similar conditions. We will not be responsible for the interpretation by others of the information developed. No warranty is made regarding the services performed under this agreement, either express or implied.

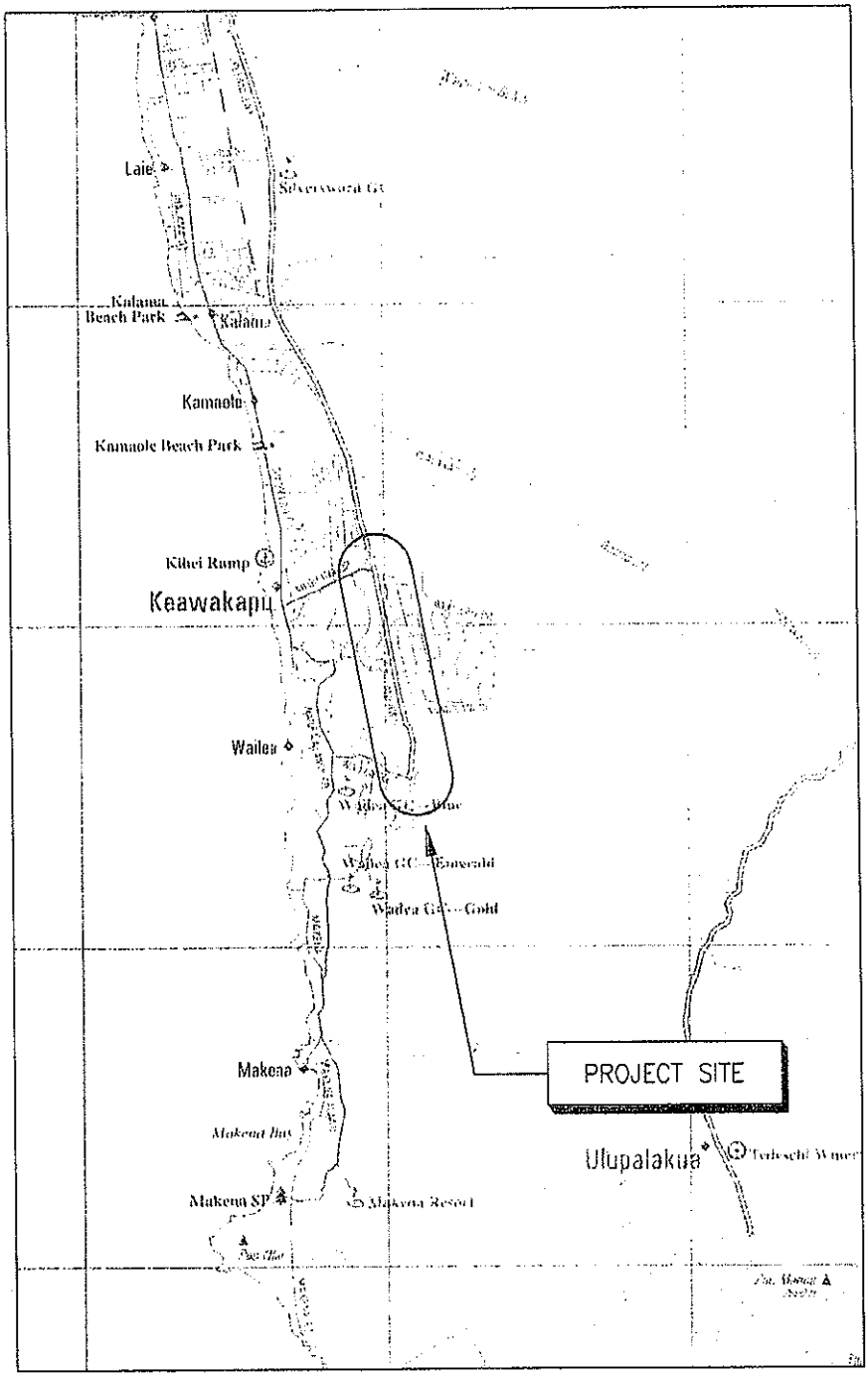
Respectfully submitted,

HIRATA & ASSOCIATES, INC.

Rick I. K. Yoshida, P.E.

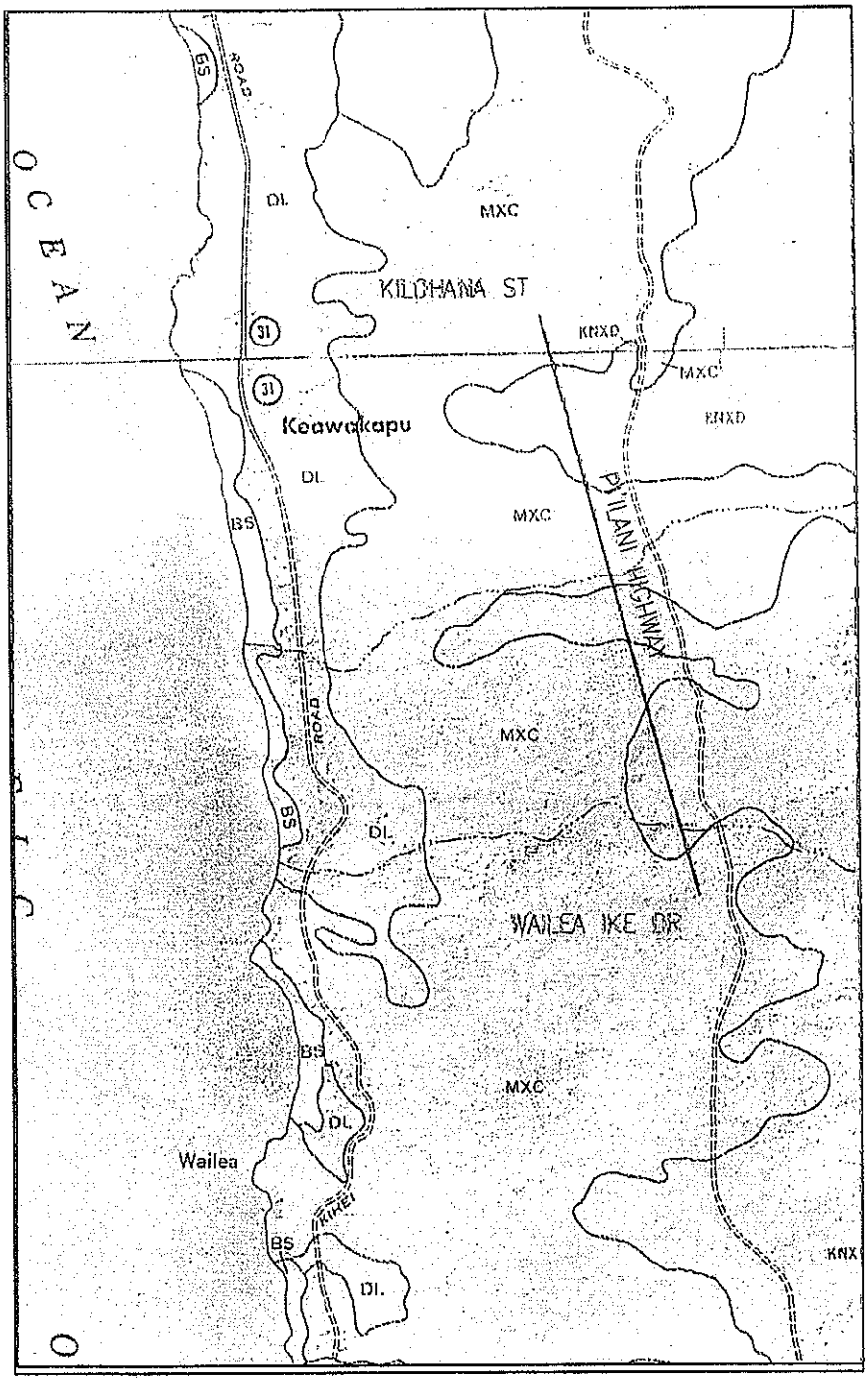
Attachments:

Location Map ..... Plate A
Soil Survey Map ..... Plate B



Reference: Hawaii Atlas & Gazetteer, Topo Maps of the Entire State by DeLorme (1999)

W.O. 09-4715	Pi'ilani Highway Widening - Kilohana Street to Wailea Ike Drive
Hirata & Associates, Inc.	LOCATION MAP Plate A

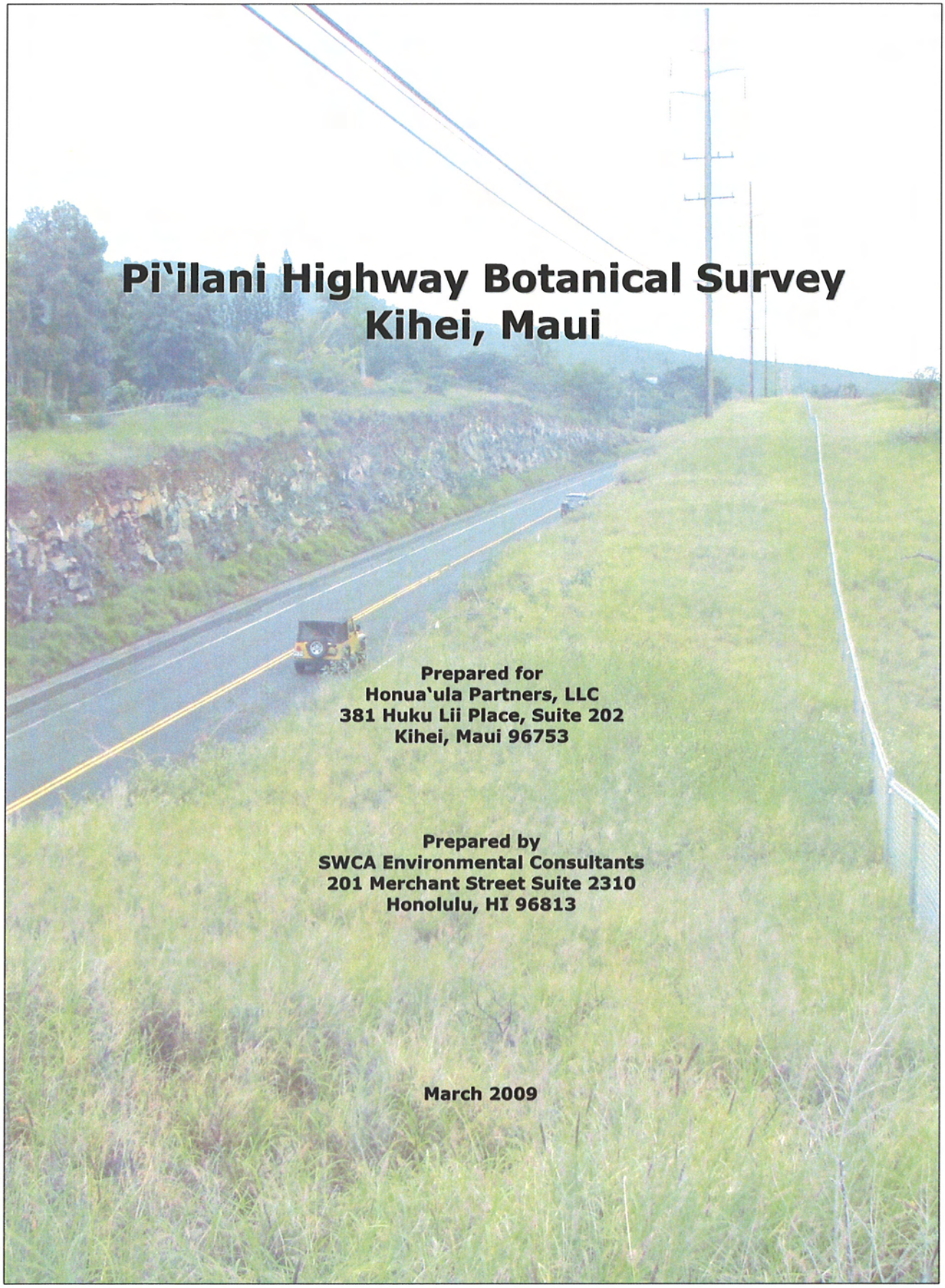


Reference: Soil Survey, Soil Conservation Service
August 1972

W.O. 09-4715	Pi'ilani Highway Widening - Kilohana Street to Wailea Ike Drive
Hirata & Associates, Inc.	SOIL SURVEY MAP Plate B

APPENDIX C.

Pi`ilani Highway Botanical Survey



Pi'ilani Highway Botanical Survey
Kihei, Maui

Prepared for
Honua'ula Partners, LLC
381 Huku Lii Place, Suite 202
Kihei, Maui 96753

Prepared by
SWCA Environmental Consultants
201 Merchant Street Suite 2310
Honolulu, HI 96813

March 2009

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3.0 Findings 3

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Figure 2. Native 'ilima (*Sida fallax*) (yellow flowers) was common throughout Pi'ilani Highway right-of-way. 7

Figure 3. Typical portion of Pi'ilani Highway right-of-way comprised of steep slopes with exposed rocks. 7

Figure 4. The dominant vegetation within the right-of-way of Pi'ilani Highway mostly comprised of buffel grass (*Cenchrus ciliaris*) grassland. 8

Figure 5. The east side of Pi'ilani Highway right-of-way comprised of long stretches of monotypic stands of buffel grass (*Cenchrus ciliaris*). 8

Figure 6. Patches of burnt vegetation along the east side of Pi'ilani Highway 9

1.0 Introduction

In January 2009, SWCA was tasked by Honua'ula Partners, LLC to conduct a botanical survey along a 2,000 m (6,560 ft) stretch along Pi'ilani Highway between Kilohana Drive and Wailea Ike Drive. The survey was prepared in support of an environmental assessment (EA) being prepared for the Pi'ilani Highway widening under Hawai'i Revised Statutes (HRS) Chapter 343 (Environmental Impact Statements) and Hawai'i Administrative Rules (HAR) Title 11, Chapter 200 (Environmental Impact Statement Rules). The highway widening project was mandated by the Maui County Council in the Phase I conditions for completion of the proposed Honua'ula development.

Pi'ilani Highway is the major north-south arterial road serving the Kihei-Makena area including Honua'ula. At present, Pi'ilani Highway is a two lane road between Kilohana Drive and Wailea Ike Drive and intersects Wailea Ike Drive in a T- intersection, with the highway forming the stem of the intersection. The future extension of Pi'ilani Highway will bisect the Project site (Figure 1).

This report summarizes the findings of a botanical survey conducted on February 5, 2009 along 2,000 m (6,560 ft) of Pi'ilani Highway between Wailea Ike Drive and Kilohana Drive in Wailea, Maui. The objectives of the botanical survey along the Pi'ilani Highway between Wailea Ike Drive and Kilohana Drive were:

1) To identify and document the vegetation type and all plant species which occur within the right-of-way (ROW) on either side of Pi'ilani Highway;
2) To document the relative abundance of the plant species which occur along the highway; and
3) To map any State or Federally listed candidate, threatened, or endangered plant species, species of concern and/ or rare (either locally or State-wide) plants on either side of the highway.

2.0 Methods

SWCA botanists Shahin Ansari, Ph.D. and Tiffany Thair (M.S. candidate) conducted a vegetation survey of the project area on February 5, 2009. The botanists walked the rights-of-way on either side of the highway within the areas identified for expansion, and identified and documented the plant species. On the eastern (mauka) side of the highway, the ROW was approximately 2 to 5 m (7-16 ft) wide with small sections that extended up to 18 m (59 ft) wide. On the western (makai) side of the highway, the ROW was approximately 5 to 8 m (16-26 ft) wide with several sections that extended up to 20 to 30 m (66-98 ft) wide. A Garmin GPS unit was employed together with a detailed topographic map (1:1,200) to map native species of interest. Approximately 38,445 sq m (413,819 sq ft) of ROW were surveyed along the Pi'ilani Highway between Wailea Ike Drive and Kilohana Drive during this study.

3.0 Findings

No federally listed threatened, endangered, or candidate endangered plant species (USFWS 2009a, 2009b) were observed within the ROW on either side of Pi'ilani Highway. No rare native plant species were found during the survey along the highway. A total of 88 plant species were recorded of which three species are native. Two indigenous species, 'ilima (*Sida fallax*) (Figure 2) and uhaloa (*Waltheria indica*), were common along both sides of the highway. The third native species, milo (*Thespesia populnea*), was only found at one location adjacent to a home owner's backyard.

The terrain within the ROW on either side of Pi'ilani Highway varied. Parts of the ROW adjacent to the road primarily consisted of steep slopes while the other areas were flat to gently undulating. The soil was broken in most places with exposed rocks along the slopes (Figure 3). The vegetation along both sides of the highway consisted primarily of buffel grass grassland (Figure 4). Kiawe (*Prosopis juliflora*) trees and shrubs of koa haole (*Luceana leucocephala*), slender mimosa (*Desmanthus pernambucanus*) castor (*Ricinus communis*), fuzzy rattle pod (*Crotolaria incana*), hairy abutilon (*Abutilon grandifolium*) and tree tobacco (*Nicotiana glauca)*

were common along the highway ROW. Sow thistle (*Sonchus oleraceus*), golden crown beard (*Verbesina enceloides*) and spurge (*Chamaecyse hirta*) were some of the common herbaceous plants in the ROW. Hairy merremia (*Merremia aegyptia*) and wild bean (*Macroptilium lathyroides*) were vines commonly found on both sides of the highway. Compared to the east side (n= 40) the vegetation along the west side (n= 75) of the highway had a higher diversity of introduced weedy species. Monotypic stands of buffel grass (Figure 5) were found along stretches of the ROW on the east side of the highway. Evidence of fire damage to vegetation was found on the west side of Pi'ilani Highway (Figure 6).

4.0 Discussion and Recommendation

The proposed road widening on Pi'ilani Highway will not have a significant negative impact on the botanical resources in the ROW area between Wailea Ike Drive and Kilohana Drive. The majority (97%) of the plants observed within this area are introduced species. The native species found within the project area are common throughout Maui and the other islands within the state. The lower species diversity found on the eastern side of the highway ROW may be attributed to recent brushfires.

1. Non-native tree tobacco (*Nicotiana glauca*) trees found on the site are host plants for the listed endangered Blackburn sphinx moth (*Manduca blackburni*). *M. blackburni* has been found on tree tobacco plants elsewhere in Kihei and within the Honua'ula project site (SWCA 2009). To help insure against the accidental take of individual sphinx moths, each tree tobacco plant should first be screened by a qualified wildlife biologist prior to any land clearing. If sphinx moths or signs of sphinx moths (frass, cut stems or leaves, caterpillars, pupae, or adults) are found on any tree, that tree should be marked and protected against disturbance for the duration of the breeding season.

2. Landscaping following realignment construction should focus on the use of native plant species normally found in coastal dry shrubland habitats. Suitable species may include: 'ilima (*Sida fallax*) 'aki'aki (*Sporobolus virginicus*), pohinahina (*Vitex rotundifolia*), 'akia (*Wikstroemia uva-ursi*), and mau'u 'aki'aki (*Fimbristylus cymosa*). Seeds or seedlings for these native plants may be obtained from various native plant nurseries on Maui such as Ho'olawa Farms or Native Nursery LLC.

3. The use of plants within the Solenaceae (nightshade family) for ROW landscaping should be forbidden so as not to attract endangered Blackburn sphinx moths to the highway where they are at higher risk for injury or death.

5.0 Literature Cited

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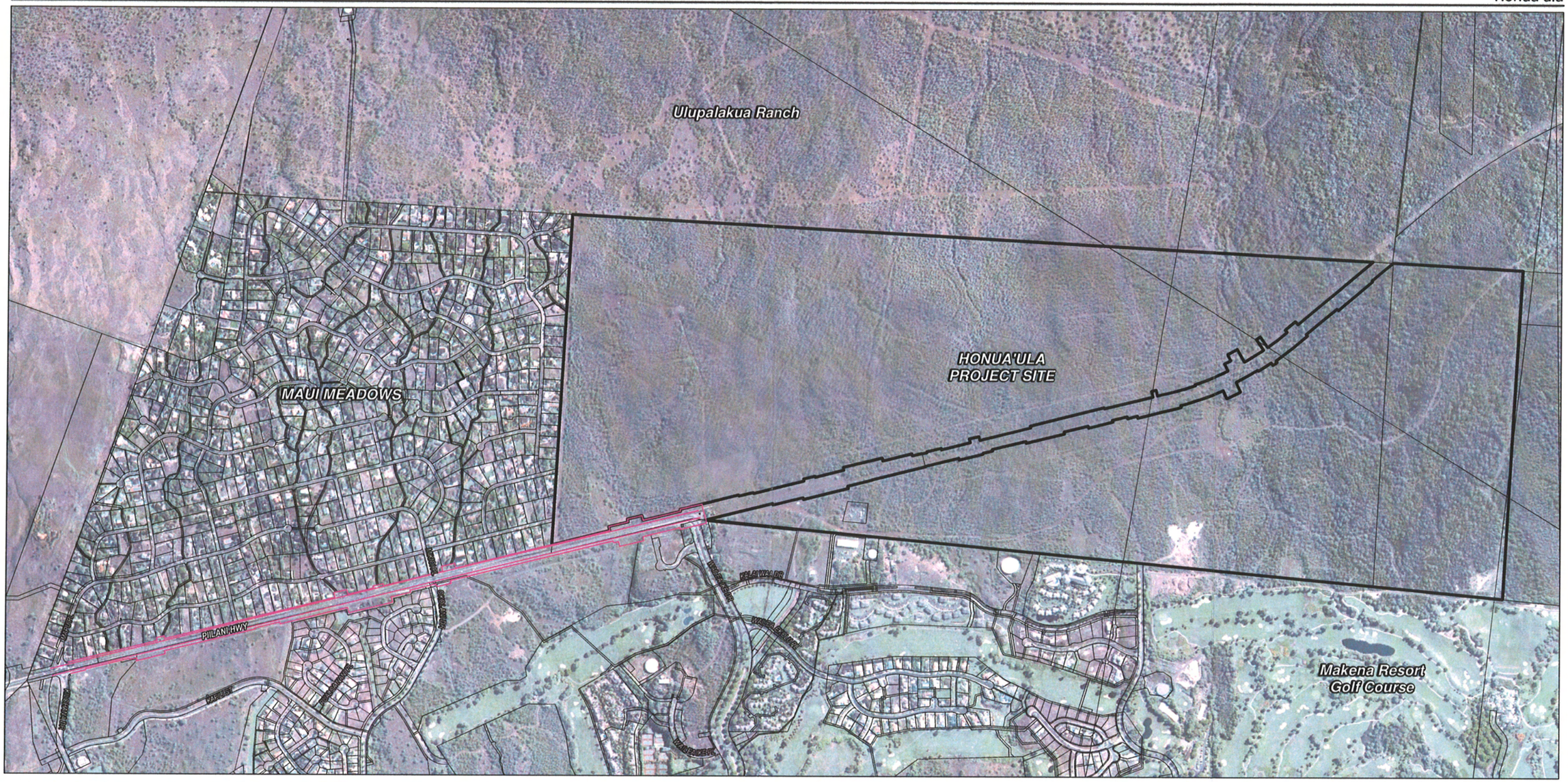

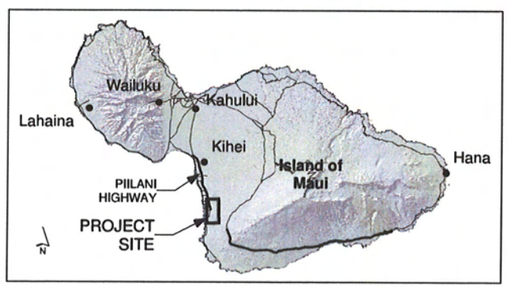

Legend

- Honua'ula Project Boundary
- Survey Area Extents
- TMK Parcels

Source: State of Hawaii GIS; PBR Hawaii

Figure 1
Location Map

N

0 250 500 1,000 ft

0 50 100 200 M

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Figure 2. Native ʻilima (*Sida fallax*) (yellow flowers) was common throughout Piʻilani Highway right-of-way.

Figure 3. Typical portion of Piʻilani Highway right-of-way comprised of steep slopes with exposed rocks.

Figure 4. The dominant vegetation within the right-of-way of Pi'ilani Highway mostly comprised of buffel grass (*Cenchrus ciliaris*) grassland.

Figure 5. The east side of Pi'ilani Highway right-of-way comprised of long stretches of monotypic stands of buffel grass (*Cenchrus ciliaris*).

Figure 6. Patches of burnt vegetation along the east side of Pi'ilani Highway.

Appendix 1. *List of plant species that occur within the right-of-way on either side of the Pi'ilani Highway between Wailea Ike Drive and Kilohana Drive.*

The following checklist is an inventory of all the plant species observed along 2,000m (6,560 ft) of Pi'ilani Highway between Wailea Ike Drive and Kilohana Drive. The plant names are arranged alphabetically by family and then by species into each of three groups: pterdiphytes (ferns), monocots and dicots. The taxonomy and nomenclature of the flowering plants, monocots and dicots, are in accordance with Wagner et al. (1990, 1999), Wagner and Herbst (1999), and Staples and Herbst (2005). Recent name changes are those recorded in the Hawaii Biological Survey series (Evenhuis and Eldredge, eds, 1999-2002).

For each species, the following name is provided:

Status:

1. Scientific name with author citation
2. Common English and/or Hawaiian name(s), when known
3. Biogeographic status. The following symbols are used:

E = endemic = native only to the Hawaiian Islands.

I = indigenous = native to the Hawaiian Islands and elsewhere.

Pol = introduced by Polynesians

X = introduced or alien = all those plants brought to the Hawaiian Islands by humans, intentionally or accidentally, after Western contact, that is Cook's arrival in the islands in 1778.

Side of the highway:

E = East or 'makai' side of Pi'ilani Highway

W = West or 'mauka' side of Pi'ilani Highway.

Relative Site Abundance:

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

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

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

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

Family / Scientific Name	Common Name	Status	Side of Highway	Relative Site Abundance
FERNS				
Aspleniaceae				
Nephrolepis multiflora (Roxb.) F.M.Jarrett ex C.V.Morton	sword fern	X	W, E	Rare
Pteris vittata L.	ladder brake, cliff brake, Chinese brake	X	W	Rare
MONOCOTS				
Aloeaceae (Asphodelaceae)				
Aloe vera (L.) N. L. Burman	aloe	X	W	Rare
Arecaceae				
Cocus nucifera L.	coconut, ololani, niu	X	W, E	Rare
Phoenix roebelenii O' Brien	dwarf date palm, pygmy date palm	X	E	Rare
Commelinaceae				
Commelina diffusa Burm.f.	honohono, blue day flower	X	W	Rare
Cyperaceae				
Cyperus rotundus L.	purple nut sedge, nut grass, kili'o'opu, mau'u mokae	X	W	Rare
Liliaceae				
Ophiopogon japonicus (Linnaeus filius) Ker Gawler	dwarf lilyturf, mondo grass	X	E	Rare
Poaceae				
Cenchrus ciliaris L.	buffel grass	X	W, E	Abundant
Chloris gayana Kunth	rhode grass	X	W, E	Abundant
Chloris barbata Sw.	Swollen finger grass			
Eragrostis pectinacea (Michx.) Nees	Carolina lovegrass	X	W	Common
Melinis repens (Wild.) Zizka	natal redtop	X	W, E	Abundant
Panicum maximum Jacq.	guinea grass	X	W, E	Common
DICOTS				
Acanthaceae				
Asystasia gangetica (L.) T.Anderson	Chinese violet	X	W, E	Uncommon
Aizoaceae				
Carpobrotus sp.	ice plant	X	W	Rare
Amaranthaceae				
Amaranthus spinosus (L.)	spiny amaranth, pakai kukü	X	W, E	Uncommon

Family / Scientific Name	Common Name	Status	Side of Highway	Relative Site Abundance
Anacardiaceae				
Schinus terebinthifolius Raddi	Christmas berry	X	W	Rare
Apocynaceae				
Nerium oleander L.	oleander	X	E	Rare
Thevetia peruviana (Pers.) K.Schum.	be-still tree, yellow oleander, lucky nut, nohomālie	X	W, E	Rare
Araliaceae				
Schefflera actinophylla (Endl.) Harms	octopus tree	X	W, E	Rare
Asteraceae				
Ageratum conyzoides L.	maile hohono, maile honohono, maile kula	X	W	Rare
Bidens pilosa L.	Spanish needle, beggartick, kī, kī nehe, kī pipili, nehe	X	W, E	Uncommon
Conyza bonariensis (L.) Cronquist	hairy horseweed, ilioha, ʻawīʻawī, pua mana,	X	W	Rare
Emilia fosbergii Nicolson	pualele (Niʻihau)	X	W, E	Uncommon
Parthenium hysterophorus L.	false ragweed, Santa Maria	X	W, E	Uncommon
Pluchea carolinensis (Jacq.) G.Don	sourbush, marsh fleabane	X	W	Uncommon
Pluchea indica (L.) Less	Indian fleabane, Indian pluchea, marsh fleabane	X	E	Rare
Senecio madagascariensis Poir.	fireweed	X	W	Uncommon
Sonchus oleraceus L.	sow thistle, pualele	X	W, E	Abundant
Tridax procumbens L.	coat buttons	X	W, E	Uncommon
Sphagneticola trilobata (L.) Pruski	wedelia	X	W	Rare
Zinnia peruviana L.	pua pihi	X	W	Rare
Verbesina encelioides (Cav.) Benth. & Hook.	golden crown-beard	X	W	Common
Bignoneaceae				
Pyrostegia venusta (Ker Gawler) Miers	orange trumpet vine, flame flower, huapala	X	W	Rare
Spathodea campanulata P. Beauv.	African tulip tree, fountain tree	X	W	Rare
Brassicaceae				
Lepidium virginicum L.	pepperwort, peppergrass	X	W	Uncommon
Buddlejaceae				
Buddleja asiatica Lour.	huelo ʻīlio, dog tail	X	W	Rare

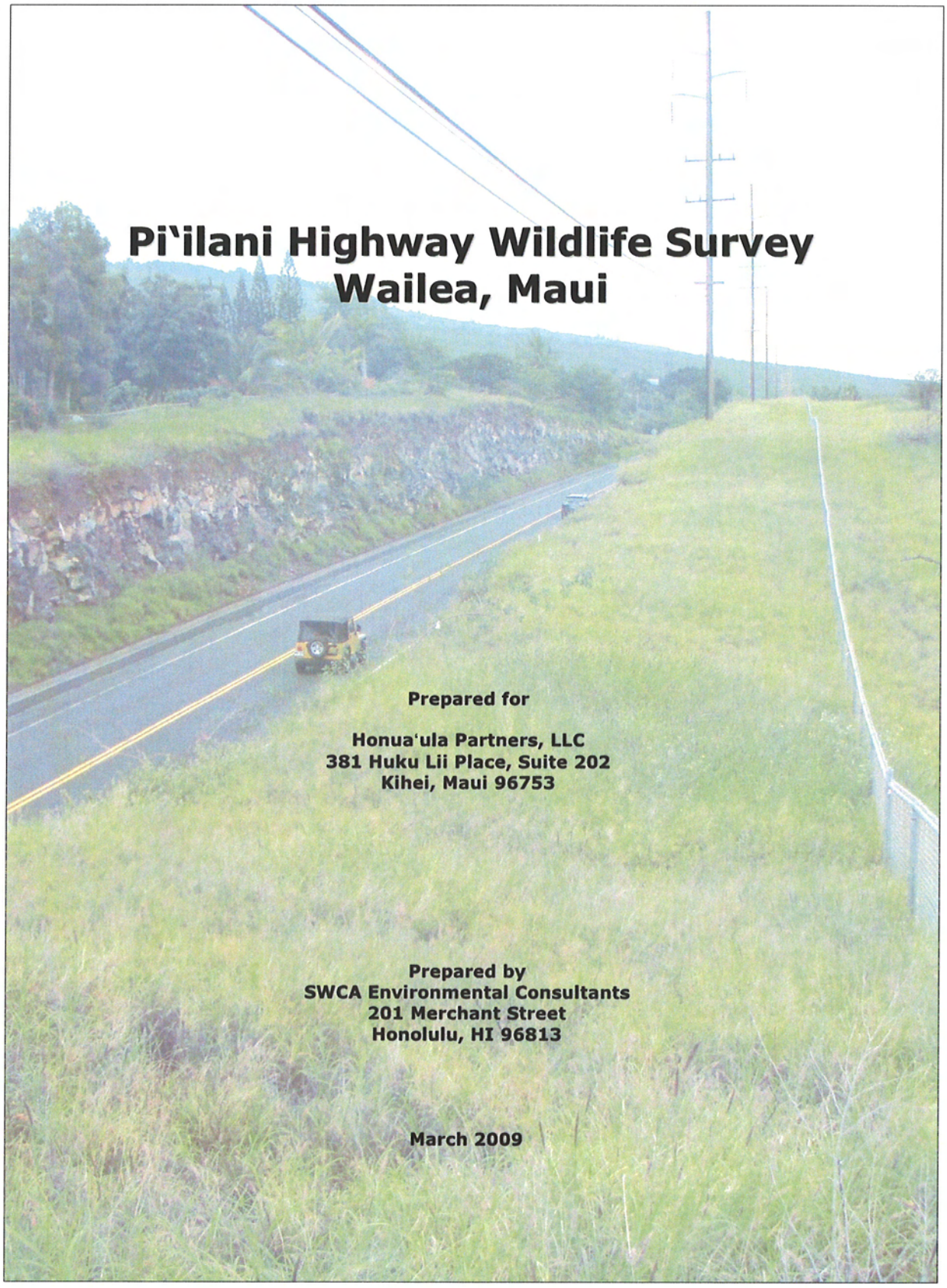
Family / Scientific Name	Common Name	Status	Side of Highway	Relative Site Abundance
Capparaceae				
Cleome gynandra L.	wild spider flower, spider wisp, honohina, ʻili'ohu	X	W	Uncommon
Casuarinaceae				
Casuarina equisetifolia L.	common ironwood, paina	X	W	Rare
Chenopodiaceae				
Chenopodium carinatum R.Br.	goosefoot, pigweed, lamb's quarters	X	W	Uncommon
Chenopodium murale L.	goosefoot, pigweed, lamb's quarters, ʻāheahea	X	W	Rare
Convolvulaceae				
Ipomoea triloba L.	Little bell	X	W, E	Uncommon
Ipomoea obscura (L.) Ker Gawl.	morning glory	X	W	Rare
Merremia aegyptia (L.) Urb	hairy merremia, koali kua hulu, kuahulu	X	W, E	Common
Merremia tuberosa (L.) Rendle	wood rose, pilikai	X	W	Rare
Cucurbitaceae				
Cucumis dipsaceus Ehrenb. ex Spach	hedgehog gourd, teasel gourd	X	W	Uncommon
Momordica charantia L.	balsam pear, bitter melon	X	W	Uncommon
Euphorbiaceae				
Chamaesyce hirta (L.) Millsp.	hairy spurge, garden spurge, koko kahiki	X	W, E	Uncommon
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	X	W, E	Common
Codiaeum variegatum (Linnaeus) Blume	croton	X	E	Rare
Euphorbia heterophylla L.	kaliko, spurge	X	E	Rare
Ricinus communis L.	castor bean, pāʻaila, kaʻapehā, kamākou, kolī, lāʻau ʻaila	X	W, E	Common
Fabaceae				
Bauhinia x blakeana Dunn	Hong Kong orchid tree	X	E	Rare
Caesalpinia pulcherrima (L.) Swartz	dwarf Poinciana, pride-of-Barbados, Barbados flower-fence	X	W	Rare
Chamaecrista nictitans subsp. patellaria var. glabrata (Vogel) H.S.Irwin & Barneby	partridge pea, laukī	X	W, E	Uncommon
Crotalaria assamica Benth.	rattlepod	X	W	Rare
Crotalaria incana L.	Fuzzy rattlepod, kūkaehoki, kolomona	X	W, E	Common

Family / Scientific Name	Common Name	Status	Side of Highway	Relative Site Abundance
Delonix regia (Bojer ex Hook.) Raf.	royal poinciana, flame tree, flamboyant, ʻohai ʻula	X	W	Rare
Desmanthus pernambucanus (L.) Thell.	slender mimosa, virgate mimosa	X	W, E	Common
Indigofera suffruticosa Mill.	indigo, ʻinikō, ʻinikoa, kolū	X	W	Rare
Leucaena leucocephala (Lam.) de Wit	koa haole	X	W, E	Uncommon
Macroptilium lathyroides (L.) Urb.	wild bean, cow pea	X	W, E	Common
Neonotonia wightii (Wight & Arn.) Lackey		X	W	Rare
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	algaroba, mesquite, kiawe	X	W, E	Uncommon
Samanea saman (Jacq.) Merr.	monkeypod, rain tree, ʻohai, pū ʻohai	X	W	Rare
Lamiaceae				
Leonotis nepetifolia (L.) R.Br.	lion's ear	X	W	Uncommon
Malvaceae				
Abelmoschus esculentus (L.) Moench	okra, lady's finger	X	W	Rare
Abutilon grandifolium (Willd.) Sweet	hairy abutilon, maʻo	X	W, E	Common
Hibiscus rosa-sinensis L.	red hibiscus, Chinese hibiscus, aloalo	X	W	Rare
Malva parviflora L.	cheeseweed	X	W	Uncommon
Sida acuta subsp. carpinifolia (L.f.) Borss.Waalk.		X	W	Rare
Sida fallax Walp.	ʻilima	I	W, E	Common
Thespesia populnea (L.) Sol. ex Corrêa	milo, portia tree	I	W	Rare
Nyctaginaceae				
Boerhavia coccinea Mill.		X	W	Uncommon
Bougainvillea sp.		X	W	Rare
Oxalidaceae				
Oxalis corniculata L.	yellow wood sorrel, ʻihi ʻai, ʻihi ʻawa, ʻihi maka ʻula, ʻihi mākole	Pol?	E	Rare
Plumbaginaceae				
Plumbago auriculata Lam.		X	W	Rare
Portulacaceae				
Portulaca oleracea L.	pigweed, ʻākulikuli kula, ʻākulikuli lau liʻi, ʻihi	X	W, E	Uncommon

Family / Scientific Name	Common Name	Status	Side of Highway	Relative Site Abundance
Solanaceae				
Datura stramonium L.	jimson weed	X	W	Uncommon
Nicandra physalodes (L.) Gaertn.	apple of Peru	X	W, E	Common
Nicotiana glauca Graham	tree tobacco, mustard tree, mākāhala, paka	X	W, E	Common
Solanum lycopersicum var. cerasiforme (Dunal) Spooner, G.J.Anderson & R.K.Jansen	tomato, ʻōhiʻa lomi, kamako, ʻōhiʻa, ʻōhiʻa haole	X	W	Rare
Sterculiaceae				
Waltheria indica (L.)	ʻuhaloa, ʻalaʻala pū loa, hala ʻuhaloa, hiʻaloa, kanakaloa	I	W, E	Common

APPENDIX D.

Pi`ilani Highway Wildlife Survey



Pi'ilani Highway Wildlife Survey
Wailea, Maui

Prepared for

Honua'ula Partners, LLC
381 Huku Lii Place, Suite 202
Kihei, Maui 96753

Prepared by
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March 2009

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1.0 INTRODUCTION

In January 2009, SWCA was tasked by Honua'ula Partners, LLC to conduct a wildlife and botanical survey along a 2,000 m (6,560 ft) stretch along Pi'ilani Highway between Kilohana Drive and Wailea Ike Drive. The survey was prepared in support of an environmental assessment (EA) being prepared for the Pi'ilani Highway widening under Hawai'i Revised Statutes (HRS) Chapter 343 (Environmental Impact Statements) and Hawai'i Administrative Rules (HAR) Title 11, Chapter 200 (Environmental Impact Statement Rules). The highway widening project was mandated by the Maui County Council in the Phase I conditions for completion of the proposed Honua'ula development.

Pi'ilani Highway is the major north-south arterial road serving the Kihei-Makena area including Honua'ula. At present, Pi'ilani Highway is a two lane road between Kilohana Drive and Wailea Ike Drive and intersects Wailea Ike Drive in a T- intersection, with the highway forming the stem of the intersection. The future extension of Pi'ilani Highway will bisect the Project site (Figure 1).

This report summarizes the findings of a wildlife survey conducted on February 5, 2009 along 2,000 m (6,560 ft) of Pi'ilani Highway between Wailea Ike Drive and Kilohana Drive in Wailea, Maui. The objectives of the wildlife survey along the Pi'ilani Highway between Wailea Ike Drive and Kilohana Drive were:

1) To identify and document the presence and relative abundance of bird, mammal, amphibian, reptile, and invertebrate macrofauna which occur within the right-of-way (ROW) on either side of Pi'ilani Highway;
2) To map any State or Federally listed candidate, threatened, or endangered wildlife species, species of concern and/ or rare (either locally or State-wide) species on either side of the highway.

2.0 DESCRIPTION OF THE STUDY AREA

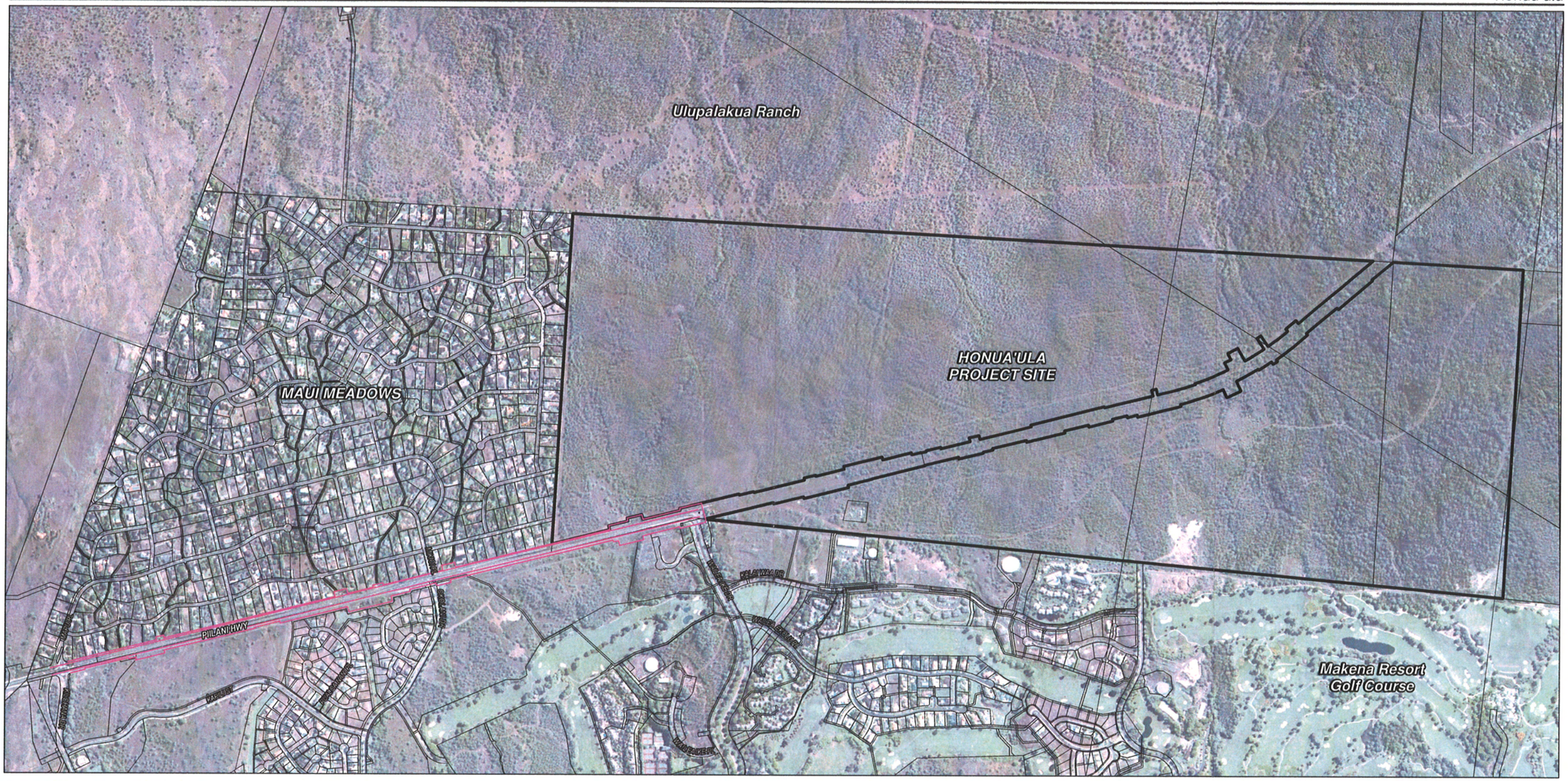
The terrain within the rights-of-way (ROW) on either side of Pi'ilani Highway varied from steeply sloping road cuts to flat or gently undulating lands. The vegetation along both sides of the highway is predominantly buffel grass. Kiawe (*Prosopis juliflora*) trees and shrubs of koa haole (*Luceana leucocephala*), slender mimosa (*Desmanthus pernambucanus*) castor (Ricinus communis), fuzzy rattle pod (*Crotolaria incana*), hairy abutilon (*Abutilon grandifolium*) and tree tobacco (*Nicotiana glauca)* were common along the highway ROW. SWCA prepared a separate botanical report for the Pi'ilani Highway ROW as a part of this study.

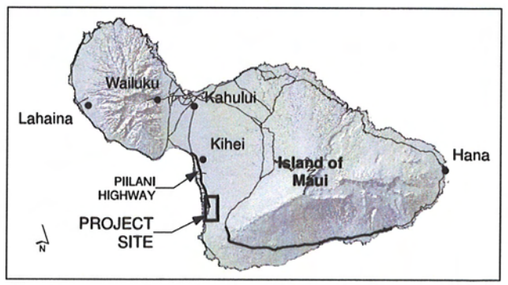
3.0 METHODS

3.1 Avian Survey Methods

Point count surveys were conducted by SWCA biologist Dr. Ling Ong and GIS Analyst Ryan Taira on March 5, 2009. 11 point count stations at least 162 m apart were placed on both sides of the ROW (Figure 2). The location of the observers at each point count site was confirmed in the field with a GPS receiver. Field observations of birds were recorded using 10 x 50 binoculars with a 6.5 degree field of vision. The observers also listened for vocalizations. The relative densities of species were estimated using five-minute 50 m radius point counts conducted during peak bird activity periods (0800 - 1100). However, since point counts were located along the side of a road, observations were confined to the same side of the highway that the point count was on. Observations were of five minute duration to maximize the likelihood of detecting new species during the survey (Lynch 1995).

Mammals, reptiles and invertebrates seen or heard during the point count surveys were also recorded as incidental sightings. Rare or previously unrecorded bird, mammal, reptile, or amphibian species seen between count stations were also noted.





Legend

- Honua'ula Project Boundary
- Survey Area Extents
- TMK Parcels

Source: State of Hawaii GIS; PBR Hawaii

Figure 1
Location Map

N

0 250 500 1,000 ft

0 50 100 200 M

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3.2 Nocturnal Surveys for Hawaiian Hoary Bats

Surveys for endangered Hawaiian hoary bats (*Lasiurus cinereus semotus*) were conducted at the project site between 1830 and 2030 on March 12, 2009 by SWCA biologists Dr. Ling Ong and Tiffany Thair. These surveys were conducted under ideal weather conditions using night vision goggles (Morovison PVS-7 Ultra).

Bat point count stations were established at 6 locations at least 317 m (1,040 ft) apart along the ROW and surveyed for ten minutes each (Figure 2). The detection distance for bats using night vision goggles was estimated to be 30 m radius at each point count station.

3.3 Surveys for the Blackburn's Sphinx Moth

Surveys for the Endangered Blackburn's sphinx moth were conducted within the project area on March 5, 2009 by SWCA biologist Dr. Ling Ong and GIS Analyst Ryan Taira. The surveys focused on host plants used by the various life stages of Blackburn's sphinx moth that are known to occur within the ROW. The only host plant observed within the ROW was the non-native tree tobacco (*Nicotiana glauca*), a known food plant for the caterpillar (USFWS 2005). Leaves and stems of tree tobacco plants within the ROW were examined carefully for the presence or sign of caterpillars, signs included frass (fecal matter), cut stems and leaves, and eggs.

4.0 RESULTS

4.1 Endangered Species

No federally or state endangered bird, mammal or insect species were found along the ROW. No caterpillars of the Blackburn Sphinx moth, other life stages or sign, were observed on the non-native tree tobacco plants in the ROW. No Hawaiian hoary bats were observed along the ROW in the evening and night.

4.2 Endemic or Native Species

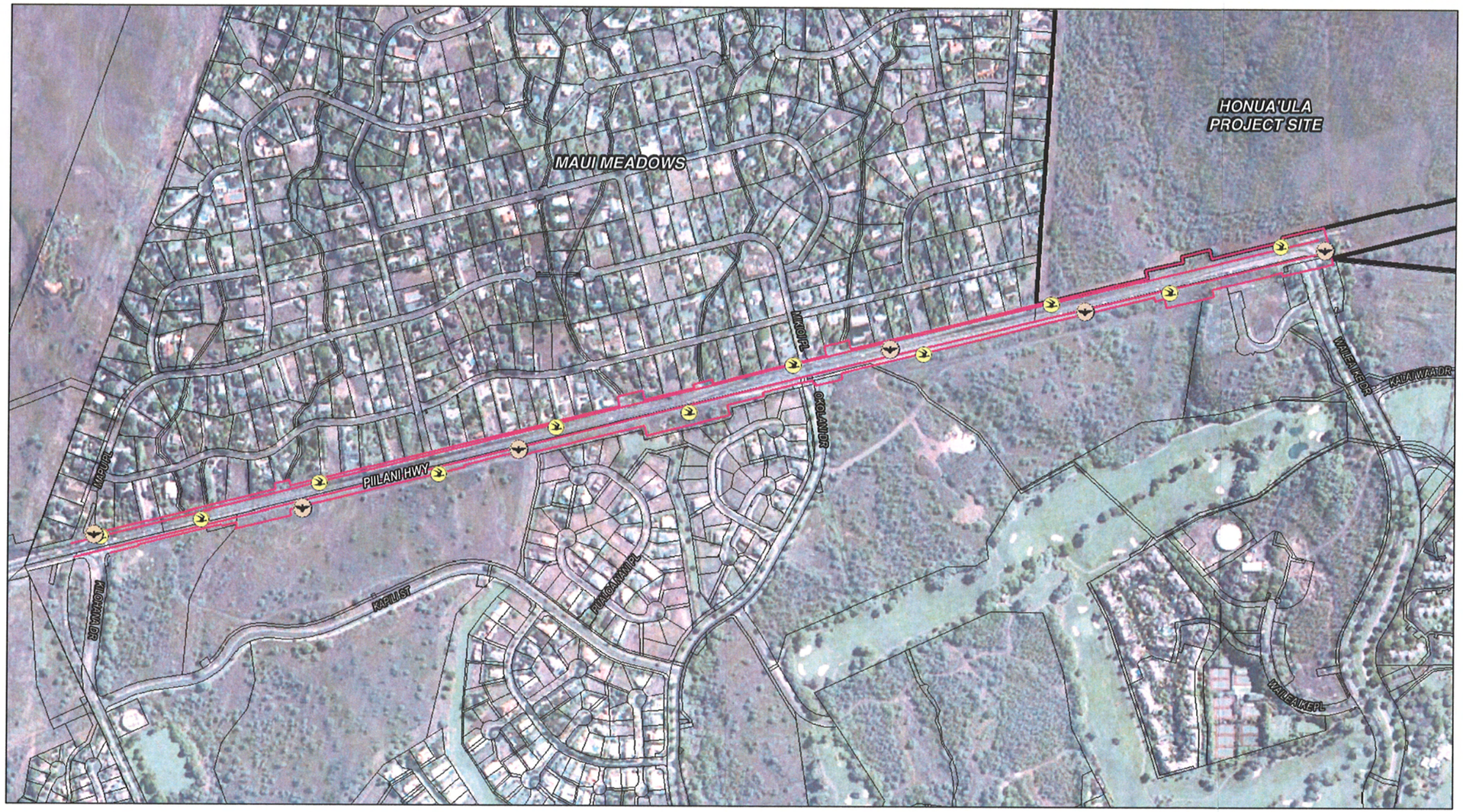
No endemic or native birds or mammals were found along the ROW. It is possible that pueo (*Asio flammeus sandwichensis*) may hunt along the ROW at night. Pueo have been observed in Honua'ula Project site which is adjacent to the east end of the ROW (SWCA 2009).

4.3 Migratory Birds

Cattle egrets (*Bulbulcus ibis*) are common visitors to highway ROW throughout all the main Hawaiian Islands. A few cattle egrets were seen outside the point count stations during this survey. No other migratory birds were observed along the ROW even though the survey was conducted during the migratory season. Migratory birds, especially Pacific golden plover (*Pluvialis fulva*), which are the most common migrants in urban areas, are not expected to use the ROW as overwintering grounds. The dense stands of tall buffel grass present along the ROW represents unsuitable foraging habitat for the Pacific golden plover and other migratory shorebirds.

4.4 Introduced Birds

A total of 12 introduced bird species were recorded. House sparrow (*Passer domesticus*), zebra dove (*Geopelia striata*), common myna (*Acridotheres tristis*) and Japanese white-eye (*Zosterops japonicus*) were the most abundant (Table 1). Barn owls, while not observed, may hunt along the ROW at night and are found in Honua'ula Project site which is adjacent to the east end of the ROW (SWCA 2009).



Legend

Point Count Locations

- Bat
- Bird
- Honua'ula Project Boundary
- Survey Area Extents
- TMK Parcels

Source: State of Hawaii GIS; PBR Hawaii

Figure 2
Bird and Bat Points

N

0 125 250 500 ft

0 25 50 100 M

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4.5 Mammals

Feral cats (*Felis catus*) and one juvenile axis deer (*Axis axis*) were observed during this study. Deer scat was also observed along the ROW, and mammals such as mongoose (*Herpestes javanicus*), rats (*Rattus* spp.) and mice can be expected to occur within the ROW.

4.6 Reptiles and Amphibians

There are no native reptiles or amphibians in Hawai'i (McKeown 1996). Skinks (Family: Scincidae) were observed during the morning survey. Geckos (Family: Gekkonidae) were heard during the nocturnal point counts for bats. One cane toad (*Bufo marinus*) was found dead along the road during the bird point count surveys.

4.7 Insects and Other Invertebrates

Introduced butterflies observed along the ROW consisted of the monarch butterfly (*Danaus plexippus*) and the cabbage white butterfly (*Artogeia rapae*). Other introduced insects observed within the ROW include the Garden spider (*Argiope appensa*) and the carpenter bee (*Xylocopa sonorina*).

5.0 CONCLUSION AND RECOMMENDATIONS

No endangered species were found or are likely to occur along the Pi'ilani Highway ROW. The wildlife species present with the ROW are found commonly throughout Maui and the main Hawaiian Islands.

Non-native tree tobacco (*Nicotiana glauca*) is present along the ROW. Caterpillars of the Blackburn's sphinx moth have been found on tree tobacco plants elsewhere in Kihei and within the adjacent Honua'ula project site (SWCA 2009). Therefore, to help insure against the accidental take of individual sphinx moths, each tree tobacco plant should first be screened by a qualified wildlife biologist prior to any land clearing. If sphinx moths or signs of sphinx moths (frass, cut stems or leaves, caterpillars, pupae, or adults) are found on any tree, that tree should be marked and protected against disturbance for the duration of the breeding season.

The use of plants within the Solenaceae (nightshade family) for ROW landscaping should be forbidden so as not to attract endangered Blackburn sphinx moths to the highway where they are at higher risk for injury or death.

6.0 REFERENCES

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Table 1. Relative abundance of birds observed during point counts.
X = observed outside of point count stations

Species name	Common Name	Status	Birds per point count (n=11)	Abundance Rank
Bubulcus ibis	Cattle egret	I	X	-
Francolinus pondicerianus	Gray francolin	I	0.571	7
Streptopelia chinensis	Spotted dove	I	0.286	8
Geopelia striata	Zebra dove	I	1.929	2
Zosterops japonicus	Japanese white-eye	I	1.714	4
Acridotheres tristis	Common myna	I	1.786	3
Cardinalis cardinalis	Northern cardinal	I	0.643	6
Carpodacus mexicanus	House finch	I	0.929	5
Lonchura punctulata	Nutmeg mannikin	I	0.143	10
Passer domesticus	House sparrow	I	2.643	1
Padda oryzivora	Java Sparrow	I	0.071	11
Lonchura cantans	African silverbill	I	0.286	9

APPENDIX E.

Air Quality Study

AIR QUALITY STUDY

FOR THE PROPOSED

PIILANI HIGHWAY WIDENING PROJECT

WAILEA, MAUI

Prepared for:

Honua'ula Partners, LLC

June 2009

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5 Estimated Worst Case 8-Hour Carbon Monoxide Concentrations Near Intersections Included Within Piilani Highway Widening Project

1.0 SUMMARY

Honua'ula Partners, LLC is proposing highway improvements in the Wailea area on the island of Maui. These improvements involve widening Piilani Highway between Kilohana Drive and Wailea Ike Drive. The proposed improvements are needed to provide sufficient capacity to accommodate the projected increase in traffic volume at least through the year 2022.

This study examines the potential short- and long-term air quality impacts that could occur as a result of construction and use of the proposed highway facilities. Mitigative measures are suggested where possible and appropriate to lessen any impacts from the project.

Both federal and state standards have been established to maintain ambient air quality. At the present time, seven parameters are regulated including: particulate matter, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, carbon monoxide, ozone and lead. Hawaii air quality standards are comparable to the national standards except those for nitrogen dioxide and carbon monoxide which are more stringent than the national standards.

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the project area is very much affected by its elevation near sea level and by nearby mountains. Haleakala shelters the area from the northeast trade winds, and local winds (such as land/sea breezes and upslope/downslope winds) affect the wind flow in the area much of the time. Temperatures in the project area are generally very consistent and warm with average daily temperatures ranging from about 63°F to 86°F.

Rainfall in the project area is minimal with an average of only about 12 inches per year.

Except for periodic impacts from volcanic emissions (vog) and possibly occasional localized impacts from traffic congestion and local agricultural sources, the present air quality of the project area is believed to be relatively good. There is very little air quality monitoring data from the Department of Health for the project area, but the limited data that are available suggest that concentrations are generally well within state and national air quality standards.

If the proposed project is given the necessary approvals to proceed, it is inevitable that some short- and long-term impacts on air quality will unavoidably occur either directly or indirectly as a consequence of project construction and use. Short-term impacts from fugitive dust will likely occur during the project construction phase. To a lesser extent, exhaust emissions from stationary and mobile construction equipment and from the disruption of traffic may also affect air quality during the period of construction. State air pollution control regulations require that there be no visible fugitive dust emissions at the project boundary. Hence, an effective dust control plan should be implemented to ensure compliance with state regulations. Fugitive dust emissions can be controlled to a large extent by watering of active work areas, using wind screens, keeping adjacent paved roads clean, and by covering of open-bodied trucks. Other dust control measures could include limiting the area that can be disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Paving and landscaping of project areas early in the construction schedule will also reduce dust emissions. Excess exhaust emissions from traffic disruption can be mitigated by moving construction equipment and workers to and from the project area during off-peak

traffic hours and by minimizing road closures during peak traffic periods.

To assess the potential long-term impact of emissions from vehicles operating within the project corridor, both mesoscale and microscale analyses were performed, and a qualitative assessment of mobile source air toxics was prepared. The mesoscale analysis was designed to provide estimates of air pollution emissions from traffic for the entire highway corridor, while the microscale analyses assessed ambient air quality impacts near selected intersections within the project study area. Both mesoscale and microscale analyses considered an existing (2008) case and three future scenarios. The future scenarios included 2016 without the project, 2016 with the project and 2022 with the project.

The mesoscale analysis indicated that in 2008 the totals of emissions from traffic using Piilani Highway within the study area were 383 lbs per day of carbon monoxide, 34 lbs per day of volatile organic compounds and 43 lbs per day of nitrogen oxides. These emission amounts are relatively small in comparison to island-wide emissions. Without the project in the year 2016, it was estimated that carbon monoxide emissions would increase by 57 percent, volatile organic compounds emissions would increase by 50 percent and nitrogen oxides emissions would remain unchanged. With the project in the year 2016 compared to without it, carbon monoxide emissions would decrease by 5 percent, volatile organic compounds emissions would decrease by about 11 percent, and nitrogen oxides emissions would decrease by 12 percent. Thus, the project would provide a net air quality benefit in terms of the estimated mesoscale emissions. In the year 2022 with the project, the emission estimates show a slight downward trend, and air quality can be expected to improve accordingly.

The microscale analyses performed for this project involved the use of computerized emission and atmospheric dispersion models to estimate current worst-case ambient concentrations of carbon monoxide during peak travel hours at three intersections in the project study area. The intersections studied included: Kilohana Drive at Piilani Highway, Okolani Drive at Piilani Highway and Wailea Ike Drive at Piilani Highway. The highest worst-case carbon monoxide concentration for 2008 was predicted to occur at the intersection of Kilohana Drive and Piilani Highway during the morning. The concentration at this location and time reached about 10 percent of the national standard and about 41 percent of the more stringent state standard. In the year 2016 without the project, the predicted worst-case concentrations in the project area increased by about 5 to 25 percent, but concentrations remained within the state and national standards. With the project in the year 2016 compared to without it, the intersection of Kilohana Drive and Piilani Highway would likely have slightly reduced carbon monoxide concentrations, while the intersections of Okolani Drive at Piilani Highway and Wailea Ike Drive at Piilani Highway would likely experience slightly higher concentrations. Concentrations in the year 2016 would remain well within the state and federal standards with or without the project. In the year 2022 with the project, concentrations would remain largely unchanged compared to 2016 with the project. Based on the microscale analysis, the project would have a slight negative air quality impact in the vicinity of Okolani Drive and Wailea Ike Drive and a small positive impact near Kilohana Drive.

A qualitative assessment of the potential impacts from mobile source air toxics (MSATs) indicated that the project would not likely result in higher MSAT emissions. This is based on the fact that the project is not expected to affect the volume of traffic using the project roadway.

Based on the results of the analyses of the potential long-term effects of the project, it may be concluded that the proposed highway widening project would likely have an overall positive impact on the air quality of the area. Although options are available to mitigate long-term traffic-related air quality impacts, requiring these to be implemented is probably unnecessary and unwarranted in this case.

2.0 INTRODUCTION

Honua'ula Partners, LLC is proposing to widen Piilani Highway on the island of Hawaii between Kilohana Drive and Wailea Ike Drive (see Figure 1 for general project location). The proposed project would involve the construction of additional northbound and southbound lanes so that Piilani Highway would provide two lanes for through traffic in each direction. The proposed improvements are needed to provide sufficient capacity to accommodate the projected increase in future traffic volumes through the year 2022. The proposed project is expected to be completed by 2016.

The purpose of this study was to evaluate the potential air quality impacts of the proposed project and recommend mitigative measures, if possible and appropriate, to reduce or eliminate any project-related degradation of air quality in the area. Before examining the potential impacts of the project, a discussion of ambient air quality standards is presented and background information concerning the regional and local climatology and the present air quality of the project area is provided.

3.0 AMBIENT AIR QUALITY STANDARDS

Ambient concentrations of air pollution are regulated by both national and state ambient air quality standards (AAQS). National AAQS are specified in Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaii AAQS are defined in Chapter 11-59 of the Hawaii Administrative Rules. Table 1 summarizes both the national and the state AAQS that are specified in the cited documents. As indicated in the table, national and state AAQS have been established for particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. The state has also set a standard for hydrogen sulfide. National AAQS are stated in terms of both primary and secondary standards for most of the regulated air pollutants. National primary standards are designed to protect the public health with an "adequate margin of safety". National secondary standards, on the other hand, define levels of air quality necessary to protect the public welfare from "any known or anticipated adverse effects of a pollutant". Secondary public welfare impacts may include such effects as decreased visibility, diminished comfort levels, or other potential injury to the natural or man-made environment, e.g., soiling of materials, damage to vegetation or other economic damage. In contrast to the national AAQS, Hawaii State AAQS are given in terms of a single standard that is designed "to protect public health and welfare and to prevent the significant deterioration of air quality".

Each of the regulated air pollutants has the potential to create or exacerbate some form of adverse health effect or to produce environmental degradation when present in sufficiently high concentration for prolonged periods of time. The AAQS specify a maximum allowable concentration for a given air pollutant for one or more averaging times to prevent harmful effects. Averaging times vary from one hour to one year depending on the pollutant and type of exposure necessary to cause adverse effects. In the

case of the short-term (i.e., 1- to 24-hour) AAQS, both national and state standards allow a specified number of exceedances each year.

The Hawaii AAQS are in some cases considerably more stringent than the comparable national AAQS. In particular, the Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit. The U.S. Environmental Protection Agency (EPA) is currently working on a plan to phase out the national 1-hour ozone standard in favor of the new (and more stringent) 8-hour standard.

The Hawaii AAQS for sulfur dioxide were relaxed in 1986 to make the state standards essentially the same as the national limits. In 1993, the state also revised its particulate standards to follow those set by the federal government. During 1997, the federal government again revised its standards for particulate, but the new standards were challenged in federal court. A Supreme Court ruling was issued during February 2001, and as a result, the new standards for particulate were finally implemented during 2005. To date, the Hawaii Department of Health has not updated the state particulate standards. In September 2001, the state vacated the state 1-hour standard for ozone and an 8-hour standard was adopted.

During the latter part of 2008, EPA revised the standard for lead making the standard more stringent. So far, the Hawaii Department of Health has not revised the corresponding state standard for lead.

4.0 REGIONAL AND LOCAL CLIMATOLOGY

Regional and local climatology significantly affect the air quality of a given location. Wind, temperature, atmospheric turbulence, mixing height and rainfall all influence air quality. Although the climate of Hawaii is relatively moderate throughout most of the state, significant differences in these parameters may occur from one location to another. Most differences in regional and local climates within the state are caused by the mountainous topography.

The topography of Maui is dominated by the great volcanic masses of Haleakala (10,023 feet) and the West Maui Mountains (5,788 feet). The island consists entirely of the slopes of these mountains and of a connecting isthmus. Haleakala is still considered to be an active volcano and last erupted about 1790. The project site is located along the lower western slope of Haleakala at an elevation of about 300 feet.

Maui lies well within the belt of northeasterly trade winds generated by the semi-permanent Pacific high pressure cell to the north and east. Because the project area is located on the lower western slope of Haleakala, it is sheltered much of the time from the northeast trade winds. Local winds such as land/sea breezes and/or upslope/downslope winds also influence the wind pattern for the area. During the daytime, winds can typically be expected to move onshore because of seabreeze and/or upslope effects or because of the aerodynamic cavity caused by the trade winds flowing around Haleakala. At night, winds are often drainage winds that move downslope and out to sea. During winter, occasional strong winds from the south or southwest occur in association with the passage of winter storm systems.

Air pollution emissions from motor vehicles, the formation of photochemical smog and smoke plume rise all depend in part on air temperature. Colder temperatures tend to result in higher emissions of contaminants from automobiles but lower concentrations of photochemical smog and ground-level concentrations of air pollution from elevated plumes. In Hawaii, the annual and daily variation of temperature depends to a large degree on elevation above sea level, distance inland and exposure to the trade winds. Average temperatures at locations near sea level generally are warmer than those at higher elevations. Areas exposed to the trade winds tend to have the least temperature variation, while inland and leeward areas often have the most. The project site's lower elevation and leeward location results in warmer temperatures compared with many other parts of the island. At Puunene, which is a few miles to the north of the project area and at an elevation of about 130 feet, average daily minimum and maximum temperatures are 63°F and 86°F, respectively [1]. Temperatures at the project site can be expected to be similar to this or slightly cooler due to the slightly higher elevation.

Small scale, random motions in the atmosphere (turbulence) cause air pollutants to be dispersed as a function of distance or time from the point of emission. Turbulence is caused by both mechanical and thermal forces in the atmosphere. It is often measured and described in terms of Pasquill-Gifford stability class. Stability class 1 is the most turbulent and class 6 is the least. Thus, air pollution dissipates the best during stability class 1 conditions and the worst when stability class 6 prevails. In the Pukualani area, stability classes 5 or 6 typically occur during the nighttime or early morning hours when temperature inversions form due to radiational cooling or to drainage flow from the nearby mountains. Stability classes 1 through 4 occur during the daytime, depending mainly on the amount of cloud cover and incoming solar radiation and the onset and extent of the sea breeze.

Mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. Low mixing heights can result in high ground-level air pollution concentrations because contaminants emitted from or near the surface can become trapped within the mixing layer. In Hawaii, minimum mixing heights tend to be high because of mechanical mixing caused by the trade winds and because of the temperature moderating effect of the surrounding ocean. Low mixing heights may sometimes occur, however, at inland locations and even at times along coastal areas early in the morning following a clear, cool, windless night. Coastal areas also may experience low mixing levels during sea breeze conditions when cooler ocean air rushes in over warmer land. Mixing heights in Hawaii typically are above 3,000 feet (1,000 meters).

Rainfall can have a beneficial affect on the air quality of an area in that it helps to suppress fugitive dust emissions, and it also may "washout" gaseous contaminants that are water soluble. Rainfall in Hawaii is highly variable depending on elevation and on location with respect to the trade wind. The climate of the project area is relatively dry due to the leeward location. Historical records from Kihei, a few miles to the north, show that this area of Maui averages about only 12 inches of precipitation per year with the summer months being the driest [1].

5.0 PRESENT AIR QUALITY

Present air quality in the project area is mostly affected by air pollutants from vehicular, industrial, natural and/or agricultural sources. Table 2 presents an air pollutant emission summary for the island of Maui for calendar year 1993. This is the most recent year for which an island-wide emission inventory is

available. The emission rates shown in the table pertain to manmade emissions only, i.e., emissions from natural sources are not included. As suggested in the table, most of the manmade particulate and sulfur oxides emissions on Maui originate from point sources, such as power plants and other fuel-burning industries. Nitrogen oxides emissions are roughly equally divided between point sources and area sources (mostly motor vehicle traffic). The majority of carbon monoxide emissions occur from area sources (motor vehicle traffic and sugar cane burning), while hydrocarbons are emitted mainly from point sources. Emissions today are probably higher than those shown in the table, but the proportional relationships are likely about the same.

The largest sources of air pollution in the immediate project area are most likely agricultural operations and automobile traffic using local roadways. Emissions from these sources consist primarily of particulate, carbon monoxide and nitrogen oxides. Power plants burning diesel fuel are located several miles away. These sources mostly emit sulfur dioxide, nitrogen oxides and particulate. Volcanic emissions from distant natural sources on the Big Island also affect the air quality at times during kona wind conditions. By the time the volcanic emissions reach the project area, they consist mostly of fine particulate sulfate.

The State Department of Health operates a network of air quality monitoring stations at various locations around the state, but only very limited data are available for Maui Island. The only air quality data for the project area consists of particulate measurements collected at Kihei, which is about 4 miles to the north. These data are probably at least semi-representative of the project area. Table 3 summarizes the data from the Kihei monitoring station. Annual second-highest 24-hour particulate concentrations (which are most relevant to the air quality standards) ranged from 63 to 119 $\mu g/m^3$ between 2002 and 2006.

Average annual concentrations ranged from 19 to 25 $\mu g/m^3$. One exceedance of the state standard was recorded during 2005. This was reported to be due to agricultural tilling operations in the area.

Given the limited air pollution sources in the area, it is likely that air pollution concentrations are near natural background levels most of the time, except possibly for locations adjacent to agricultural operations or near traffic-congested intersections. Present concentrations of carbon monoxide in the project area are estimated later in this study based on computer modeling of motor vehicle emissions.

6.0 SHORT-TERM IMPACTS OF PROJECT

Short-term direct and indirect impacts on air quality could potentially occur during project construction. For a project of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during construction: (1) fugitive dust from vehicle movement and soil excavation; and (2) exhaust emissions from on-site construction equipment. Indirectly, there also could be short-term impacts from slow-moving construction equipment traveling to and from the project site and from the disruption of traffic due to road construction.

Fugitive dust emissions may arise from the grading and dirt-moving activities associated with land clearing and preparation work. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately because of its elusive nature of emission and because the potential for its generation varies greatly depending upon the type of soil at the construction site, the amount and type of dirt-disturbing activity

taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA [2] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions in the project area would likely be somewhere near this level or possibly lower due to the rocky nature of the soil in the area. In any case, State of Hawaii Air Pollution Control Regulations [3] prohibit visible emissions of fugitive dust from construction activities at the project boundary, and thus an effective dust control plan for the project construction phase is essential.

Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in construction areas from becoming significant sources of dust. In dust-prone or dust-sensitive areas, other control measures such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens may be necessary. Control regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting materials that could be blown away. Haul trucks tracking dirt onto paved streets from unpaved areas is oftentimes a significant source of dust in construction areas. Some means to alleviate this problem, such as road cleaning or tire washing, may be appropriate. Paving and/or establishment of landscaping as early in the construction schedule as possible can also lower the potential for fugitive dust emissions.

On-site mobile and stationary construction equipment also will emit air pollutants from engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-

powered equipment, but the standard for nitrogen dioxide is set on an annual basis and is not likely to be violated by short-term construction equipment emissions. Carbon monoxide emissions from diesel engines, on the other hand, are low and should be relatively insignificant compared to vehicular emissions on nearby roadways.

Indirectly, slow-moving construction vehicles on roadways leading to and from the project area could obstruct the normal flow of traffic to such an extent that overall vehicular emissions are increased, but this impact can be mitigated by moving heavy construction equipment during periods of low traffic volume. Likewise, road closures during peak traffic periods should be avoided to the extent possible to minimize air pollution impacts from traffic disruption. Thus, with careful planning and attention to dust control, most potential short-term air quality impacts from project construction can be mitigated.

7.0 LONG-TERM IMPACTS OF PROJECT

After construction is completed, the proposed widened highway is expected to result in improved traffic flow in the project area. To evaluate the potential long-term, ambient air quality impact of the proposed project, both mesoscale and microscale analyses were performed for each of four scenarios. The four scenarios studied included:

- 2008 with present conditions
- 2016 without the project
- 2016 with the project
- 2022 with the project.

Without the project in the year 2016, Piilani Highway is assumed to remain as it presently exists with one lane for through traffic in each direction between Kilohana Drive and Wailea Ike Drive. With the project in the year 2016 or 2022, Piilani Highway is assumed to be widened to two lanes for through traffic in each direction between Kilohana Drive and Wailea Ike Drive. With the project in the year 2022, Piilani Highway is assumed to be extended southward at Wailea Ike Drive. The with- and without-project alternatives indicated above are described in further detail in the project traffic study [4]. The following subsections of this report describe in detail the air quality study methodologies and the results of these analyses.

7.1 Mesoscale Analysis

To evaluate the potential mesoscale impact of the proposed project, an analysis of daily and annual emissions from the roadway network in the project area was prepared. The mesoscale analysis was designed to quantify project-related emissions of carbon monoxide, nitrogen oxides and hydrocarbons occurring within the study area for the existing case and for the future with and without project scenarios.

The mesoscale emission estimates for each scenario were made by first obtaining the estimated daily southbound and northbound traffic volumes and average travel speeds for the section of highway under study from the project traffic analysis [4]. The length of the section of highway included in the project is approximately 0.9 mile. Vehicle-miles per day for each traffic direction were then calculated. Emission estimates were then prepared for each scenario based on the estimated vehicle-miles of travel, average travel speeds, and U.S. EPA emission factors obtained using the computer model MOBILE6.2 [5]. MOBILE6.2 is the most recently released version of the EPA mobile emission model.

Aside from vehicle speed, several other key inputs are required by the model. One of these is vehicle mix. Unless very detailed information is available, national average values are typically assumed, which is what was used for the present study. Based on national average vehicle mix figures, the present vehicle mix in the project area was estimated to be 38.0% light-duty gasoline-powered automobiles, 49.1% light-duty gasoline-powered trucks and vans, 3.6% heavy-duty gasoline-powered vehicles, 0.2% light-duty diesel-powered vehicles, 8.5% heavy-duty diesel-powered trucks and buses, and 0.6% motorcycles. For the future scenarios studied, the vehicle mix was estimated to change somewhat with fewer light-duty gasoline-powered automobiles and more light-duty gasoline-powered trucks and vans.

Another key input to MOBILE6.2 is ambient temperature. An average ambient temperature 68 degrees F was used for all of the mesoscale emission computations.

The resulting emission factors generated by MOBILE6.2 are given in terms of grams of volatile organic compounds (VOC), carbon monoxide (CO) and nitrogen oxides (NOx) emitted per vehicle mile. Within the speed range of interest, emission factors for carbon monoxide and nitrogen oxides are generally proportional to vehicle speed, while emission factors for VOC are inversely proportional to vehicle speed. It should also be noted that at a given vehicle speed emission factors are generally lower for future years due to the effects of older, more-polluting vehicles being retired.

Table 3 provides the details of the mesoscale analysis. A summary of the results is presented below:

Scenario	Emissions (tons/year)		
	CO	NOx	VOC
2008 Existing	70	8	6
2016 Without Project	110	8	9
2016 With Project	104	7	8
2022 With Project	99	5	6

In comparison to the island-wide emissions given in Table 2, emissions in the year 2008 from traffic within the project area were relatively small, amounting to much less than 1 percent.

Without the project in the year 2016, carbon monoxide emissions within the project area were estimated to increase by about 57 percent compared to existing emissions, and VOC emissions were estimated to increase by about 50 percent. Nitrogen oxides emissions, on the other hand, were estimated to remain about the same. Even with the increases in carbon monoxide and VOC emissions, the emission amounts would remain small in comparison to island-wide emissions.

With the project in the year 2016, emissions of carbon monoxide, nitrogen oxides and VOC would decrease slightly compared to the without-project case. Emissions of carbon monoxide would continue to be higher compared to the existing emissions, while all emissions would be relatively small in comparison to island-wide emissions.

In the year 2022 with the project, despite slightly higher traffic volumes, emissions were estimated to decrease slightly compared to the 2016 with project case. This is due to the reduction in

emission factors with time. Carbon monoxide emissions would likely remain higher than the existing levels but low in comparison to island-wide emissions.

7.2 Microscale Analyses

In most traffic-related air quality assessments, roadway intersections are one of the primary concerns because of traffic congestion and because of the increase in vehicular emissions associated with traffic queuing. To investigate potential air quality impacts near roadway intersections within the project area, microscale analyses were performed for selected locations using computerized emission and atmospheric dispersion models to estimate worst-case ambient carbon monoxide concentrations. Carbon monoxide was selected for the microscale analyses because it is both the most stable and the most abundant of the pollutants generated by motor vehicles. Furthermore, carbon monoxide air pollution is generally considered to be a microscale problem that can be addressed locally to some extent, whereas other air pollutants most often are regional issues that cannot be addressed by a single highway improvement.

The selected locations for microscale analyses included three intersections along the project corridor. These included:

- Kilohana Drive at Piilani Highway
- Okolani Drive at Piilani Highway
- Wailea Iki Drive at Piilani Highway.

All three of these intersections currently exist, although Piilani Highway currently ends at Wailea Iki Drive.

The main objective of the microscale analyses was to estimate worst-case 1-hour average carbon monoxide concentrations for each of the three scenarios studied. To evaluate the significance of the estimated concentrations, a comparison of the predicted values for each scenario can be made. A comparison of the estimated values to the national and state AAQS will provide another measure of significance.

Traffic estimates for the project indicate that traffic volumes generally are or will be higher during the afternoon peak hour than during the morning peak period. However, worst-case emission and meteorological dispersion conditions typically occur during the morning hours at most locations. Thus, both morning and afternoon peak-traffic hours were examined to ensure that worst-case concentrations were identified.

As for the mesoscale emission burden analysis, the EPA computer model MOBILE6.2 was used to calculate vehicular emissions for each year/scenario studied in the microscale analyses. Vehicle mix and ambient temperatures, inputs to MOBILE6.2, were assumed to be the same as those used for the mesoscale emission estimates.

After computing vehicular carbon monoxide emissions through the use of MOBILE6.2, these data were then input to an atmospheric dispersion model. EPA air quality modeling guidelines [6] currently recommend that the computer model CAL3QHC [7] be used to assess carbon monoxide concentrations at roadway intersections, or in areas where its use has previously been established, CALINE4 [8] may be used. Until a few years ago, CALINE4 was used extensively in Hawaii to assess air quality impacts at roadway intersections. In December 1997, the California Department of Transportation recommended that the intersection mode of CALINE4 no longer be used because it was

thought the model had become outdated. Studies have shown that CALINE4 may tend to over-predict maximum concentrations in some situations. Therefore, CAL3QHC was used for the subject analysis.

CAL3QHC was developed for the U.S. EPA to simulate vehicular movement, vehicle queuing and atmospheric dispersion of vehicular emissions near roadway intersections. It is designed to predict 1-hour average pollutant concentrations near roadway intersections based on input traffic and emission data, roadway/receptor geometry and meteorological conditions.

Although CAL3QHC is intended primarily for use in assessing atmospheric dispersion near signalized roadway intersections, it can also be used to evaluate unsignalized intersections. This is accomplished by manually estimating queue lengths and then applying the same techniques used by the model for signalized intersections. Currently, only one of the study intersections (Kilohana Drive at Piilani Highway) is signalized.

Input peak-hour traffic data were obtained from the traffic study cited previously. This included vehicle approach volumes, saturation capacity estimates, intersection laneage and signal timings (where applicable). All emission factors that were input to CAL3QHC for free-flow traffic on roadways were obtained from MOBILE6.2 based on assumed free-flow vehicle speeds corresponding to the posted speed limits.

Model roadways were set up to reflect roadway geometry, physical dimensions and operating characteristics. Concentrations predicted by air quality models generally are not considered valid within the roadway-mixing zone. The roadway-mixing zone is

usually taken to include 3 meters on either side of the traveled portion of the roadway and the turbulent area within 10 meters of a cross street. Model receptor sites were thus located at the edges of the mixing zones near all intersections that were studied for all scenarios. This implies that pedestrian sidewalks or public walkways either already exist or are assumed to exist in the future (no sidewalks are planned along the new roadway section). All receptor heights were placed at 1.8 meters above ground to simulate levels within the normal human breathing zone.

Input meteorological conditions for this study were defined to provide "worst-case" results. One of the key meteorological inputs is the atmospheric stability category. For these analyses, atmospheric stability category 6 was assumed for morning scenarios and stability category 4 was assumed for afternoon cases. These are the most conservative stability categories that are generally used for estimating pollutant dispersion at suburban locations for these time periods. For all cases, a surface roughness length of 100 cm was assumed and a mixing height of 300 meters was used. Worst-case wind conditions were defined as a wind speed of 1 meter per second with a wind direction resulting in the highest predicted concentration. Concentration estimates were calculated at wind directions of every 5 degrees.

Existing background concentrations of carbon monoxide in the project vicinity are believed to be at relatively low levels. Hence, background contributions of carbon monoxide from sources or distant roadways not directly considered in the analysis were accounted for by adding a small background concentration of 0.5 ppm to all predicted concentrations for 2008. Although at least moderate development and increased traffic are expected to occur within the project area within the next few years, background carbon monoxide concentrations may not change significantly since individual emissions from motor vehicles are

forecast to decrease with time. Hence, a background value of 0.5 ppm was assumed to persist for the future scenarios studied.

Predicted Worst-Case 1-Hour Concentrations

Table 4 summarizes the final results of the microscale modeling study in the form of the estimated worst-case 1-hour morning and afternoon ambient carbon monoxide concentrations for 2008 and for each of the three future alternatives that were studied. The locations of these estimated worst-case 1-hour concentrations all occurred at or very near the indicated intersections.

As indicated in the table, the highest estimated worst-case 1-hour concentration for the present (2008) scenario was 4.1 mg/m^3, and this occurred during the morning at the intersection of Kilohana Drive and Piilani Highway. Worst-case values for other locations and times ranged from 2.0 to 3.1 mg/m^3. These concentrations are within both the national AAQS of 40 mg/m^3 and the state standard of 10 mg/m^3.

In the year 2016 without the proposed project, the predicted highest worst-case 1-hour concentration occurred again during the morning at the intersection of Kilohana Drive and Piilani Highway with a value of 4.5 mg/m^3. Other concentrations for this scenario at other times and locations ranged between 2.2 and 3.3 mg/m^3. Without the project, carbon monoxide concentrations in the year 2016 were predicted to increase by about 5 to 25 percent in the project area compared to the existing case. Even with the increase, worst-case values would likely remain well within the state and federal standards for this scenario.

In the year 2016 with the proposed project, carbon monoxide concentrations were predicted to be about 15 percent lower than the without project scenario at the intersection of Kilohana Drive and Piilani Highway, but other locations would likely experience an increase of about 5 to 15 percent. Similar to the existing and 2016 without-project scenarios, the highest worst-case concentration with the project was predicted to occur during the morning at the intersection of Kilohana Drive and Piilani Highway. A worst-case 1-hour concentration of 3.9 mg/m^3 was predicted to occur at this location and time. Worst-case concentrations at other locations and times ranged between about 2.5 and 3.2 mg/m^3. Predicted worst-case 1-hour concentrations for the 2016 with-project alternative at all locations studied continued to remain well within both the national and state standards.

In the year 2022 with the proposed project, carbon monoxide concentrations were predicted to remain mostly unchanged compared to the 2016 with-project scenario. Compared to the existing case, worst-case concentrations were estimated to remain nearly unchanged at the intersection of Kilohana Drive and Piilani Highway, and increase moderately at other locations. The highest worst-case concentration with the project in the year 2022 was predicted to continue to occur during the morning at the intersection of Kilohana Drive and Piilani Highway. A worst-case 1-hour concentration of 4.1 mg/m^3 was predicted to occur at this location and time. Worst-case concentrations at other locations and times ranged between about 2.9 and 3.7 mg/m^3. Predicted worst-case 1-hour concentrations for the 2022 with-project alternative at all locations studied remained well within both the national and state standards.

Predicted Worst-Case 8-Hour Concentrations

Worst-case 8-hour carbon monoxide concentrations were estimated by multiplying the worst-case 1-hour values by a persistence factor of 0.5. This accounts for two factors: (1) traffic volumes averaged over eight hours are lower than peak 1-hour values, and (2) meteorological conditions are more variable (and hence more favorable for dispersion) over an 8-hour period than they are for a single hour. Based on monitoring data, 1-hour to 8-hour persistence factors for most locations generally vary from 0.4 to 0.8 with 0.6 being the most typical. One recent study based on modeling [9] concluded that 1-hour to 8-hour persistence factors could typically be expected to range from about 0.4 to 0.5. EPA guidelines [10] recommend using a value of 0.6 to 0.7 unless a locally derived persistence factor is available. Recent monitoring data for Honolulu reported by the Department of Health [11] suggest that this factor may range between about 0.35 and 0.55 depending on location and traffic variability. Considering the location of the project and the traffic pattern for the area, a 1-hour to 8-hour persistence factor of 0.5 will likely yield reasonable estimates of worst-case 8-hour concentrations. However, it should be noted that the 8-hour concentration estimates are generally less reliable than the 1-hour values due to the prediction methodology involved.

The resulting estimated worst-case 8-hour concentrations are indicated in Table 5. For the 2008 scenario, the estimated worst-case 8-hour carbon monoxide concentrations for the three locations studied ranged from 1.2 mg/m^3 to 2.0 mg/m^3, with the highest concentration occurring at the intersection of Kilohana Drive and Piilani Highway. The estimated worst-case concentrations for the existing case were well within both the national limit of 10 mg/m^3 and the state standard of 5 mg/m^3.

For the 2016 without project scenario in comparison to the existing case, worst-case concentrations increased by about 10 to 25 percent. Concentrations ranged from 1.4 mg/m^3 to 2.2 mg/m^3 with the highest concentration occurring at the intersection of Kilohana Drive and Piilani Highway. Despite the increase, all predicted 8-hour concentrations for this scenario were well within both the national and the state AAQS.

For the 2016 with-project scenario in comparison to the 2016 without-project case, worst-case concentrations decreased slightly at Kilohana Drive and increased slightly at Okolani Drive and at Wailea Ike Drive. Worst-case concentrations ranged from 1.6 mg/m^3 to 2.0 mg/m^3 with the highest concentration occurring at the intersection of Kilohana Drive and Piilani Highway. All predicted 8-hour concentrations for this scenario were well within both the national and the state AAQS.

With the project in the year 2022, worst-case carbon monoxide concentrations at the three locations studied would not change significantly compared to the 2016 with-project scenario. Worst-case concentrations ranged between 1.8 and 2.0 mg/m^3 with the highest concentration occurring at the intersection of Kilohana Drive and Piilani Highway. All predicted 8-hour concentrations for the 2022 with-project alternative were well within both the national and the state standards.

Conservativeness of Estimates

The results of this study reflect several assumptions that were made concerning both traffic movement and worst-case meteorological conditions. One such assumption concerning worst-case meteorological conditions is that a wind speed of 1 meter per second with a steady direction for 1 hour will occur. A steady

wind of 1 meter per second blowing from a single direction for an hour is extremely unlikely and may occur only once a year or less. With wind speeds of 2 meters per second, for example, computed carbon monoxide concentrations would be only about half the values given above. The 8-hour estimates are also conservative in that it is unlikely that anyone would occupy the assumed receptor sites (within 3 m of the roadways) for a period of 8 hours.

7.3 Mobile Source Air Toxics Analysis

In addition to the criteria air pollutants for which there are National Ambient Air Quality Standards (NAAQS), EPA also regulates air toxics. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners) and stationary sources (e.g., factories or refineries). Mobile Source Air Toxics (MSATs) are a subset of the 188 air toxics defined by the Clean Air Act. The MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline.

The EPA is the lead Federal Agency for administering the Clean Air Act and has certain responsibilities regarding the health effects of MSATs. The EPA issued a Final Rule on Controlling Emissions of Hazardous Air Pollutants from Mobile Sources on March 29, 2001. This rule was issued under the authority in Section 202 of the Clean Air Act. In its rule, EPA examined the impacts of existing and newly promulgated mobile source control programs, including its reformulated gasoline (RFG) program, its national low emission vehicle (NLEV) standards, its Tier 2 motor

vehicle emissions standards and gasoline sulfur control requirements, and its proposed heavy duty engine and vehicle standards and on-highway diesel fuel sulfur control requirements. Between 2000 and 2020, Federal Highway Administration (FHWA) projects that even with a 64 percent increase in VMT, these programs will reduce on-highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde by 57 percent to 65 percent, and will reduce on-highway diesel PM emissions by 87 percent. As a result, EPA concluded that no further motor vehicle emissions standards or fuel standards were necessary to further control MSATs. The agency is preparing another rule under authority of the Clean Air Act (CAA) Section 202(l) that will address these issues and could make adjustments to the full 21 and the primary six MSATs.

7.3.1 Unavailable Information for Project Specific MSAT Impact Analysis

This document includes a basic analysis of the likely MSAT emission impacts of this project. However, available technical tools do not provide a means to predict the project-specific health impacts of the emission changes associated with the project alternatives. Due to these limitations, the following discussion is included in accordance with Council on Environmental Quality (CEQ) regulations (40 CFR 1502.22(b)) regarding incomplete or unavailable information.

Information that is Unavailable or Incomplete. Evaluating the environmental and health impacts from MSATs on a proposed highway project would involve several key elements, including emissions modeling, dispersion modeling in order to estimate ambient concentrations resulting from the estimated emissions, exposure modeling in order to estimate human exposure to the estimated concentrations, and then final determination of health impacts

based on the estimated exposure. Each of these steps as outlined below is encumbered by technical shortcomings or uncertain science that prevents a more complete determination of the MSAT health impacts of this project.

- **Emissions:** The EPA tools to estimate MSAT emissions from motor vehicles are not sensitive to key variables determining emissions of MSATs in the context of highway projects. While MOBILE6.2 is used to predict emissions at a regional level, it has limited applicability at the project level. MOBILE6.2 is a trip-based model, and emission factors are projected based on a typical trip of 7.5 miles and on average speeds for this typical trip. This means that MOBILE6.2 does not have the ability to predict emission factors for a specific vehicle operating condition at a specific location at a specific time. Because of this limitation, MOBILE6.2 can only approximate the operating speeds and levels of congestion likely to be present on the largest-scale projects, and cannot adequately capture emissions effects of smaller projects. For particulate matter, the model results are not sensitive to average trip speed, although the other MSAT emission rates do change with changes in trip speed. Also, the emissions rates used in MOBILE6.2 for both particulate matter and MSATs are based on a limited number of tests of mostly older-technology vehicles. Lastly, in its discussions of particulate matter under the conformity rule, EPA has identified problems with MOBILE6.2 as an obstacle to quantitative analysis. These deficiencies compromise the capability of MOBILE6.2 to estimate MSAT emissions. MOBILE6.2 is an adequate tool for projecting emissions trends, and performing relative analyses between alternatives for very large projects, but it is not sensitive enough to capture the effects of travel changes tied to smaller projects or to predict emissions near specific roadside locations.

- **Dispersion.** The tools to predict how MSATs disperse are also limited. The EPA's current regulatory models, CALINE3 and CAL3QHC, were developed and validated more than a decade ago for the purpose of predicting episodic concentrations of carbon monoxide to determine compliance with the national ambient air quality standards. The performance of dispersion models is more accurate for predicting maximum concentrations that can occur at some time at some location within a geographic area. This limitation makes it difficult to predict accurate exposure patterns at specific times at specific highway project locations across an urban area to assess potential health risk. The National Cooperative Highway Research Program (NCHRP) is conducting research on best practices in applying models and other technical methods in the analysis of MSATs. This work also will focus on identifying appropriate methods of documenting and communicating MSAT impacts in the National Environmental Policy Act (NEPA) process and to the general public. Along with these general limitations of dispersion models, FHWA is also faced with a lack of monitoring data in most areas for use in establishing project-specific MSAT background concentrations.

- **Exposure Levels and Health Effects.** Finally, even if emission levels and concentrations of MSATs could be accurately predicted, shortcomings in current techniques for exposure assessment and risk analysis preclude us from reaching meaningful conclusions about project-specific health impacts. Exposure assessments are difficult because it is difficult to accurately calculate annual concentrations of MSATs near roadways, and to determine the portion of a year that people are actually exposed to those concentrations at a specific location. These difficulties are magnified for 70-year cancer assessments, particularly

because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over a 70-year period. There are also considerable uncertainties associated with the existing estimates of toxicity of the various MSATs, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population. Because of these shortcomings, any calculated difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with calculating the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against other project impacts that are better suited for quantitative analysis.

Summary of Existing Credible Scientific Evidence Relevant to Evaluating the Impacts of MSATs. Research into the health impacts of MSATs is ongoing. For different emission types, there are a variety of studies that show that some either are statistically associated with adverse health outcomes through epidemiological studies (frequently based on emissions levels found in occupational settings) or that animals demonstrate adverse health outcomes when exposed to large doses. Exposure to toxics has been a focus of a number of EPA efforts. Most notably, the agency conducted the National Air Toxics Assessment (NATA) in 1996 to evaluate modeled estimates of human exposure applicable to the county level. While not intended for use as a measure of or benchmark for local exposure, the modeled estimates in the NATA database best illustrate the levels of various toxics when aggregated to a national or State level.

The EPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The EPA Integrated Risk Information System (IRIS) is a database of human health effects

that may result from exposure to various substances found in the environment. The IRIS database is located at http://www.epa.gov/iris. The following toxicity information for the six prioritized MSATs was taken from the IRIS database *Weight of Evidence Characterization* summaries. This information is taken verbatim from EPA's IRIS database and represents the Agency's most current evaluations of the potential hazards and toxicology of these chemicals or mixtures.

- **Benzene** is characterized as a known human carcinogen.
- The potential carcinogenicity of **acrolein** cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation route of exposure.
- **Formaldehyde** is a probable human carcinogen, based on limited evidence in humans, and sufficient evidence in animals.
- **1,3-butadiene** is characterized as carcinogenic to humans by inhalation.
- **Acetaldehyde** is a probable human carcinogen based on increased incidence of nasal tumors in male and female rats and laryngeal tumors in male and female hamsters after inhalation exposure.
- **Diesel exhaust** (DE) is likely to be carcinogenic to humans by inhalation from environmental exposures. Diesel exhaust as reviewed in this document is the combination of diesel particulate matter and diesel exhaust organic gases.
- **Diesel exhaust** also represents chronic respiratory effects, possibly the primary noncancer hazard from MSATs. Prolonged exposures may impair pulmonary function and could produce symptoms, such as cough, phlegm, and chronic bronchitis. Exposure relationships have not been developed from these studies.

There have been other studies that address MSAT health impacts in proximity to roadways. The Health Effects Institute, a non-profit organization funded by EPA, FHWA, and industry, has undertaken a major series of studies to research near-roadway MSAT hot spots, the health implications of the entire mix of mobile source pollutants, and other topics. The final summary of the series is not expected for several years.

Some recent studies have reported that proximity to roadways is related to adverse health outcomes, particularly respiratory problems. Much of this research is not specific to MSATs, instead surveying the full spectrum of both criteria and other pollutants. The FHWA cannot evaluate the validity of these studies, but more importantly, they do not provide information that would be useful to alleviate the uncertainties listed above and enable one to perform a more comprehensive evaluation of the health impacts specific to this project.

Relevance of Unavailable or Incomplete Information to Evaluating Reasonably Foreseeable Significant Adverse Impacts on the Environment, and Evaluation of impacts based upon theoretical approaches or research methods generally accepted in the scientific community. Because of the uncertainties outlined above, a quantitative assessment of the effects of air toxic emissions impacts on human health cannot be made at the project level. While available tools can be used to reasonably predict relative emissions changes between alternatives for larger projects, the amount of MSAT emissions from each of the project alternatives and MSAT concentrations or exposures created by each of the project alternatives cannot be predicted with enough accuracy to be useful in estimating health impacts. (As noted above, the current emissions model is not capable of serving as a meaningful emissions analysis tool for smaller projects.) Therefore, the relevance of the unavailable or incomplete

information is that it is not possible to make a determination of whether any of the alternatives would have "significant adverse impacts on the human environment."

Within this document, a quantitative analysis of MSAT emissions relative to the various project alternatives cannot be provided, and it is acknowledged that the project alternatives may result in increased exposure to MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain, and because of this uncertainty, the health effects from these emissions cannot be estimated.

7.3.2 Qualitative Assessment of Project MSATs

As discussed above, technical shortcomings of emissions and dispersion models and uncertain science with respect to health effects prevent meaningful or reliable estimates of MSAT emissions and effects of this project. However, even though reliable methods do not exist to accurately estimate the health impacts of MSATs at the project level, it is possible to qualitatively assess the levels of future MSAT emissions under the project. Although a qualitative analysis cannot identify and measure health impacts from MSATs, it can give a basis for identifying and comparing the potential differences among MSAT emissions, if any, from the various alternatives. The qualitative assessment presented below is derived in part from a study conducted by the FHWA entitled *A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives.*

For each project alternative, the amount of MSATs emitted would be proportional to the vehicle miles traveled, or VMT, assuming that other variables such as fleet mix are the same for each

alternative. For this project, as indicated in Table 3, the estimated daily VMT for each scenario were as follows:

Scenario	VMT/day
2008 Existing	13,590
2016 Without Project	28,926
2016 With Project	28,926
2022 With Project	30,330

Between 2008 and 2016, VMT within the project corridor are expected to more than double. In the year 2016, the estimated VMT with or without the project are the same, i.e., the proposed project is not expected to affect traffic volumes. Between 2016 and 2022, the VMT is projected to increase by about 5 percent.

Although the with-project alternative is not expected to affect VMT, the with-project alternative will provide for somewhat higher average travel speeds due to the improved traffic flow. The relationship between travel speed and MSAT emission rates has not been well established. If it is assumed that the average travel speed is not a factor and that the proposed project will not affect VMT, then the project would probably have no affect on the emission of MSATs.

Regardless of the alternative chosen, emissions will likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce MSAT emissions by 57 to 87 percent from 2000 to 2020. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions

is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future.

In sum, under the with-project alternative in the design year, it is expected MSAT emissions in the immediate area of the project would not change relative to the without project alternative based solely on VMT considerations. It is likely, however, that the improved traffic flow with the project would actually help to reduce MSAT emissions, but this cannot be quantified at the present time.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Existing Conditions

Although very little ambient air quality data are available to characterize existing conditions, it is likely that state and federal ambient air quality standards are currently being met in the project area, except perhaps for occasional exceedances of the stringent state carbon monoxide standards within small areas near traffic-congested locations. Locations adjacent to large-scale agricultural activities may also be occasionally affected by dust.

Short-Term Impacts and Mitigation

The major potential short-term impact of the project on air quality will occur from the emission of fugitive dust during construction. Uncontrolled fugitive dust emissions from construction activities are estimated to amount to about 1.2 tons per acre per month, depending on rainfall and other factors. To control dust, active work areas and any temporary unpaved work roads should be watered at least twice daily on days without rainfall. Use of wind screens and/or limiting the area that is disturbed at

any given time will also help to contain fugitive dust emissions. Wind erosion of inactive areas of the project that have been disturbed could be controlled by mulching or chemical stabilization. Dirt-hauling trucks should be covered when traveling on roadways to prevent windage. A routine road cleaning and/or tire washing program will also help to reduce fugitive dust emissions that may occur as a result of trucks tracking dirt onto paved roadways in the project area. Establishment of landscaping early in the construction schedule will also help to control dust.

During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from the disruption of normal traffic flow. Increased vehicular emissions due to the disruption of traffic can be alleviated by minimizing road closures during peak traffic hours.

Long-Term Mesoscale Impacts

Mesoscale emissions from the project are relatively small compared to island-wide emissions. Without the project by the year 2016, mesoscale analysis indicates that emissions of carbon monoxide and VOC from motor vehicles operating within the project study area would increase by about 50 percent or more compared to 2008 emissions while nitrogen oxides emissions would remain about the same. Even with these increases, emissions from traffic operating within the project area would remain relatively small compared to island-wide emissions. With the proposed project in the year 2016, emissions of carbon monoxide, nitrogen oxides and VOC would be slightly lower compared to the without-project case. Thus, air quality in the area will likely benefit from the project. Between 2016 and 2022, there would likely be a diminishing trend in emissions, despite a projected small increase in traffic volumes, and air quality would likely improve.

Long-Term Microscale Impacts

Without the project, microscale analysis of selected intersections in the project area for the year 2016 indicate that worst-case concentrations of carbon monoxide can be expected to increase by about 5 to 25 percent compared to existing concentrations, but concentrations would remain well within the standards. With the project in the year 2016, worst-case carbon monoxide concentrations would likely decrease at the intersection of Kilohana Drive and Piilani Highway by about 10 percent and increase by about 5 to 20 percent in the vicinity of Okolani Drive and Piilani Highway and at the intersection of Wailea Ike Drive and Piilani Highway. Even with the increased concentrations at some locations, the worst-case concentrations should remain well within the state and federal standards in the year 2016 with the project. With the project in the year 2022, carbon monoxide concentrations along Piilani Highway would remain about the same or decrease at the intersection of Kilohana Drive and remain about the same or increase slightly near the intersections of Okolani Drive and Wailea Ike Drive. Concentrations in the year 2022 with the project would remain well within the state and federal standards.

Long-Term MSAT Impacts

The analysis of potential long-term impacts due to mobile source air toxics (MSATs) is primarily a qualitative assessment based on the estimated vehicle miles of travel for each of the study scenarios. This analysis did not reveal any significant differences amongst the alternatives studied. Based on the higher traffic volumes that are expected, emissions of MSATs in the 2016-2022 timeframe may be about twice as high as existing emissions, with or without the project. However, the project itself would

not result in increased traffic volumes, and hence it should not result in increased emissions of MSATs. The improved traffic flow with the project may actually help to reduce MSAT emissions.

Long-Term Mitigation

Options available to mitigate long-term, traffic-related air pollution are generally to further improve roadways, to reduce traffic and/or to reduce individual vehicular emissions. Aside from providing added roadway improvements, air pollution impacts from vehicular emissions could conceivably be additionally mitigated by reducing traffic volumes through the promotion of bus service and car pooling in the project area and/or by adjusting local school and business hours to begin and end during off-peak times. This mitigation measure is generally considered only partially successful. Reduction of emissions from individual vehicles would have to be achieved through the promulgation of local, state or federal air pollution control regulations. For example, Hawaii currently does not require annual inspections of motor vehicle air pollution control equipment. However, at the present time there is no indication that the state is contemplating adopting such rules.

From a mesoscale viewpoint, the with-project alternative would result in reduced air pollution emissions in the project area. Thus, the project can be expected to provide a positive impact on air quality, and it does not appear that mitigation for long-term impacts is warranted based on the mesoscale analysis of the project.

Mitigation measures to address microscale impacts are similar to those for mesoscale impacts. An additional mitigation measure for microscale impacts might be to provide added buffer zones between

walkways and roadways, although technically, the public would have to somehow be excluded from the buffer zones. The predicted worst-case concentrations in this report are based on a separation distance of 3 m (10 ft) between walkways and roadways. Doubling this distance to about 6 m (20 ft) would reduce maximum concentrations by about 10 to 15 percent.

As indicated above, the analysis of microscale impacts indicated that the with-project alternative would result in higher carbon monoxide concentrations compared to the without-project scenario at some locations, but worst-case concentrations of carbon monoxide with the project would be well within the state and national standards through the design year (2022). Thus, mitigation of air quality impacts based on the microscale analysis does not appear to be warranted.

The analysis of MSAT impacts suggests that the increase in MSAT emissions will likely be minimal for the with-project alternative. Thus, mitigation based on the MSAT impact analysis does not appear to be warranted.

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Figure 1 - Project Location

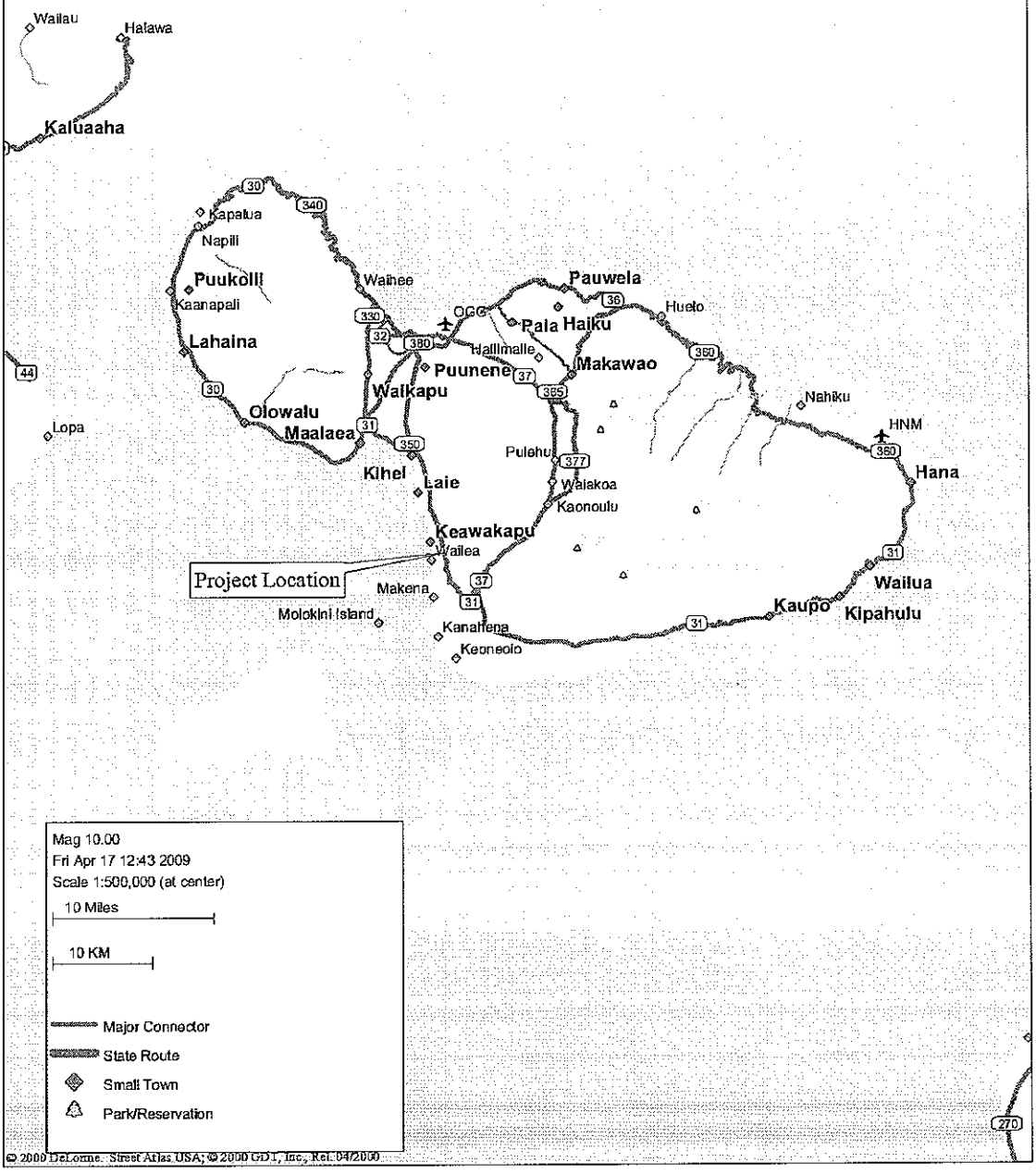

Table 1

SUMMARY OF STATE OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawaii
Particulate Matter (<10 microns)	$\mu g/m^3$	Annual 24 Hours	- 150[a]	- 150[a]	50 150[b]
Particulate Matter (<2.5 microns)	$\mu g/m^3$	Annual 24 Hours	15[c] 35[d]	15[c] 35[d]	- -
Sulfur Dioxide	$\mu g/m^3$	Annual 24 Hours 3 Hours	80 365[b] -	- - 1300[b]	80 365[b] 1300[b]
Nitrogen Dioxide	$\mu g/m^3$	Annual	100	100	70
Carbon Monoxide	mg/m^3	8 Hours 1 Hour	10[b] 40[b]	- -	5[b] 10[b]
Ozone	$\mu g/m^3$	8 Hours 1 Hour	157[e] 235[f]	157[e] 235[f]	157[e] -
Lead	$\mu g/m^3$	Calendar Quarter	0.15[g]	0.15[g]	1.5
Hydrogen Sulfide	$\mu g/m^3$	1 Hour	-	-	35[b]

[a] Not to be exceeded more than once per year on average over three years.

[B] Not to be exceeded more than once per year.

[C] Three-year average of the weighted annual arithmetic mean.

[D] 98th percentile value averaged over three years.

[E] Three-year average of fourth-highest daily 8-hour maximum.

[F] Standard is attained when the expected number of exceedances is less than or equal to 1.

[G] Rolling 3-month average.

Table 2

AIR POLLUTION EMISSIONS INVENTORY FOR ISLAND OF MAUI, 1993

Air Pollutant	Point Sources (tons/year)	Area Sources (tons/year)	Total (tons/year)
Particulate	63,275	7,030	70,305
Sulfur Oxides	6,419	nil	6,419
Nitrogen Oxides	7,312	8,618	15,930
Carbon Monoxide	4,612	20,050	24,662
Hydrocarbons	1,991	234	2,225

Source: Final Report, "Review, Revise and Update of the Hawaii Emissions Inventory Systems for the State of Hawaii", prepared for Hawaii Department of Health by J.L. Shoemaker & Associates, Inc., 1996

Table 3

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR MONITORING STATIONS NEAREST PIILANI HIGHWAY WIDENING PROJECT

Parameter / Location	2002	2003	2004	2005	2006
Particulate (PM-10) / Kihei					
24-Hour Averaging Period:					
No. of Samples	352	340	308	337	337
Highest Concentration ($\mu g/m^3$)	95	78	65	155	72
2nd Highest Concentration ($\mu g/m^3$)	80	72	63	119	66
No. of State AAQS Exceedances	0	0	0	1	0
Annual Average Concentration ($\mu g/m^3$)	20	23	19	25	22

Source: State of Hawaii Department of Health, "Annual Summaries, Hawaii Air Quality Data, 2002 - 2006"

Table 3

ESTIMATED EMISSIONS FOR PIILANI HIGHWAY - KILOHANA DRIVE TO WAILEA IKE DRIVE

Scenario / Traffic Direction	Length (miles)	Average Daily Traffic Volume	Vehicle Miles Per Day	Average Travel Speed (mph)	Emission Factors (grams/veh-mile)			Emissions (lb/day)		
					CO	NOx	VOC	CO	NOx	VOC
Existing / Southbound	0.9	7,700	6,930	32	12.8	1.43	1.15	195	22	18
Existing / Northbound	0.9	7,400	6,660	35	12.8	1.42	1.11	188	21	16
	Totals	15,100	13,590					383	43	34
							(tons/yr)	70	8	6
2016 Without Project / Southbound	0.9	16,220	14,598	24	9.32	0.665	0.725	300	21	23
2016 Without Project / Northbound	0.9	15,920	14,328	22	9.53	0.679	0.751	301	21	24
	Totals	32,140	28,926					601	42	47
							(tons/yr)	110	8	9
2016 With Project / Southbound	0.9	16,220	14,598	30	8.96	0.638	0.668	288	20	21
2016 With Project / Northbound	0.9	15,920	14,328	32	8.96	0.636	0.653	283	20	21
	Totals	32,140	28,926					571	40	42
							(tons/yr)	104	7	8
2022 With Project / Southbound	0.9	17,000	15,300	29	8.15	0.418	0.511	275	14	17
2022 With Project / Northbound	0.9	16,700	15,030	30	8.11	0.415	0.504	268	14	17
	Totals	33,700	30,330					543	28	34
							(tons/yr)	99	5	6

Table 4

ESTIMATED WORST-CASE 1-HOUR CARBON MONOXIDE CONCENTRATIONS NEAR INTERSECTIONS WITHIN PIILLANI HIGHWAY WIDENING PROJECT (milligrams per cubic meter)

Roadway Intersection	Year/Scenario							
	2008/Present		2016/Without Project		2016/With Project		2022/With Project	
	AM	PM	AM	PM	AM	PM	AM	PM
Kilohana Drive at Piilani Highway	4.1	3.1	4.5	3.3	3.9	2.9	4.1	3.0
Okolani Drive at Piilani Highway	2.4	2.1	3.0	2.2	3.1	2.6	3.7	2.9
Wailea Ike Drive at Piilani Highway	2.4	2.0	2.8	2.2	3.2	2.5	3.7	3.0

Hawaii State AAQS: 10
National AAQS: 40

Table 5

ESTIMATED WORST-CASE 8-HOUR CARBON MONOXIDE CONCENTRATIONS NEAR INTERSECTIONS WITHIN PIILANI HIGHWAY WIDENING PROJECT (milligrams per cubic meter)

Roadway Intersection	Year/Scenario			
	2008/Present	2016/Without Project	2016/With Project	2022/With Project
Kilohana Drive at Piilani Highway	2.0	2.2	2.0	2.0
Okolani Drive at Piilani Highway	1.2	1.5	1.6	1.8
Wailea Ike Drive at Piilani Highway	1.2	1.4	1.6	1.8

Hawaii State AAQS: 5
National AAQS: 10

APPENDIX F.

Acoustic Study

ACOUSTIC STUDY FOR THE PIILANI HIGHWAY WIDENING KILOHANA STREET TO WAILEA IKE DRIVE WAILEA, MAUI

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CHAPTER I. SUMMARY

The existing and future traffic noise levels in the environs of the proposed Piilani Highway Widening (between Kilohana Street and Wailea Ike Drive) Project in Wailea on the island of Maui were studied to evaluate potential noise impacts associated with the Build Alternative. Noise measurements were obtained, traffic noise predictions developed, and noise abatement alternatives evaluated.

Existing traffic noise levels in the project area currently exceed the U.S. Federal Highway Administration (FHWA) and Hawaii State Department of Transportation, Highways Division (HDOT) noise abatement criteria. Future (CY 2022) traffic noise levels are expected to exceed the "66 Leq" HDOT noise abatement criteria along the mauka (east) and makai (west) Rights-of-Way, under the Build or No-Build Alternatives. The noise abatement criteria will continue to be exceeded at noise sensitive dwelling units, but not at any public use facilities or park lands. Traffic noise mitigation measures in the form of noise barrier construction may be applied at the affected residences, but should be examined according to the criteria of reasonable and feasible. Because of the potential visual impacts of the noise barriers and the potential for graffiti, landscaping should be used on the roadway side of the barriers.

The following general conclusions can be made in respect to the number of impacted structures and lands which can be expected by CY 2022 under the Build Alternative. These conclusions are valid as long as the future vehicle mixes and average speeds do not differ from the assumed values.

- The HDOT's ">15 dB increase" criteria for substantial change in traffic noise levels will not be exceeded at any noise sensitive structure. Maximum increases in traffic noise levels in the project area should not exceed 6.6 dB as a result of growth in traffic volumes and the construction of the project.

- Under the No Build Alternative, future traffic noise levels at 13 residences which are located within the limits of project construction are expected to exceed the HDOT "66 Leq" criteria.

- Under the Build Alternative, future traffic noise levels at 16 residences which are located within the limits of project construction are expected to exceed the HDOT "66 Leq" criteria if they do not benefit from the noise shielding benefits of new sound attenuating walls. No parks or public structures (such as churches) within the limits of project construction should be affected by the proposed project or require noise mitigation measures under the Build Alternative.

- Future traffic noise levels at two commercial structures under construction at the future Wailea Gateway Shopping Center should not exceed current HDOT and FHWA noise criteria.

- The 5 mile per hour reduction in the posted maximum speed limit of 45 miles per hour to 40 miles per hour in the northbound lanes will result it a maximum traffic noise reduction benefit of 1.0 dB.

- The construction of sound attenuation barriers along the highway Rights-of-Way and Top of Fill is a possible noise mitigation measure which could also meet FHWA and HDOT policy requirements. For ground level receptors, 8 of the 11 sound attenuating walls which are required to meet the minimum 5 dBA attenuation criteria at the affected residences exceed the HDOT costs which are considered to be reasonable and feasible. Sound attenuating walls fronting lots TMK: 2-1-15: 015, TMK: 2-1-15: 013, and TMK: 2-1-08: 112 may be included in the highway improvement project since they will probably meet the HDOT cost criteria for "reasonable and feasible" traffic noise mitigation measures.

Potential short term construction noise impacts are possible during the project construction period along the entire project corridor. However, minimizing these types of noise impacts is possible using standard curfew periods, properly muffled equipment, administrative controls, and construction barriers as required. The possible use of blasting or chemicals to break or dislodge rock will be considered to reduce the total construction period, and to reduce the amount of time required to remove the rock if only mechanical (such as hoe ram) equipment were used. Controlled blasting operations using relatively small charges may be feasible without causing adverse noise and vibration impacts at nearby residences. In addition, the use of chemical expansion to break or dislodge rock during construction will also be considered where blasting or mechanical means are less desirable.

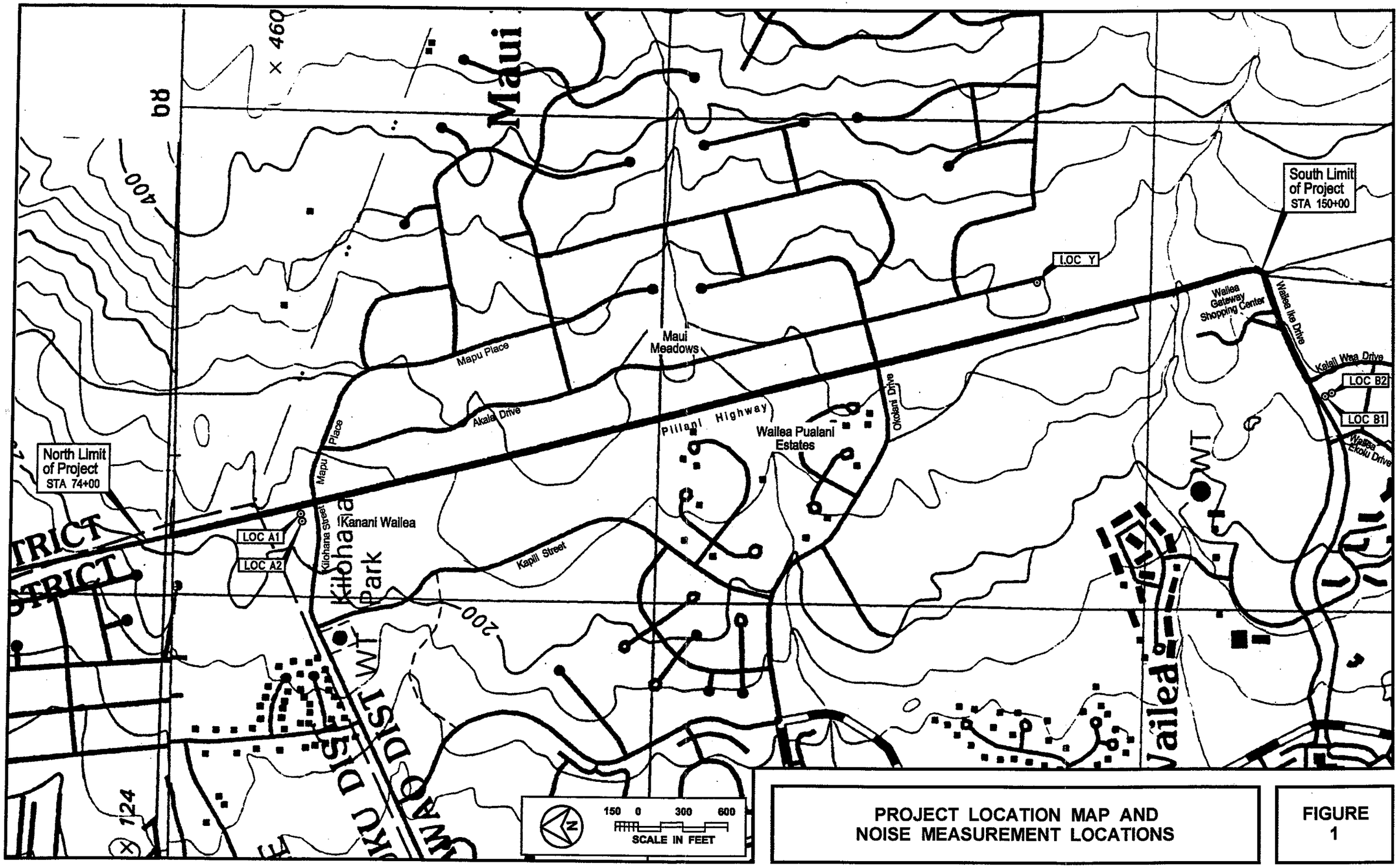
CHAPTER II. GENERAL STUDY METHODOLOGY

Noise Measurements. Existing traffic and background ambient noise levels at five locations in the project area were measured in March 2009. The traffic noise measurements were used to calibrate the traffic noise model which was used to calculate the Base Year (CY 2008) and future (CY 2022) traffic noise levels under the No Build and Build Alternatives. The background ambient noise measurements were used to define existing noise levels at noise sensitive receptors which may be affected by the project. Also, the measurements were used in conjunction with forecast traffic noise levels to determine if future traffic noise levels are predicted to "substantially exceed" existing background ambient noise levels at these noise sensitive receptors, and therefore exceed FHWA and HDOT noise standards and noise abatement criteria.

The noise measurement locations ("A1," "A2," "B1," "B2," and "Y") are shown in Figure 1. The results of the traffic and background noise measurements are summarized in Table 1. In the tables, Leq represents the average (or equivalent), A-Weighted, Sound Level. A list and description of the acoustical terminology used are contained in Appendix B.

Traffic Noise Predictions. The Federal Highway Administration (FHWA) Traffic Noise Model, Version 2.5 (or TNM, see Reference 1) was used as the primary method of calculating Base Year and future traffic noise levels, with model parameters adjusted to reflect terrain, ground cover, and local shielding conditions. At all traffic noise measurement locations, the measured noise levels were compared with TNM model predictions to insure that measured and calculated noise levels for the existing conditions were consistent and in general agreement. As indicated in Table 1, spot counts of traffic volumes were also obtained during the measurement periods and were used to generate the Equivalent Sound Level (Leq) predictions shown in the table. The average vehicle speeds entered into the TNM were higher than posted speeds so as to achieve better agreement between measured noise levels and those calculated by the TNM. With these input speed adjustments, the agreement between measured and predicted traffic noise levels was considered to be good and sufficiently accurate to formulate the Base Year and future year traffic noise levels.

Base Year traffic noise levels were then calculated along the project corridor using Base Year (2008) traffic volume data for the AM and PM peak hours from Reference 2. These traffic volumes are summarized in Appendix C. Traffic mix by vehicle types and average vehicle speeds for the various sections of the existing and future roadway were derived from observations during the noise monitoring periods. Determinations of the periods of highest hourly traffic volumes along the project corridor were made after reviewing the AM and PM peak hour traffic volumes from Reference 2 and the noise measurement results. Total two-way traffic volumes were generally highest during the PM peak hour. However, measured traffic noise levels were not significantly different for the AM, midday, and PM peak hours. For the purposes of this study, the PM peak hour was used to model the period with the highest traffic noise



PROJECT LOCATION MAP AND NOISE MEASUREMENT LOCATIONS

FIGURE 1

TABLE 1
TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

	LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
A1	50 FT from the double yellow line of Piilani Hwy. on makai side (3/16/09)	0745 TO 0845	50	1,127	21	5	71.0	70.1
A2	100 FT from the double yellow line of Piilani Hwy. on makai side (3/16/09)	0745 TO 0845	50	1,127	21	5	62.8	63.1
B1	50 FT from the center-line of Wailea Ike Dr. (3/16/09)	0910 TO 1010	42	639	11	2	65.4	65.3
B2	100 FT from the center-line of Wailea Ike Dr. (3/16/09)	0910 TO 1010	42	639	11	2	60.7	61.1
A1	50 FT from the double yellow line of Piilani Hwy. on makai side (3/16/09)	1321 TO 1421	50	1,338	17	4	70.3	69.6
A2	100 FT from the double yellow line of Piilani Hwy. on makai side (3/16/09)	1321 TO 1421	50	1,338	17	4	64.0	63.3

TABLE 1 (CONTINUED)
TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

	LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
Y	260 FT from the center-line of Piilani Highway (3/16/09)	1511 TO 1546	52	1,546 (Estimate)	13 (Estimate)	3 (Estimate)	49.1	46.7
A1	50 FT from the double yellow line of Piilani Hwy. on makai side (3/16/09)	1553 TO 1653	50	1,781	15	3	71.0	71.2
A2	100 FT from the double yellow line of Piilani Hwy. on makai side (3/16/09)	1553 TO 1653	50	1,781	15	3	61.1	64.3
A1	50 FT from the double yellow line of Piilani Hwy. on makai side (3/17/09)	0645 TO 0745	50	1,106	21	6	70.8	70.0
A2	100 FT from the double yellow line of Piilani Hwy. on makai side (3/16/09)	0645 TO 0745	50	1,106	21	6	62.7	63.0

The Equivalent (or Average) Hourly Sound Level [Leq(h)] noise descriptor was used to calculate the Base Year and CY 2022 traffic noise levels as required by Reference 4. Aerial photo maps, tax maps, and project plans (where available) of the area were used to determine terrain, ground cover, and local shielding effects and distances from building structures, which were entered into the noise prediction model. Topographic maps of the areas far beyond the highway Rights-of-Way were not available, so receptor elevations were assumed to be equal to the ground elevations shown on the highway plans at locations closest to the study receptors.

Future year (2022) traffic noise levels were then developed for the No Build and Build (roadway improvement) Alternatives using the future traffic assignments of References 2 and 3. Under the Build Alternative, it was assumed that the proposed Honua`ula and Makena Resort Developments conditioned on the completion of the highway widening project would be in place. Forecast mixes of vehicle types were assumed to be identical for both existing and future traffic, with 98.7% automobiles, 1.0% medium trucks, 0.3% heavy trucks and buses. Vehicle speeds for Year 2022 were assumed to be identical to their Base Year values for the No Build Alternative (with speed reduction in the southbound lane at the approach to Wailea Ike Drive), and uniformly at 50 miles per hour in both directions under the Build Alternative. Future traffic conditions under the No Build Alternative may worsen, with average vehicle speeds declining as a result of increased congestion. Nevertheless, under the No Build Alternative, average vehicle speeds were assumed to remain the same as current values. For the purposes of evaluating the effects of speed reduction as a programmed traffic noise mitigation measure, future traffic noise levels under the Build Alternative were calculated for conditions with and without the 5 mile per hour reduction of the existing 45 miles per hour posted speed limit in the northbound direction.

Impact Assessments and Mitigation. Following the calculation of the future traffic noise levels, evaluations of the future traffic noise levels and impacts at noise sensitive receptor locations along Piilani Highway within the limits of construction were made. Comparisons of predicted future traffic noise levels with FHWA and HDOT noise abatement criteria (see Table 2) were made to determine specific locations where the noise abatement criteria are expected to be exceeded.

The HDOT 66 Leq(h) noise abatement threshold criteria and the HDOT "greater than 15 dB increase" criteria were applied to all noise sensitive buildings along the project corridor. By Reference 5, the HDOT has replaced the FHWA 67 Leq(h) criteria with their 66 Leq(h) criteria. The HDOT 71 Leq(h) noise abatement threshold criteria and the HDOT "greater than 15 dB increase" criteria were applied to all commercial buildings along the project corridor. Along the project corridor, the locations of the 66 and 71 Leq(h) traffic noise contours, without the benefit of shielding from natural terrain or man-made sound barriers, were also used to identify noise sensitive and commercial receptor locations, respectively, where the HDOT's noise abatement criteria would not be exceeded, and which would not require more detailed evaluations. In addition, the HDOT's criteria of "greater than 15 dB increase above existing background noise levels" was also used as a noise abatement criteria for this project (from Reference 5).

TABLE 2

FHWA & HDOT NOISE ABATEMENT CRITERIA
[Hourly A–Weighted Sound Level––Decibels (dBA)]

ACTIVITY CATEGORY	LEQ (h)*	DESCRIPTION OF ACTIVITY CATEGORY
A	57 (Exterior)	Lands on which serenity and quiet are of extra–ordinary significance and serve an important public need and where the preservation of those qualities is essential if the areas are to continue to serve their intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, activity sports areas, parks, residences, motels, hotels, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	------	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

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* The Hawaii State Department of Transportation, Highways Division, utilizes Leq criteria levels which are 1 Leq unit less than the FHWA values shown.

Where noise mitigation measures were indicated for this project, the effectiveness of sound attenuating barriers and other possible noise mitigation measures were evaluated. The ability to meet the HDOT criteria of 5 dBA noise reduction was also examined for various noise barrier heights.

The noise barriers which would be required to meet the HDOT's 5 dBA noise reduction criteria were then examined in respect to potential cost per benefited residence. By HDOT policy (Reference 5), the sound attenuation walls were considered "reasonable and feasible" if their costs did not exceed $35,000 per benefited residence. For CMU walls, a cost of $39.00 per square foot was used to develop the cost estimates for the sound attenuation walls. For rock walls, a cost of $35.00 per square foot was used to develop the cost estimates for sound attenuating walls which are located on top of existing rock walls. Walls whose estimated cost exceeded $35,000 per benefited residence were identified for exclusion from the highway widening project.

Evaluations of potential airborne noise and ground vibrations from blasting operations to break and/or dislodge rock during construction were also performed. Predictions of expected airborne and ground vibration levels were performed at the closest residential areas in the project environs. Comparisons between predicted levels with current blast noise and vibration criteria and standards were also performed. Potential airborne noise and vibration impacts from blasting operations during construction were then evaluated, and mitigation measures recommended as necessary.

CHAPTER III. EXISTING ACOUSTICAL ENVIRONMENT

For the purposes of this study, 2008 was used as the Base Year for calculating changes in traffic noise levels with the future No Build and Build Alternatives. The Base Year noise environment along the project corridor was described by calculating the Hourly Equivalent Sound Level [Leq(h)] along the existing roadway during the PM peak traffic hour for the 2008 time period. The hourly sound level, expressed in decibels, represents the average level of traffic noise along the project roadway during the PM peak hour of the study's Base Year.

Table 3 presents the traffic volume, speed, and mix assumptions used to calculate the Base Year noise levels during the PM peak hour along the existing Piilani Highway. Shown in Table 3 are the calculated peak hour Leq(h)'s at reference distances of 50, 100, and 150 FT from the geometrical center of the inbound and outbound lanes of the highway. The calculated distances to the 66 and 71 Leq noise contour lines under unobstructed, line-of-sight conditions to the roadway are shown in Table 4 for the PM peak hour. The actual distances to the contour lines will generally be less than indicated in Table 4 when intervening structures or terrain obstructions exist between the roadway and a receptor. This reduction (or shrinkage) of the traffic noise contour distances from the roadway's centerline is the result of noise shielding (or attenuation) effects caused by the intervening structures or terrain features (such as highway cuts).

By using the traffic noise data shown in Tables 3 and 4, and aerial photo maps of the existing improvements on the west (makai) and east (mauka) sides of the project corridor, the relationship of the existing free-field traffic noise contours to existing noise sensitive dwellings and commercial buildings in the project area were obtained. No park lands border the project corridor.

Table 5 presents the Base Year traffic noise levels at the various noise sensitive and commercial structures on both sides of the Rights-of-Way. The relationships of these receptor locations to the existing highway are shown in Figure 2. The existing traffic noise levels exceed the 66 Leq criteria at 2 single family structures within the limits of project construction. From Table 4, existing traffic noise levels could exceed the 66 Leq criteria at any residence located within 74 feet from the centerline of the highway. Existing traffic noise levels do not exceed the 71 Leq criteria for commercial properties at the two commercial buildings under construction at the future Wailea Gateway Shopping Center.

Some existing residences presently benefit from the noise shielding effects of walls which have been constructed along the lot boundary lines, and other residences in the Maui Meadows subdivision on the mauka side of the highway benefit from the noise shielding effects of the large highway cuts. In general, if the visual lines of sight between the receptors at the residences and the highway are blocked by the walls or the highway cuts, the residences will experience lower traffic noise levels due to the sound attenuation effects of the obstructions.

TABLE 3

EXISTING (CY 2008) TRAFFIC VOLUMES AND NOISE LEVELS ALONG VARIOUS SECTIONS OF PIILANI HIGHWAY (PM PEAK HOUR)

LOCATION	SPEED (MPH)	TOTAL VPH	********** VOLUMES (VPH) ********** AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	150' Leq
North of Kilohana Street	50	1,880	1,855	19	6	70.9	64.5	61.5
Between Kilohana St. & Okolani Dr.	50 & 55*	1,356	1,338	14	4	70.0	63.8	60.9
Between Okolani Dr. & Wailea Ike Dr.	55 to 30**	1,193	1,177	12	4	69.5	63.3	60.3

Notes:

1. * 50 mph southbound; 55 mph northbound
2. ** 50 to 30 mph southbound; 55 mph northbound
3. All distances shown are from the center of Piilani Highway.
4. Calculated Leq's are for unobstructed line-of-sight conditions.

TABLE 4

YEAR 2008 AND 2022 DISTANCES TO 66 AND 71 LEQ CONTOURS (PM PEAK HOUR)

STREET SECTION	66 Leq SETBACK (FT) EXISTING	66 Leq SETBACK (FT) CY 2022	71 Leq SETBACK (FT) EXISTING	71 Leq SETBACK (FT) CY 2022
North of Kilohana Street	85	137	49	78
Between Kilohana St. & Okolani Dr.	78	127	45	72
Between Okolani Dr. & Wailea Ike Dr.	74	119	42	67
South of Wailea Ike Drive	N/A	35	N/A	19

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See TABLES 3 and 6 for traffic volume, speed, and mix assumptions.
(3) Setback distances are for unobstructed line-of-sight conditions.
(4) Soft ground conditions assumed along all roadways.

TABLE 5

EXISTING AND FUTURE TRAFFIC NOISE LEVELS WITHOUT AND WITH 5 MPH SPEED REDUCTION (4.92 FT RECEPTOR, PM PEAK HOUR)

RECEPTOR LOCATION	EXISTING (CY 2008) Leq	FUTURE (CY 2022) Leq NO BUILD / (CHANGE)		FUTURE (CY 2022) Leq BUILD / (CHANGE)		FUTURE (CY 2022) Leq -5 MPH / (CHANGE)	
PIILANI HIGHWAY (MAUKA):							
Receiver 2-1-15:017	57.2	59.7 /2.5		60.9 /3.7		60.9 /3.7	
Receiver 2-1-15:016a	64.0	66.5 /2.5	*	68.3 /4.3	*	68.3 /4.3	*
Receiver 2-1-15:016b	59.6	62.1 /2.5		63.7 /4.1		63.7 /4.1	
Receiver 2-1-15:016c	62.0	64.5 /2.5		65.5 /3.5		65.5 /3.5	
Receiver 2-1-15:015	64.8	67.3 /2.5	*	68.4 /3.6	*	68.4 /3.6	*
Receiver 2-1-15:014	56.5	59.1 /2.6		59.8 /3.3		59.8 /3.3	
Receiver 2-1-15:013	66.9 *	69.5 /2.6	*	70.8 /3.9	*	70.8 /3.9	*
Receiver 2-1-15:012	59.2	61.8 /2.6		62.7 /3.5		62.6 /3.4	
Receiver 2-1-15:011	60.6	63.3 /2.7		64.4 /3.8		64.4 /3.8	
Receiver 2-1-15:010	59.1	61.7 /2.6		63.4 /4.3		63.4 /4.3	
Receiver 2-1-15:009	64.3	66.9 /2.6	*	68.1 /3.8	*	68.1 /3.8	*
Receiver 2-1-15:008	62.4	65.0 /2.6		65.4 /3.0		65.3 /2.9	
Receiver 2-1-15:007	57.8	60.5 /2.7		61.8 /4.0		61.6 /3.8	
Receiver 2-1-15:006	57.5	60.1 /2.6		61.4 /3.9		61.2 /3.7	
Receiver 2-1-15:005	54.0	56.7 /2.7		58.2 /4.2		58.0 /4.0	
Receiver 2-1-15:004	52.8	55.5 /2.7		57.4 /4.6		57.2 /4.4	
Receiver 2-1-15:003	51.6	54.3 /2.7		56.6 /5.0		56.3 /4.7	
Receiver 2-1-15:002	50.4	53.1 /2.7		54.7 /4.3		54.4 /4.0	
Receiver 2-1-15:001	50.7	53.3 /2.6		55.1 /4.4		54.7 /4.0	
Receiver 2-1-14:019	52.7	55.4 /2.7		57.0 /4.3		56.5 /3.8	
Receiver 2-1-14:018	58.8	61.5 /2.7		63.5 /4.7		63.0 /4.2	
Receiver 2-1-14:017	60.6	63.3 /2.7		65.1 /4.5		64.4 /3.8	
Receiver 2-1-14:016	54.8	57.5 /2.7		58.9 /4.1		58.4 /3.6	
Receiver 2-1-14:015	61.9	64.6 /2.7		66.2 /4.3	*	65.5 /3.6	
Receiver 2-1-14:014	63.5	66.1 /2.6	*	67.2 /3.7	*	66.4 /2.9	*
Receiver 2-1-14:013	64.8	67.5 /2.7	*	68.5 /3.7	*	67.7 /2.9	*
Receiver 2-1-14:012	66.2 *	68.8 /2.6	*	70.4 /4.2	*	69.5 /3.3	*
Receiver 2-1-14:011	59.9	62.6 /2.7		63.5 /3.6		62.8 /2.9	
Receiver 2-1-14:010	63.2	65.9 /2.7		66.6 /3.4	*	65.8 /2.6	
Receiver 2-1-14:009	56.3	58.9 /2.6		59.7 /3.4		58.9 /2.6	
Receiver 2-1-14:008	57.7	60.3 /2.6		60.8 /3.1		60.1 /2.4	
Receiver 2-1-14:007	60.8	63.5 /2.7		64.2 /3.4		63.3 /2.5	
Receiver 2-1-14:006	60.4	63.1 /2.7		63.2 /2.8		62.4 /2.0	
Receiver 2-1-14:005	64.1	66.7 /2.6	*	68.9 /4.8	*	67.9 /3.8	*
Receiver 2-1-14:004	58.7	61.4 /2.7		63.2 /4.5		62.4 /3.7	
Receiver 2-1-14:003	55.1	57.8 /2.7		59.0 /3.9		58.4 /3.3	
Receiver 2-1-14:002	56.1	58.8 /2.7		60.0 /3.9		59.5 /3.4	
Receiver 2-1-14:001	64.1	66.8 /2.7	*	67.9 /3.8	*	67.2 /3.1	*
Receiver 2-1-13:001	64.2	66.8 /2.6	*	68.4 /4.2	*	67.6 /3.4	*
Receiver 2-1-13:002	54.9	57.4 /2.5		57.8 /2.9		57.2 /2.3	
Receiver 2-1-13:003	64.2	66.7 /2.5	*	68.3 /4.1	*	67.6 /3.4	

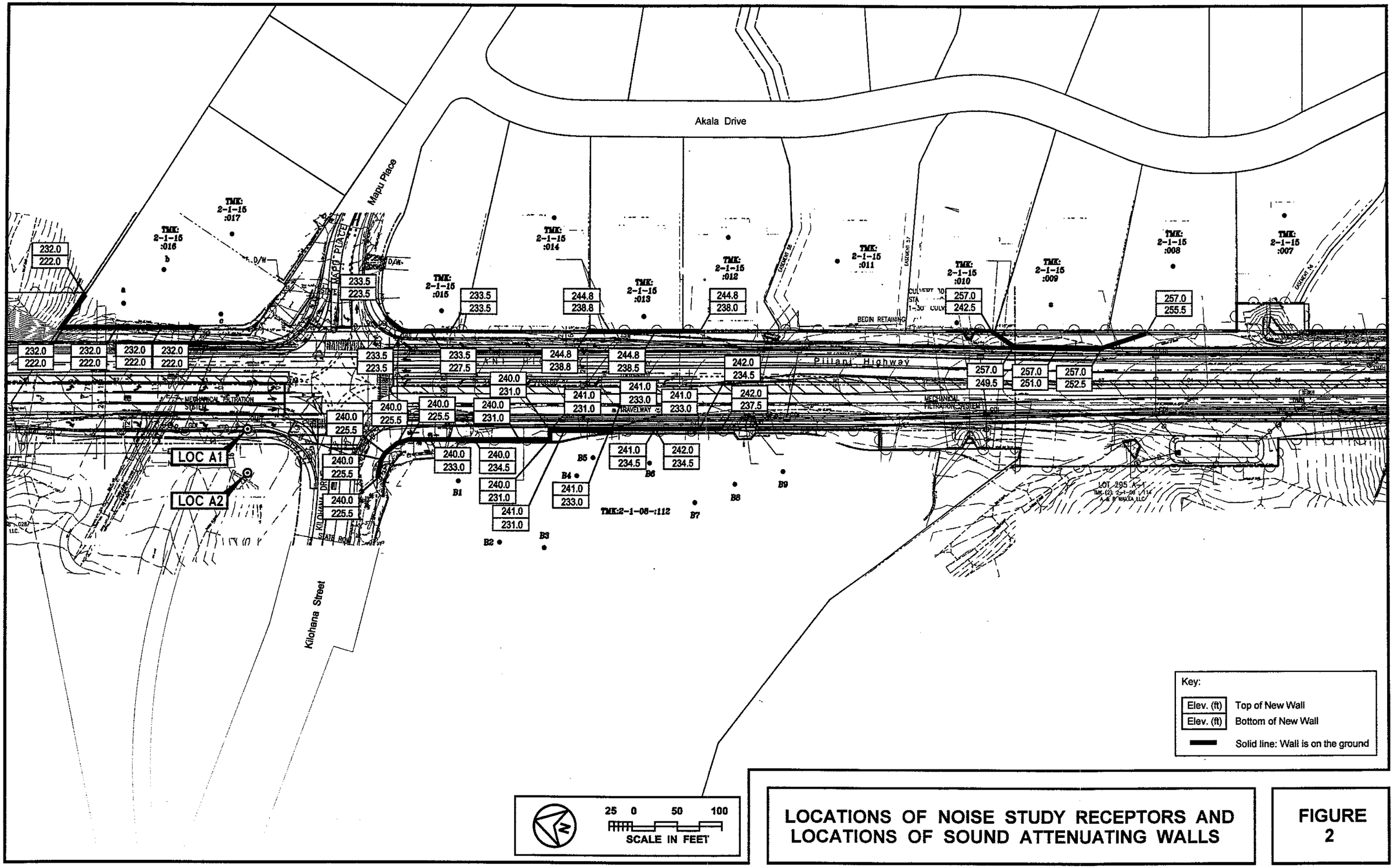
TABLE 5 (CONTINUED)

EXISTING AND FUTURE TRAFFIC NOISE LEVELS WITHOUT AND WITH 5 MPH SPEED REDUCTION (4.92 FT RECEPTOR, PM PEAK HOUR)

RECEPTOR LOCATION	EXISTING (CY 2008) Leq	FUTURE (CY 2022) Leq NO BUILD / (CHANGE)	FUTURE (CY 2022) Leq BUILD / (CHANGE)	FUTURE (CY 2022) Leq -5 MPH / (CHANGE)
PIILANI HIGHWAY (MAUKA) (Continued):				
Receiver 2-1-13:004	54.2	56.7 /2.5	59.6 /5.4	59.2 /5.0
Receiver 2-1-13:005	59.0	61.5 /2.5	64.9 /5.9	64.5 /5.5
Receiver 2-1-13:006	48.9	51.4 /2.5	53.9 /5.0	53.6 /4.7
Receiver 2-1-13:007	48.5	51.0 /2.5	54.0 /5.5	53.6 /5.1
Receiver 2-1-13:008	53.9	56.4 /2.5	59.3 /5.4	58.8 /4.9
Receiver 2-1-13:009	51.9	54.4 /2.5	57.8 /5.9	57.3 /5.4
Receiver 2-1-13:010	54.6	57.1 /2.5	60.7 /6.1	60.3 /5.7
Receiver 2-1-13:011	51.0	53.4 /2.4	57.1 /6.1	56.7 /5.7
Receiver 2-1-13:012 (Vacant)	58.9	61.4 /2.5	65.9 /7.0	65.5 /6.6
Location Y	47.4	49.8 /2.4	53.1 /5.7	52.7 /5.3
PIILANI HIGHWAY (MAKAI):				
Location A1	69.7 *	72.2 /2.5 *	75.6 /5.9 *	75.6 /5.9 *
Location A2	63.4	65.8 /2.4 *	69.3 /5.9 *	69.3 /5.9 *
Receiver 2-1-08:112 B1	61.4	64.0 /2.6	66.6 /5.2 *	66.6 /5.2 *
Receiver 2-1-08:112 B2	57.1	59.7 /2.6	61.5 /4.4	61.5 /4.4
Receiver 2-1-08:112 B3	57.1	59.8 /2.7	61.4 /4.3	61.3 /4.2
Receiver 2-1-08:112 B4	62.3	64.9 /2.6	67.8 /5.5 *	67.8 /5.5 *
Receiver 2-1-08:112 B5	64.9	67.6 /2.7 *	71.0 /6.1 *	71.0 /6.1 *
Receiver 2-1-08:112 B6	63.8	66.5 /2.7 *	69.8 /6.0 *	69.8 /6.0 *
Receiver 2-1-08:112 B7	59.9	62.5 /2.6	64.8 /4.9	64.8 /4.9
Receiver 2-1-08:112 B8	61.3	63.9 /2.6	65.0 /3.7	65.0 /3.7
Receiver 2-1-08:112 B9	61.9	64.6 /2.7	65.0 /3.1	65.1 /3.2
Receiver 2-1-26:029	62.4	65.1 /2.7	65.8 /3.4	65.4 /3.0
Receiver 2-1-26:030	62.1	64.8 /2.7	65.4 /3.3	65.0 /2.9
Receiver 2-1-26:031	61.8	64.5 /2.7	65.2 /3.4	64.8 /3.0
Receiver 2-1-26:032	61.6	64.3 /2.7	65.0 /3.4	64.5 /2.9
Receiver 2-1-26:033	55.0	57.7 /2.7	58.5 /3.5	58.1 /3.1
Receiver 2-1-26:070	57.7	60.3 /2.6	60.7 /3.0	60.3 /2.6
Receiver 2-1-26:071	57.5	60.2 /2.7	60.9 /3.4	60.6 /3.1
Receiver 2-1-26:072	61.1	63.7 /2.6	64.8 /3.7	64.4 /3.3
Receiver 2-1-26:073	61.6	64.3 /2.7	66.7 /5.1 *	66.3 /4.7 *
Receiver 2-1-26:074 (Vacant)	63.4	66.0 /2.6 *	69.3 /5.9 *	68.9 /5.5 *
Receiver 2-1-26:077	54.9	57.6 /2.7	58.9 /4.0	58.3 /3.4
Receiver 2-1-08:144 WG-1	56.2	58.7 /2.5	62.8 /6.6	62.4 /6.2
Receiver 2-1-08:144 WG-2	48.8	51.3 /2.5	54.4 /5.6	54.1 /5.3

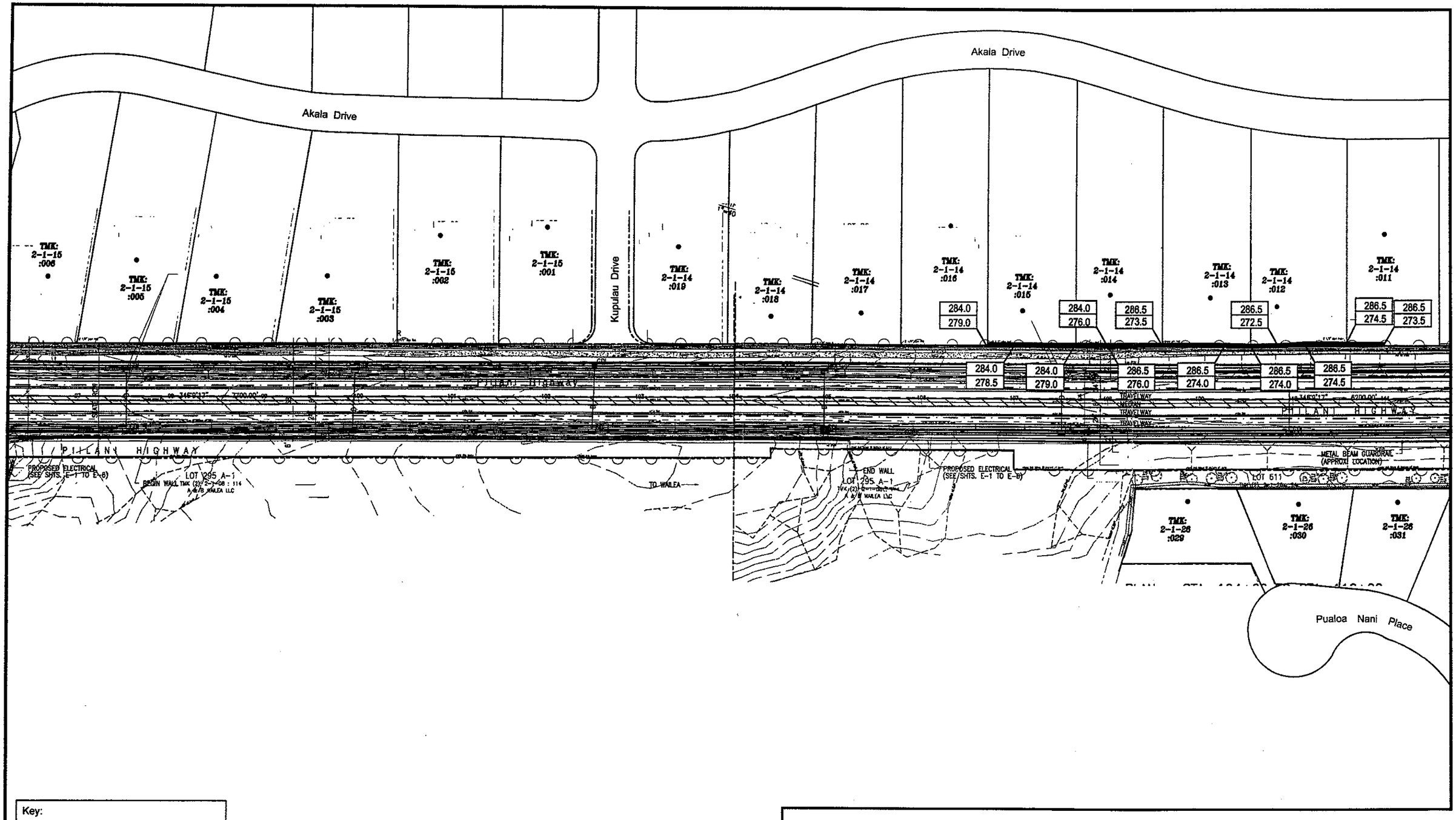
Notes:

1. All receivers were assumed to be at 4.92 feet above ground level.
2. * Denotes exceedance of HDOT "66 Leq" criteria for residences.



LOCATIONS OF NOISE STUDY RECEPTORS AND LOCATIONS OF SOUND ATTENUATING WALLS

FIGURE 2



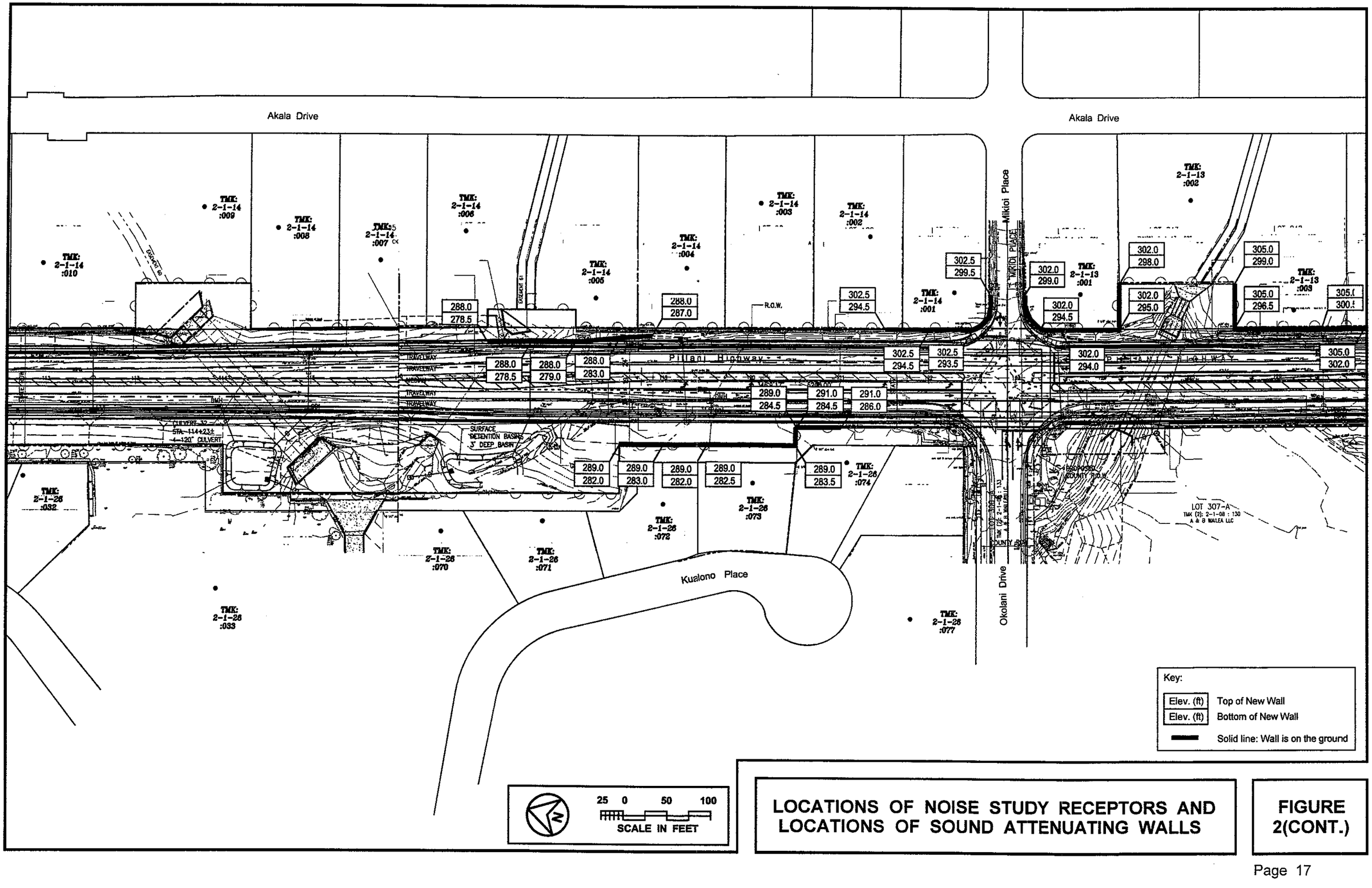
Key:

Elev. (ft)	Top of New Wall
Elev. (ft)	Bottom of New Wall
▬	Solid line: Wall is on the ground

25 0 50 100
SCALE IN FEET

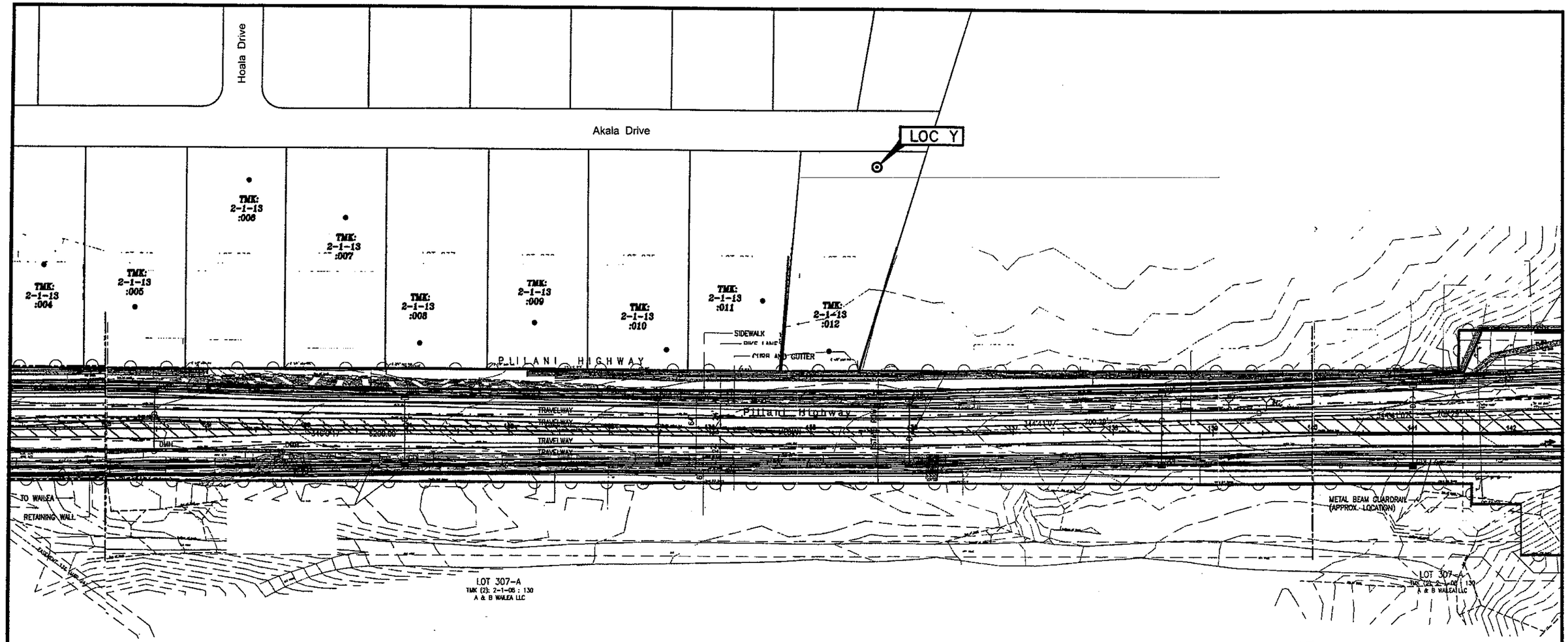
LOCATIONS OF NOISE STUDY RECEPTORS AND LOCATIONS OF SOUND ATTENUATING WALLS

FIGURE 2(CONT.)



LOCATIONS OF NOISE STUDY RECEPTORS AND LOCATIONS OF SOUND ATTENUATING WALLS

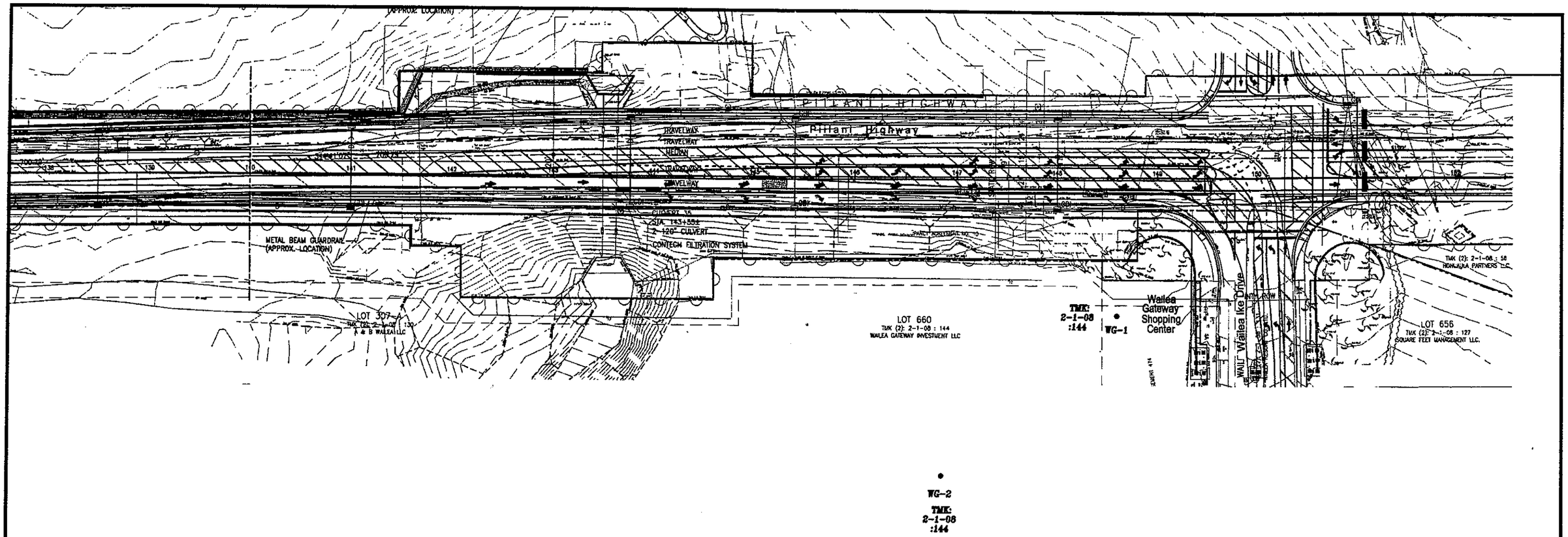
FIGURE 2(CONT.)



25 0 50 100
SCALE IN FEET

LOCATIONS OF NOISE STUDY RECEPTORS AND LOCATIONS OF SOUND ATTENUATING WALLS

FIGURE 2(CONT.)



LOCATIONS OF NOISE STUDY RECEPTORS AND LOCATIONS OF SOUND ATTENUATING WALLS

FIGURE 2(CONT.)

At areas removed from Piilani Highway (such as at Location "Y"), Base Year noise levels are much lower than along the highway's Rights-of-Way due to distance factors and local shielding effects from buildings and terrain features. Base Year noise levels in areas removed from the highway are typically less than 66 Leq(h), and possibly as low as 45 Leq(h). For example, as shown in Table 1, the measured background noise level at Location "Y" during the period prior to the PM peak traffic hour was 49.1 Leq(h). Location "Y" was partially shielded from Piilani Highway traffic noise by the large highway cut. Other non-traffic noise sources (birds, distant construction, and foliage moving with the wind) were probably in the order of 45 to 46 Leq(h), with the estimated traffic noise contributions at 47 Leq(h).

CHAPTER IV. DESCRIPTION OF FUTURE TRAFFIC NOISE LEVELS

The future traffic noise levels in the immediate vicinity of the project during CY 2022 were evaluated for the No Build and Build Alternatives. The same methodology that was used to calculate the Base Year noise levels was also used to calculate the Year 2022 noise levels. It should be noted that forecast traffic volumes along Piilani Highway for the Year 2022 under the Build Alternative were greater than those under the No Build Alternative due to the addition of traffic from the proposed Honua`ula and Makena Resort Developments. Under both the No Build and Build Alternatives, vehicle mixes were assumed to be identical to the Base Year values.

Tables 4, 5, 6, and 7 summarize the traffic conditions, noise levels, and setback distances for the Build Alternative during the PM peak hour in CY 2022. Table 5 also indicates the increases in future traffic noise levels expected under the No Build and Build Alternatives prior to the inclusion of sound attenuation walls. As indicated in Table 7, future traffic noise levels in the immediate vicinity of the project are predicted to increase by approximately 2.4 to 2.8 dB between CY 2008 and CY 2022 solely as a result of projected traffic volume increases under the No Build Alternative. Under the No Build Alternative, the HDOT 66 noise abatement criteria will be exceeded at 13 existing dwelling units which do not benefit from the noise shielding effects of walls or terrain features.

Under the Build Alternative, widening of the highway between Kilohana Street and Wailea Ike Drive is planned so that the existing two, 12 foot wide lanes are replaced with four, 12 foot wide lanes plus turning lanes and 8 foot wide median. Figure 2 presents the noise sensitive receptor (or receiver) locations where future traffic noise levels were calculated for the Build Alternative using the FHWA Traffic Noise Model. The predicted CY 2022 traffic noise levels at the various receptor locations along Piilani Highway where traffic noise levels could exceed 66 Leq(h) are shown in Table 5 for the Build Alternative first under worst case conditions without a reduction in the northbound posted speed limit from 45 to 40 miles per hour. Then, for the condition with the planned reduction of the posted speed limit for the northbound lanes from 45 miles per hour to 40 miles per hour, predictions of future traffic noise levels under the Build Alternative are also shown in the far right column of Table 5. The noise reduction benefit from the reduction in the posted speed limit from 45 to 40 miles per hour in the northbound direction ranged from 0.0 to 1.0 dB. These reductions were included in the final calculations of future traffic noise levels under the Build Alternative.

The 66 Leq criteria should not be exceeded at any public use structures or park lands under the No Build or Build Alternatives. The 71 Leq criteria for commercial properties will not be exceeded at two multistory commercial buildings on the makai side of Piilani Highway at the Wailea Ike Drive intersection.

The following general conclusions can be made in respect to the impacted

TABLE 6

FUTURE (CY 2022) TRAFFIC VOLUMES AND NOISE LEVELS ALONG VARIOUS SECTIONS OF PIILANI HIGHWAY (PM PEAK HOUR; UNDER BUILD ALTERNATIVE)

LOCATION	SPEED (MPH)	TOTAL VPH	********** VOLUMES (VPH) ********** AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	150' Leq
North of Kilohana Street	50	4,335	4,279	43	13	74.9	68.8	65.8
Between Kilohana St. & Okolani Dr.	50	3,648	3,601	36	11	74.1	68.1	65.0
Between Okolani Dr. & Wailea Ike Dr.	50	3,208	3,166	32	10	73.6	67.5	64.5
South of Wailea Ike Drive	50	280	276	3	1	62.9	57.0	54.0

Note:

1. All distances shown are from the center of Piilani Highway.
2. Calculated Leq's are for unobstructed line-of-sight conditions.

TABLE 7

CALCULATIONS OF PROJECT AND NON-PROJECT TRAFFIC NOISE CONTRIBUTIONS (CY 2022) (PM PEAK HOUR)

PIILANI HIGHWAY SECTION	NOISE LEVEL INCREASE DUE TO: NON-PROJECT TRAFFIC	PROJECT TRAFFIC
North of Kilohana Street	2.40	1.60
Between Kilohana St. & Okolani Dr.	2.80	1.30
Between Okolani Dr. & Wailea Ike Dr.	2.40	1.70
South of Wailea Ike Drive	N/A	62.90

structures and lands which can be expected by CY 2022 under the Build Alternative. These conclusions are valid as long as the future vehicle mixes and average speeds do not differ from the assumed values.

The HDOT's ">15 dB increase" criteria for substantial change in traffic noise levels will not be exceeded at any noise sensitive structure. Maximum increases in traffic noise levels in the project area should not exceed 6.6 dB as a result of growth in traffic volumes and widening of the highway. Increases in future traffic noise levels without the Honua`ula and the conditionally permitted Makena Resort Developments are expected to range from 2.4 to 2.8 dB. Increases in future noise levels attributable to the Honua`ula and the conditionally permitted Makena Developments are expected to range from 1.3 to 1.7 dB within the limits of project construction.

- Under the No Build or Build Alternatives, future traffic noise levels at existing single and multifamily dwellings on both sides of the highway will continue to exceed the 66 Leq criteria. At least 13 residential structures are predicted to be affected by future traffic noise levels which exceed the 66 Leq HDOT noise criteria under the No Build Alternative. At least 16 residential structures are predicted to be affected by future traffic noise levels which exceed the 66 Leq HDOT noise criteria under the Build Alternative. At the two commercial buildings under construction at the future Wailea Gateway Shopping Center on the makai side of the highway, future traffic noise levels will not exceed the 71 Leq criteria for commercial structures under the Build Alternative.

- Exceedance of the 66 Leq noise mitigation criteria at public use structures or park lands are not expected to occur under the No Build or Build Alternatives.

CHAPTER V. POSSIBLE NOISE MITIGATION MEASURES

Possible noise mitigation measures considered included the following:

A. Restricting the Growth In the Number of Noisy Buses, Heavy Trucks, Motorcycles, and Automobiles with Defective Mufflers. The percentage contribution to the total traffic noise by heavy trucks, buses, and noisy vehicles is currently less than 10 percent, and elimination of these noise sources would reduce total traffic noise levels by less than 0.5 Leq(h) units. Restricting the growth rate of these vehicles (to growth rates below passenger automobile growth rates) could produce noise reductions in the order of 0.1 or 0.5 dB, which are not considered significant for the level of regulatory efforts required.

B. Alteration of the Horizontal Or Vertical Alignment of the Roadway. This project involves the widening of the northbound and southbound lanes of the highway and does not involve alterations to the vertical or horizontal alignments of Piilani Highway. Major alterations of the horizontal alignment of the existing highway lanes were not considered appropriate due to the scope of this roadway improvement project, and due to the constraints imposed by the locations of the existing intersections along the project corridor. Noise sensitive receptors where the 66 Leq criteria is exceeded are located on both the east (mauka) and the west (or makai) sides of the highway, so mitigation of traffic noise on both sides using roadway realignment techniques would not be possible. Vertical realignment of the highway is not a reasonable noise mitigation measure because of the need to match the grades at existing intersections of Kilohana Street, Okalani Drive, and Wailae Ike Drive, because of the need to depress the roadway to achieve the noise shielding effects of the highway cuts, and because of the need for additional Right-of-Way width so as properly slope the sides of the cuts and to not create detrimental reflections off any vertical side walls along the cuts.

C. Acquisition of Property Rights for Construction of Noise Barriers, and/or Construction of Noise Barriers Along the Right-of-Way. For single story, noise sensitive buildings, construction of a sound attenuating wall is normally the preferred noise mitigation measure. The 5 to 7 dB of noise attenuation achievable with a 6 FT high wall is normally sufficient for single story structures. Many of the structures along Piilani Highway are multistory dwelling units, and the upper floors of those structures will not benefit from sound attenuation walls which are 6 to 8 feet high. Wall heights in the order of 15 to 20 feet above ground level will be required to attenuate traffic noise at the upper floor spaces. It should also be noted that the sound barrier will block the views to the roadway which some of the residents may enjoy. For this reason, concurrence from the affected homeowners should be obtained prior to construction of a sound barrier as a noise mitigation measure.

D. Acquisition of Real Property Interests To Serve As A Noise Buffer Zone. Where tall (or multistory) structures are expected to be impacted by future traffic noise, the use of sound attenuating barriers (see para. C above) will not be practical due to the excessive heights required to shield the upper levels from traffic noise. In these situations, the only other noise mitigation possibilities are sound insulation of the affected upper level units or acquisition of the property interests. Noise buffer zones extending approximately 119 to 137 feet from the center of the highway and at substantial cost would be required to meet the HDOT 66 Leq criteria. In general, the acquisition of property for the creation of noise buffer zones for noise mitigation has seldom been applied in Hawaii.

E. Noise Insulation of Public Use or Nonprofit Institutional Structures. No public use structures should require noise insulation as a result of the proposed highway improvements.

CHAPTER VI. FUTURE TRAFFIC NOISE IMPACTS AND POSSIBLE NOISE MITIGATION MEASURES

Future traffic noise levels are predicted to exceed the HDOT 66 Leq(h) noise abatement criteria by CY 2022 under the Build Alternative at existing noise sensitive structures on both sides of the highway. Table 8 presents the predicted performances of sound attenuation walls located along the east and west sides of the highway in front of the affected structures for the Build Alternative with the Honua`ula and conditionally permitted Makena Resort Developments. The locations of the sound attenuation walls are shown in Figure 2. Sound attenuating walls were located along the makai and mauka Rights-of-Way or Tops of Fill or tops of retaining walls fronting residential lots where future traffic noise levels are expected to exceed the HDOT 66 Leq(h) noise abatement criteria, and the heights of the walls were adjusted upward until the 5 dB minimum attenuation criteria was met at the various affected receivers. Table 8 depicts the predicted traffic noise levels for various wall heights at the receivers on the mauka and makai sides for the proposed widened roadway. Based on the results shown in Table 8, relatively large wall heights exceeding 8 feet will be required to provide 5 dB of sound attenuation at receivers located on the mauka and makai sides of the highway. In the figure, the top wall elevations are required to comply with the minimum 5 dB attenuation criteria of HDOT for ground level receptors. It should be noted that complete topographic maps at the dwelling units were not available for this study, and the wall heights shown in Figure 2 are best estimates based on the available highway plans, sections, and profiles.

Attenuation of traffic noise at the upper floors of 2-story homes and town homes which are located on some of the lots along the highway will not be feasible due to the large wall heights required to shield the upper floors from the highway traffic. The other mitigation measures discussed in Chapter V are also not feasible at these upper floor receptor locations. Attenuation of traffic noise to meet HDOT criteria will be possible for the ground floors of the affected dwellings using the sound attenuation walls shown in Figure 2.

The predicted future noise levels for the required wall heights shown in Figure 2 are shown in Table 8 under the "RECOM. WALL" column. Because the HDOT "5 dBA noise reduction" criteria will not be met in all cases with 6 foot wall heights, the construction of 8 to 14.5 foot high walls will be required at some locations. A variance from local building codes may be required to construct the 8 to 14.5 foot high walls which are required to achieve at least 5 dBA of noise reduction. The sound attenuating walls must be continuous without see-through openings, and may be constructed from solid materials which have a minimum surface weight of 5 pounds per square foot. Use of landscaping on the roadway side of the wall is also recommended to soften the visual impacts of the walls and to minimize the potential for graffiti.

By the existing HDOT policy (see Reference 5), if the cost of the sound attenuating wall does not exceed $35,000 per benefited residence, construction of walls can be considered to be reasonable and feasible. Each of the 11 sound

TABLE 8

PREDICTED TRAFFIC NOISE ATTENUATION VS. BARRIER HEIGHTS
(4.92 FT HIGH RECEPTOR)

RECEPTOR LOCATION	EXISTING (CY 2008) Leq	FUTURE NOISE LEVELS (CY 2022) Leq								
		W/O BAR./ (CHANGE)		6.0 FT WALL/ (CHANGE)		7.0 FT WALL/ (CHANGE)		8.0 FT WALL/ (CHANGE)		RECOM. WALL/ (CHANGE)
PIILANI HIGHWAY (MAUKA):										
Receiver 2-1-15:017	57.2	60.9 /3.7		60.9 /3.7		60.6 /3.4		60.3 /3.1		60.7 /3.5
Receiver 2-1-15:016a	64.0	68.3 /4.3	*	68.3 /4.3	**	66.7 /2.7	**	65.0 /1.0	**	63.0 /-1.0
Receiver 2-1-15:016b	59.6	63.7 /4.1		63.6 /4.0		63.0 /3.4		62.2 /2.6		62.5 /2.9
Receiver 2-1-15:016c	62.0	65.5 /3.5		65.5 /3.5		63.6 /1.6		62.0 /0.0		65.3 /3.3
Receiver 2-1-15:015	64.8	68.4 /3.6	*	63.1 /-1.7		63.1 /-1.7		61.5 /-3.3		63.1 /-1.7
Receiver 2-1-15:014	56.5	59.8 /3.3		58.9 /2.4		58.7 /2.2		58.4 /1.9		58.9 /2.4
Receiver 2-1-15:013	66.9 *	70.8 /3.9	*	64.3 /-2.6		63.1 /-3.8		62.3 /-4.6		64.3 /-2.6
Receiver 2-1-15:012	59.2	62.6 /3.4		62.0 /2.8		61.9 /2.7		61.9 /2.7		62.0 /2.8
Receiver 2-1-15:011	60.6	64.4 /3.8		64.3 /3.7		64.2 /3.6		64.2 /3.6		64.3 /3.7
Receiver 2-1-15:010	59.1	63.4 /4.3		63.2 /4.1		63.2 /4.1		63.2 /4.1		63.2 /4.1
Receiver 2-1-15:009	64.3	68.1 /3.8	*	62.9 /-1.4		62.1 /-2.2		61.4 /-2.9		62.9 /-1.4
Receiver 2-1-15:008	62.4	65.3 /2.9		64.8 /2.4		64.6 /2.2		64.5 /2.1		64.8 /2.4
Receiver 2-1-15:007	57.8	61.6 /3.8		61.5 /3.7		61.4 /3.6		61.4 /3.6		61.5 /3.7
Receiver 2-1-15:006	57.5	61.2 /3.7		61.2 /3.7		61.2 /3.7		61.1 /3.6		61.2 /3.7
Receiver 2-1-15:005	54.0	58.0 /4.0		58.0 /4.0		58.0 /4.0		57.9 /3.9		57.9 /3.9
Receiver 2-1-15:004	52.8	57.2 /4.4		57.1 /4.3		57.1 /4.3		57.1 /4.3		57.1 /4.3
Receiver 2-1-15:003	51.6	56.3 /4.7		56.3 /4.7		56.3 /4.7		56.3 /4.7		56.3 /4.7
Receiver 2-1-15:002	50.4	54.4 /4.0		54.4 /4.0		54.4 /4.0		54.4 /4.0		54.4 /4.0
Receiver 2-1-15:001	50.7	54.7 /4.0		54.6 /3.9		54.6 /3.9		54.6 /3.9		54.6 /3.9
Receiver 2-1-14:019	52.7	56.5 /3.8		56.5 /3.8		56.5 /3.8		56.4 /3.7		56.5 /3.8
Receiver 2-1-14:018	58.8	63.0 /4.2		63.0 /4.2		63.0 /4.2		63.0 /4.2		63.0 /4.2
Receiver 2-1-14:017	60.6	64.4 /3.8		64.3 /3.7		64.2 /3.6		64.1 /3.5		64.3 /3.7
Receiver 2-1-14:016	54.8	58.4 /3.6		57.6 /2.8		57.4 /2.6		57.2 /2.4		57.2 /2.4
Receiver 2-1-14:015	61.9	65.5 /3.6		62.6 /0.7		62.0 /0.1		61.5 /-0.4		62.6 /0.7
Receiver 2-1-14:014	63.5	66.4 /2.9	*	63.0 /-0.5	**	62.6 /-0.9	**	62.0 /-1.5	**	61.4 /-2.1

TABLE 8 (CONTINUED)

PREDICTED TRAFFIC NOISE ATTENUATION VS. BARRIER HEIGHTS
(4.92 FT HIGH RECEPTOR)

RECEPTOR LOCATION	EXISTING (CY 2008) Leq	FUTURE NOISE LEVELS (CY 2022) Leq									
		W/O BAR./ (CHANGE)		6.0 FT WALL/ (CHANGE)		7.0 FT WALL/ (CHANGE)		8.0 FT WALL/ (CHANGE)		RECOM. WALL/ (CHANGE)	
PIILANI HIGHWAY (MAUKA) (Continued):											
Receiver 2-1-14:013	64.8	67.7 /2.9	*	67.4 /2.6	**	67.3 /2.5	**	67.1 /2.3	**	62.5 /-2.3	
Receiver 2-1-14:012	66.2 *	69.5 /3.3	*	69.6 /3.4	**	69.6 /3.4	**	69.3 /3.1	**	63.7 /-2.5	
Receiver 2-1-14:011	59.9	62.8 /2.9		62.7 /2.8		62.6 /2.7		62.5 /2.6		61.4 /1.5	
Receiver 2-1-14:010	63.2	65.8 /2.6		65.8 /2.6		65.7 /2.5		65.7 /2.5		65.6 /2.4	
Receiver 2-1-14:009	56.3	58.9 /2.6		58.9 /2.6		58.9 /2.6		58.9 /2.6		58.9 /2.6	
Receiver 2-1-14:008	57.7	60.1 /2.4		60.1 /2.4		60.0 /2.3		60.0 /2.3		60.0 /2.3	
Receiver 2-1-14:007	60.8	63.3 /2.5		63.2 /2.4		63.1 /2.3		63.1 /2.3		63.1 /2.3	
Receiver 2-1-14:006	60.4	62.4 /2.0		61.8 /1.4		61.6 /1.2		61.4 /1.0		61.4 /1.0	
Receiver 2-1-14:005	64.1	67.9 /3.8	*	63.6 /-0.5	**	62.6 /-1.5		62.0 /-2.1		62.0 /-2.1	
Receiver 2-1-14:004	58.7	62.4 /3.7		61.4 /2.7		61.1 /2.4		60.8 /2.1		60.8 /2.1	
Receiver 2-1-14:003	55.1	58.4 /3.3		58.0 /2.9		57.9 /2.8		57.9 /2.8		57.9 /2.8	
Receiver 2-1-14:002	56.1	59.5 /3.4		58.6 /2.5		58.4 /2.3		58.2 /2.1		58.2 /2.1	
Receiver 2-1-14:001	64.1	67.2 /3.1	*	63.7 /-0.4	**	62.7 /-1.4	**	61.9 /-2.2		62.0 /-2.1	
Receiver 2-1-13:001	64.2	67.6 /3.4	*	63.1 /-1.1	**	61.8 /-2.4		60.4 /-3.8		61.7 /-2.5	
Receiver 2-1-13:002	54.9	57.2 /2.3		56.7 /1.8		56.6 /1.7		56.5 /1.6		56.6 /1.7	
Receiver 2-1-13:003	64.2	67.6 /3.4	*	61.2 /-3.0		60.4 /-3.8		59.6 /-4.6		61.2 /-3.0	
Receiver 2-1-13:004	54.2	59.2 /5.0		58.1 /3.9		57.9 /3.7		57.7 /3.5		58.1 /3.9	
Receiver 2-1-13:005	59.0	64.5 /5.5		64.5 /5.5		64.4 /5.4		64.4 /5.4		64.4 /5.4	
Receiver 2-1-13:006	48.9	53.6 /4.7		53.2 /4.3		53.1 /4.2		53.0 /4.1		53.2 /4.3	
Receiver 2-1-13:007	48.5	53.6 /5.1		53.2 /4.7		53.1 /4.6		53.0 /4.5		53.1 /4.6	
Receiver 2-1-13:008	53.9	58.8 /4.9		58.9 /5.0		58.9 /5.0		58.9 /5.0		58.9 /5.0	
Receiver 2-1-13:009	51.9	57.3 /5.4		57.3 /5.4		57.3 /5.4		57.3 /5.4		57.3 /5.4	
Receiver 2-1-13:010	54.6	60.3 /5.7		60.3 /5.7		60.3 /5.7		60.3 /5.7		60.3 /5.7	
Receiver 2-1-13:011	51.0	56.7 /5.7		56.6 /5.6		56.6 /5.6		56.5 /5.5		56.6 /5.6	
Receiver 2-1-13:012 (Vacant)	58.9	65.5 /6.6		65.5 /6.6		65.5 /6.6		65.5 /6.6		65.5 /6.6	

TABLE 8 (CONTINUED)

PREDICTED TRAFFIC NOISE ATTENUATION VS. BARRIER HEIGHTS
(4.92 FT HIGH RECEPTOR)

RECEPTOR LOCATION	EXISTING (CY 2008) Leq	FUTURE NOISE LEVELS (CY 2022) Leq									
		W/O BAR./ (CHANGE)		6.0 FT WALL/ (CHANGE)		7.0 FT WALL/ (CHANGE)		8.0 FT WALL/ (CHANGE)		RECOM. WALL/ (CHANGE)	
PIILANI HIGHWAY (MAKAI):											
Receiver 2-1-08:112 B1	61.4	66.6 /5.2	*	60.9 /-0.5		60.1 /-1.3		59.4 /-2.0		60.8 /-0.6	
Receiver 2-1-08:112 B2	57.1	61.5 /4.4		59.7 /2.6		59.2 /2.1		59.0 /1.9		59.5 /2.4	
Receiver 2-1-08:112 B3	57.1	61.3 /4.2		59.7 /2.6		59.2 /2.1		59.0 /1.9		59.4 /2.3	
Receiver 2-1-08:112 B4	62.3	67.8 /5.5	*	63.2 /0.9	**	62.2 /-0.1		61.7 /-0.6		62.5 /0.2	
Receiver 2-1-08:112 B5	64.9	71.0 /6.1	*	65.6 /0.7		64.9 /0.0		63.4 /-1.5		64.4 /-0.5	
Receiver 2-1-08:112 B6	63.8	69.8 /6.0	*	65.3 /1.5	**	64.1 /0.3		64.0 /0.2		64.5 /0.7	
Receiver 2-1-08:112 B7	59.9	64.8 /4.9		62.9 /3.0		62.5 /2.6		62.5 /2.6		62.6 /2.7	
Receiver 2-1-08:112 B8	61.3	65.0 /3.7		64.0 /2.7		63.8 /2.5		63.7 /2.4		63.8 /2.5	
Receiver 2-1-08:112 B9	61.9	65.1 /3.2		64.6 /2.7		64.6 /2.7		64.6 /2.7		64.6 /2.7	
Receiver 2-1-26:029	62.4	65.4 /3.0		65.4 /3.0		65.4 /3.0		65.4 /3.0		65.4 /3.0	
Receiver 2-1-26:030	62.1	65.0 /2.9		65.0 /2.9		65.0 /2.9		65.0 /2.9		65.0 /2.9	
Receiver 2-1-26:031	61.8	64.8 /3.0		64.8 /3.0		64.8 /3.0		64.8 /3.0		64.8 /3.0	
Receiver 2-1-26:032	61.6	64.5 /2.9		64.5 /2.9		64.5 /2.9		64.5 /2.9		64.5 /2.9	
Receiver 2-1-26:033	55.0	58.1 /3.1		58.0 /3.0		58.0 /3.0		58.0 /3.0		58.0 /3.0	
Receiver 2-1-26:070	57.7	60.3 /2.6		60.2 /2.5		60.2 /2.5		60.2 /2.5		60.2 /2.5	
Receiver 2-1-26:071	57.5	60.6 /3.1		60.2 /2.7		60.2 /2.7		60.2 /2.7		60.2 /2.7	
Receiver 2-1-26:072	61.1	64.4 /3.3		62.0 /0.9		61.7 /0.6		61.4 /0.3		61.4 /0.3	
Receiver 2-1-26:073	61.6	66.3 /4.7	*	62.2 /0.6	**	61.6 /0.0	**	61.1 /-0.5		61.1 /-0.5	
Receiver 2-1-26:074 (Vacant)	63.4	68.9 /5.5	*	67.5 /4.1	**	67.1 /3.7	**	66.9 /3.5	**	66.9 /3.5	**
Receiver 2-1-26:077	54.9	58.3 /3.4		58.1 /3.2		58.0 /3.1		57.8 /2.9		57.8 /2.9	

TABLE 8 (CONTINUED)

PREDICTED TRAFFIC NOISE ATTENUATION VS. BARRIER HEIGHTS
(4.92 FT HIGH RECEPTOR)

RECEPTOR LOCATION	EXISTING (CY 2008) Leq	FUTURE NOISE LEVELS (CY 2022) Leq				
		W/O BAR./ (CHANGE)	6.0 FT WALL/ (CHANGE)	7.0 FT WALL/ (CHANGE)	8.0 FT WALL/ (CHANGE)	RECOM. WALL/ (CHANGE)
PIILANI HIGHWAY (MAKAI) (Continued):						
Receiver 2-1-08:144 WG-1	56.2	62.4 /6.2	62.4 /6.2	62.4 /6.2	62.4 /6.2	62.4 /6.2
Receiver 2-1-08:144 WG-2	48.8	54.1 /5.3	54.1 /5.3	54.1 /5.3	54.1 /5.3	54.1 /5.3

Notes:

1. All receivers were assumed to be at 4.92 feet above ground level.
2. * Denotes exceedance of HDOT "66 Leq" criteria for residences.
3. ** Denotes noise attenuation does not meet HDOT's 5 dB attenuation criteria for "substantial noise reduction."

attenuating walls shown in Figure 2 have an associated construction cost and an associated number of benefited residences. In Table 9, the estimated cost per benefited residence for each sound attenuating wall was calculated so as to identify those walls which can be considered to be reasonable and feasible by HDOT policy.

The estimated wall costs shown in Table 9 exceeded the maximum $35,000 per benefited residence for 8 of the 11 walls examined. Only the walls fronting lots at TMK: 2-1-15: 015, TMK: 2-1-15: 013, and TMK: 2-1-08: 112 have a possibility of being considered as reasonable and feasible under the current HDOT traffic noise abatement policy. The final estimated costs of the walls shown in Figure 2 need to be determined, since the cost estimates may rise if the new wall sections need to be modified if they are not aesthetically pleasing or if existing subdivision signs need to be relocated. In addition, some negotiations with the landowners may also occur such as at TMK: 2-1-08: 112, where modifications to the existing rock wall may be desired instead of the construction of a new wall in front of the existing wall.

It is anticipated that potential noise impacts at any new noise sensitive or commercial establishments located in the project area may be mitigated through the inclusion of sound walls or other noise mitigation measures within the individual lot development plans. In addition, any new commercial establishments, public use facilities, or housing units which may be planned alongside the roadway represent areas of potential adverse noise impacts if adequate noise mitigation measures are not incorporated into the planning of these future projects. It is anticipated that the project's roadway improvements will be completed prior to any redevelopment of the presently open areas or commercial lots adjacent to a roadway, and that noise abatement measures such as adequate setbacks, sound attenuating walls or berms, or closure and air conditioning will be incorporated into these new developments along the roadway as required. In any event, new structures whose building permits were obtained after the date of this noise study will not qualify for noise abatement measures under existing HDOT procedures.

TABLE 9

ESTIMATED COSTS OF SOUND ATTENUATING WALLS

WALL LOCATION	Benefited Residences	Total Area (SF) of New Wall	Estimated Cost of New Wall	Estimated Cost Per Benefited Residence
Mauka Side:				
TMK: 2-1-15: 016*	1	1,997	$69,911	$69,911
TMK: 2-1-15: 015	1	562	$21,910	$21,910
TMK: 2-1-15: 013	1	785	$30,608	$30,608
TMK: 2-1-15: 009	1	1,113	$43,400	$43,400
TMK: 2-1-14: 012 to 014	3	4,513	$173,911	$57,970
TMK: 2-1-14: 005	1	1,397	$54,467	$54,467
TMK: 2-1-14: 001	1	1,061	$41,386	$41,386
TMK: 2-1-13: 001	1	1,071	$41,785	$41,785
TMK: 2-1-13: 003	1	1,181	$46,072	$46,072
Makai Side:				
TMK: 2-1-08: 112*	4	3,688	$129,079	$32,270
TMK: 2-1-26: 073	1	2,014	$78,534	$78,534

Note:
* Indicates use of new rock wall on highway side of existing rock wall. For all other wall sections, use of CMU walls was assumed.

CHAPTER VII. CONSTRUCTION NOISE IMPACTS

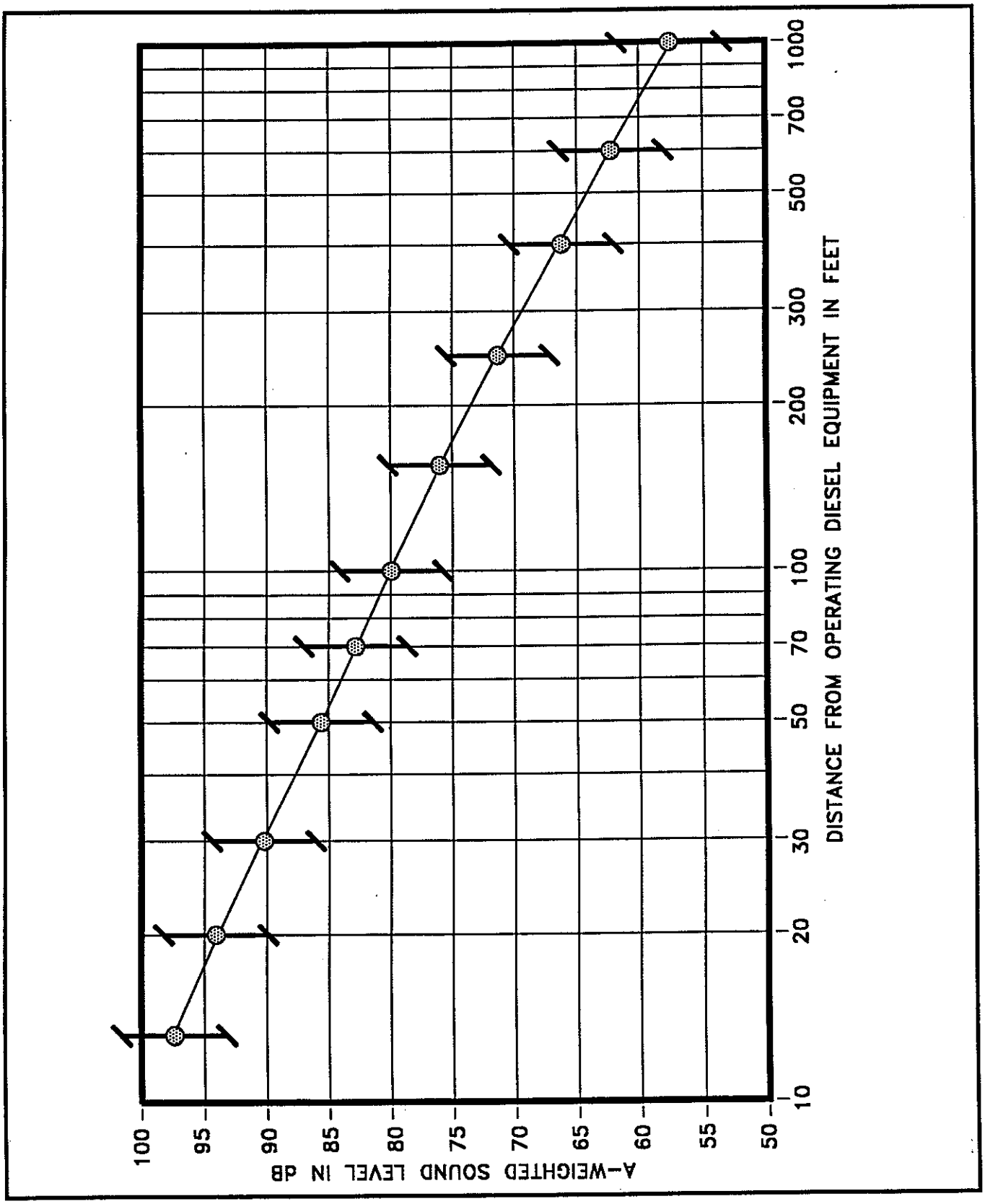
General Construction. Short-term noise impacts associated with construction activities along the existing highway may occur. These impacts can occur as a result of the short distances (less than 50 FT) between existing dwelling units to the anticipated construction corridor. The total duration of the construction period for the proposed project is not known, but noise exposure from construction activities at any one receptor location is not expected to be continuous during the total construction period.

Noise levels of diesel powered construction equipment typically range from 80 to 90 dB at 50 FT distance. Typical levels of noise from construction activity (excluding pile driving activity) are shown in Figure 3. The maximum impulsive noise levels of rock breaking equipment (such as hoe rams) can be 5 to 8 dB greater than those shown in Figure 3. Adverse impacts from construction noise are not expected to be in the "public health and welfare" category due to the temporary nature of the work and due to the administrative controls available for its regulation. Instead, these impacts will probably be limited to the temporary degradation of the quality of the acoustic environment in the immediate vicinity of the project site.

Construction noise levels at existing structures can intermittently exceed 90 dB when work is being performed at close distances in front of these structures. Along the roadway improvement project, distances between the construction sites and receptors are expected to be between 30 and 200 FT, and construction noise levels may intermittently exceed 90 dB. The State Department of Health currently regulates noise from construction activities under a permit system (Reference 6). Under current permit procedures (see Figure 4), noisy construction activities are restricted to hours between 7:00 AM and 6:00 PM, from Monday through Friday, and exclude certain holidays. Noisy construction activities are normally restricted to the hours of 9:00 AM to 6:00 PM on Saturdays, with construction not permitted on Sundays. These restrictions minimize construction noise impacts on noise sensitive receptors along the roadway project corridor, and have generally been successfully applied. In this way, construction noise impacts on noise sensitive receptors can be minimized.

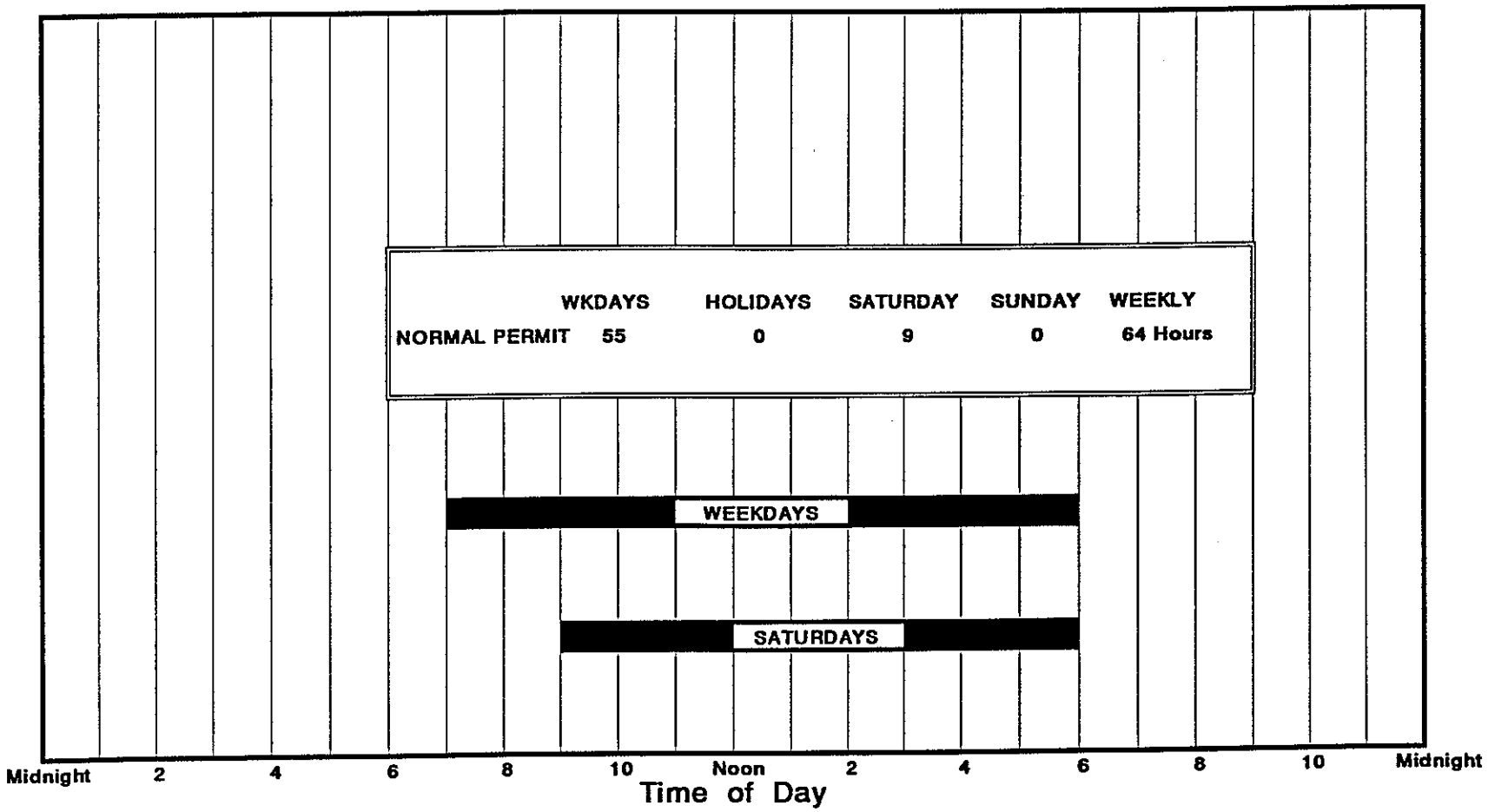
In addition, the use of quieted portable engine generators and diesel equipment should be specified for use within 500 FT of noise sensitive properties. Heavy truck and equipment staging areas should also be located at areas which are at least 500 FT from noise sensitive properties whenever possible. Truck routes which avoid residential communities should be identified wherever possible. The use of 8 to 12 FT high construction noise barriers may also be used where close-in construction work to noise sensitive structures is unavoidable.

Blasting. Blasting may be used to fragment and/or dislodge rock during the construction operations to reduce the time required to cut into the faces of the existing highway cuts. Nighttime or early morning blasting operations should not be required.



ANTICIPATED RANGE OF CONSTRUCTION NOISE LEVELS VS. DISTANCE

FIGURE 3



AVAILABLE WORK HOURS UNDER DOH PERMIT PROCEDURES FOR CONSTRUCTION NOISE

FIGURE 4

Blast induced ground and air vibrations have the potential to startle or annoy surrounding residents, and to also cause damage to structures. However, when properly controlled, blasting operations at the proposed construction site need not pose significant risks of damage or annoyance to neighboring buildings or residents.

Airborne Noise from Blasting. The air blasts associated with blasting are concussion type, low frequency vibrations, which are of relatively short duration (or impulsive) and generally described in terms of peak over pressure in psi, or in dBL. The dominant sources of the air blast are the Air Pressure Pulse, which is caused by the large displacement of the ground surface near the charge, and the Stemming Release Pulse, which is caused by gas pressure ejecting the stemming (fill) material from the hole bored for the explosive charge. The low frequency characteristic (usually referred to as bass sounds) of air blast noise tends to induce vibrations in structures (and subsequent complaint reactions) due to the low resonant frequency (10 to 25 Hz) of buildings. High frequency sounds of amplitudes equal to blast noise generally do not induce vibrations and cause physical damage to structures. Although the human ear has an opposite characteristic (i.e., the ear is less sensitive to low frequency sounds), structures which vibrate can produce secondary audible effects such as rattling sounds (of fixtures, doors, etc.), and effects which are sensitive to touch (or feelable). Sound levels at which these secondary effects occur vary with the weight (and probably stiffness) of the structure. In general, the inception point of sound induced vibration is difficult to establish, but may occur at levels as low as 80 dBL. These levels are significantly below the peak levels of 120 to 136 dBL which have been associated with low risk of damage to structures.

If blasting is used to break or dislodge rock, the charge weights per delay will be adjusted so as to eliminate any risk of damage to nearby structures. The levels of air blast are anticipated to be well below the structural damage criteria for buildings, so risks of window glass breakage from the blasting at the proposed project are considered to be very low. Since complaints resulting from air blast noise levels may occur at levels considerably below those necessary to cause damage to structures (120 to 136 dBL), additional analyses were conducted to estimate the percent of the neighboring population which may be highly annoyed by blasting operations. At air blast noise levels of 120 dBL, and with no more than five blasts per week, the average noise exposure levels from blasting operations are predicted to be 41 Lcdn, which is analogous to 41 Ldn except for the use of C-Weighting rather than A-Weighting filters. An exposure level of 41 Lcdn (or 41 Ldn) is very low, and less than 1.0 percent of the population exposed to this level are expected to be highly annoyed (see Reference 7). For these reasons, risks of adverse noise impacts from blasting operations of up to five blasts per week which are also controlled to avoid risks of damage to structures are considered to be very low.

Ground Vibration from Blasting. Ground vibrations, or seismic waves, are also generated during blasting operations, and are generally described in terms of peak particle velocity in inches/ second. Most of the seismic energy remains trapped in the ground, but some energy is released as an over pressure pulse into the air (or Rock

Pressure Pulse). In general, the ground vibrations as well as the airborne Rock Pressure Pulse are expected to be less intrusive than the Air Pressure and Stemming Release Pulses. As an example, tunneling work under Dole Street on Oahu for a sewer project generated some initial air blast complaints from nearby residents during blasting of the surface entrance to the tunnel. However, once the entrance to the tunnel was formed and blasting was confined to tunneling underground, complaints stopped.

Predictions of peak over pressure or ground vibration levels vs. scaled distance from the blast are not precise, with initial uncertainties for a given location in the order of 20 to 30 dBL. For this reason, it is standard practice to employ seismograph monitoring of air and ground vibrations during blasting operations with a 3-axis geophone (for ground vibrations) and a microphone (for air vibrations).

The separation distances between the potential blasting areas and surrounding noise sensitive neighbors range are typically very small and range from less than 500 feet to less than 100 feet. At these small separation distances between the blast areas and surrounding noise sensitive neighbors, charge weights will probably be limited to less than one pound of explosives per delay. At one pound of explosives per delay, the predicted vibration levels at 125 feet separation distance are in the order of 0.070 to 0.40 inches per second. These predicted levels of ground vibration are encroaching into the thresholds for structural or architectural damage to buildings, and may be feelable (see TABLE 10). In addition, these levels are also encroaching into the 0.35 inches per second threshold recommended to minimize adverse human responses to vibrations resulting from sporadic impulsive shock excitations (see Reference 8). Based on these predictions of vibration levels from blasting operations, it was concluded that risks of adverse impacts from ground vibrations can be very low, but the sizes of the charge weights per delay may need to be kept at relatively small values in order to minimize risks of damage to nearby structures.

Mitigation of Noise and Vibration Impacts from Blasting. Because blasts may be both feelable and audible in the surrounding communities, mitigation measures will probably be required to minimize risks of antagonizing nearby residents. These recommended mitigation measures are described as follows:

- Regularly monitor air blast and ground vibration levels simultaneously at the closest noise sensitive residence(s) or structure(s) during the blasting operations to develop the data base for the surrounding area.

- For initial blasts, prior to establishment of a data base of ground vibration and air blast levels vs. scaled distance, use the minimum practical charge weight (in equivalent pounds of TNT) per delay as well as the minimum practical number of delays (or bore holes).

- If practical, reduce maximum air blast levels to less than 110 dBL at the nearest noise sensitive residences in response to air blast complaints. Possible methods

TABLE 10

SUMMARY OF BUILDING DAMAGE CRITERIA

PEAK GROUND VELOCITY (mm/sec)	PEAK GROUND VELOCITY (in/sec)	COMMENT
193.04	7.6	Major damage to buildings (mean of data).
137.72	5.4	Minor damage to buildings (mean of data).
101.16	4.0	'Engineer structures' safe from damage.
50.8	2.0	Safe from damage limit (probability of damage <5%).
		No structural damage.
33.02	1.3	Threshold of risk of 'architectural' damage for houses.
25.4	1.0	No data showing damage to structures for vibration <1 in./sec.
15.24	0.6	No risk of 'architectural' damage to normal buildings.
10.16	0.4	Threshold of damage in older homes.
5.08	0.2	Statistically significant percentage of structures may experience minor damage (including earthquake, nuclear event, and blast data for old and new structures).
		No 'architectural' damage.
3.81	0.5 to 0.15	Upper limits for ruins and ancient monuments.
1.0	0.04	Vertical vibration clearly perceptible to humans.
0.32	0.01	Vertical vibration just perceptible to humans.

Source: 'State-of-the-Art Review: Prediction and Control of Groundborne Noise and Vibration from Rail Transit Trains'; U.S. Department of Transportation; December 1983.

of accomplishing this are: reducing charge sizes; increasing delay intervals; increasing hole depth; orienting bore holes to direct the Stemming Release Pulse away from noise sensitive properties; trucking in high quality stemming material to minimize stemming blowouts; and filling (sandbagging) over the area to be blasted and the detonating chord.

- Schedule actual blasting during the warm periods of the day to minimize the possibility of thermal ducting and focusing of air blast noise at large distances from the blast. If possible, also schedule blasting during fixed time periods, so that the members of the community can also schedule their activities accordingly.

- The most conservative vibration criteria for damage to "Ruins and Ancient Monuments" (see TABLE 10) is 0.15 inches per second. Initial test shots should be structured so as to not exceed this limit at the closest structures, with subsequent shots adjusted to reflect the results of the blast monitoring data.

APPENDIX A. REFERENCES

(1) "FHWA Highway Traffic Noise Model User's Guide;" FHWA-PD-96-009, Federal Highway Administration; Washington, D.C.; January 1998 and Version 2.5 Upgrade (April 14, 2004).

(2) Traffic Impact Analysis Report, Piilani Highway Widening; Austin, Tsutsumi & Associates, Inc.; July 21, 2009.

(3) 2022 Traffic Turning Movements without the Highway Widening Project; Austin, Tsutsumi & Associates, Inc.; August 4, 2009.

(4) Federal Highway Administration; "Procedures for Abatement of Highway Traffic Noise and Construction Noise;" 23 CFR Chapter I, Subchapter H, Part 772;" April 1, 1995.

(5) "Noise Analysis and Abatement Policy;" Hawaii State Department of Transportation, Highways Division, Materials Testing and Research Branch; June 1997.

(6) "Title 11, Administrative Rules, Chapter 46, Community Noise Control;" Hawaii State Department of Health; September 23, 1996.

(7) "Method for Assessment of High-Energy Impulsive Sounds with Respect to Residential Communities;" American National Standard, ANSI S12.4; Acoustical Society of America.

(8) "Guide to the Evaluation of Human Exposure to Vibration in Buildings;" American National Standard, ANSI S2.71; Acoustical Society of America.

APPENDIX B

EXCERPTS FROM EPA'S ACOUSTIC TERMINOLOGY GUIDE

Descriptor Symbol Usage

The recommended symbols for the commonly used acoustic descriptors based on A-weighting are contained in Table I. As most acoustic criteria and standards used by EPA are derived from the A-weighted sound level, almost all descriptor symbol usage guidance is contained in Table I.

Since acoustic nomenclature includes weighting networks other than "A" and measurements other than pressure, an expansion of Table I was developed (Table II). The group adopted the ANSI descriptor-symbol scheme which is structured into three stages. The first stage indicates that the descriptor is a level (i.e., based upon the logarithm of a ratio), the second stage indicates the type of quantity (power, pressure, or sound exposure), and the third stage indicates the weighting network (A, B, C, D, E.....). If no weighting network is specified, "A" weighting is understood. Exceptions are the A-weighted sound level and the A-weighted peak sound level which require that the "A" be specified. For convenience in those situations in which an A-weighted descriptor is being compared to that of another weighting, the alternative column in Table II permits the inclusion of the "A". For example, a report on blast noise might wish to contrast the LCdn with the LAdn.

Although not included in the tables, it is also recommended that "Lpn" and "LepN" be used as symbols for perceived noise levels and effective perceived noise levels, respectively.

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:

The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured LA values were 85 and 75 dB respectively.

Descriptor Nomenclature

With regard to energy averaging over time, the term "average" should be discouraged in favor of the term "equivalent". Hence, Leq, is designated the "equivalent sound level". For Ld, Ln, and Ldn, "equivalent" need not be stated since the concept of day, night, or day-night averaging is by definition understood. Therefore, the designations are "day sound level", "night sound level", and "day-night sound level", respectively.

The peak sound level is the logarithmic ratio of peak sound pressure to a reference pressure and not the maximum root mean square pressure. While the latter is the maximum sound pressure level, it is often incorrectly labelled peak. In that sound level meters have "peak" settings, this distinction is most important.

"Background ambient" should be used in lieu of "background", "ambient", "residual", or "indigenous" to describe the level characteristics of the general background noise due to the contribution of many unidentifiable noise sources near and far.

With regard to units, it is recommended that the unit decibel (abbreviated dB) be used without modification. Hence, DBA, PNdB, and EPNdB are not to be used. Examples of this preferred usage are: the Perceived Noise Level (Lpn was found to be 75 dB. Lpn = 75 dB). This decision was based upon the recommendation of the National Bureau of Standards, and the policies of ANSI and the Acoustical Society of America, all of which disallow any modification of bel except for prefixes indicating its multiples or submultiples (e.g., deci).

Noise Impact

In discussing noise impact, it is recommended that "Level Weighted Population" (LWP) replace "Equivalent Noise Impact" (ENI). The term "Relative Change of Impact" (RCI) shall be used for comparing the relative differences in LWP between two alternatives.

Further, when appropriate, "Noise Impact Index" (NII) and "Population Weighed Loss of Hearing" (PHL) shall be used consistent with CHABA Working Group 69 Report Guidelines for Preparing Environmental Impact Statements (1977).

APPENDIX B (CONTINUED)

TABLE I

A-WEIGHTED RECOMMENDED DESCRIPTOR LIST

	TERM	SYMBOL
1.	A-Weighted Sound Level	L_A
2.	A-Weighted Sound Power Level	L_{WA}
3.	Maximum A-Weighted Sound Level	L_{max}
4.	Peak A-Weighted Sound Level	L_{Apk}
5.	Level Exceeded x% of the Time	L_x
6.	Equivalent Sound Level	L_{eq}
7.	Equivalent Sound Level over Time (T) (1)	$L_{eq(T)}$
8.	Day Sound Level	L_d
9.	Night Sound Level	L_n
10.	Day-Night Sound Level	L_{dn}
11.	Yearly Day-Night Sound Level	$L_{dn(Y)}$
12.	Sound Exposure Level	L_{SE}

(1) Unless otherwise specified, time is in hours (e.g. the hourly equivalent level is $L_{eq(1)}$). Time may be specified in non-quantitative terms (e.g., could be specified a $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine).

SOURCE: EPA ACOUSTIC TERMINOLOGY GUIDE, BNA 8-14-78,

APPENDIX B (CONTINUED)

TABLE II

RECOMMENDED DESCRIPTOR LIST

TERM	A-WEIGHTING	ALTERNATIVE[1] A-WEIGHTING	OTHER[2] WEIGHTING	UNWEIGHTED
1. Sound (Pressure)[3] Level	L_A	L_{pA}	L_B, L_{pB}	L_p
2. Sound Power Level	L_{WA}		L_{WB}	L_W
3. Max. Sound Level	L_{max}	L_{Amax}	L_{Bmax}	L_{pmax}
4. Peak Sound (Pressure) Level	L_{Apk}		L_{Bpk}	L_{pk}
5. Level Exceeded x% of the Time	L_x	L_{Ax}	L_{Bx}	L_{px}
6. Equivalent Sound Level	L_{eq}	L_{Aeq}	L_{Beq}	L_{peq}
7. Equivalent Sound Level Over Time(T) [4]	$L_{eq(T)}$	$L_{Aeq(T)}$	$L_{Beq(T)}$	$L_{peq(T)}$
8. Day Sound Level	L_d	L_{Ad}	L_{Bd}	L_{pd}
9. Night Sound Level	L_n	L_{An}	L_{Bn}	L_{pn}
10. Day-Night Sound Level	L_{dn}	L_{Adn}	L_{Bdn}	L_{pdn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$	$L_{Adn(Y)}$	$L_{Bdn(Y)}$	$L_{pdn(Y)}$
12. Sound Exposure Level	L_S	L_{SA}	L_{SB}	L_{Sp}
13. Energy Average Value Over (Non-Time Domain) Set of Observations	$L_{eq(e)}$	$L_{Aeq(e)}$	$L_{Beq(e)}$	$L_{peq(e)}$
14. Level Exceeded x% of the Total Set of (Non-Time Domain) Observations	$L_{x(e)}$	$L_{Ax(e)}$	$L_{Bx(e)}$	$L_{px(e)}$
15. Average L_x Value	L_x	L_{Ax}	L_{Bx}	L_{px}

(1) "Alternative" symbols may be used to assure clarity or consistency.

(2) Only B-weighting shown. Applies also to C,D,E,.....weighting.

(3) The term "pressure" is used only for the unweighted level.

(4) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is Leq(1). Time may be specified in non-quantitative terms (e.g., could be specified as Leq(WASH) to mean the washing cycle noise for a washing machine.

APPENDIX C

SUMMARY OF BASE YEAR AND FUTURE YEAR TRAFFIC VOLUMES ALONG PIILANI HIGHWAY

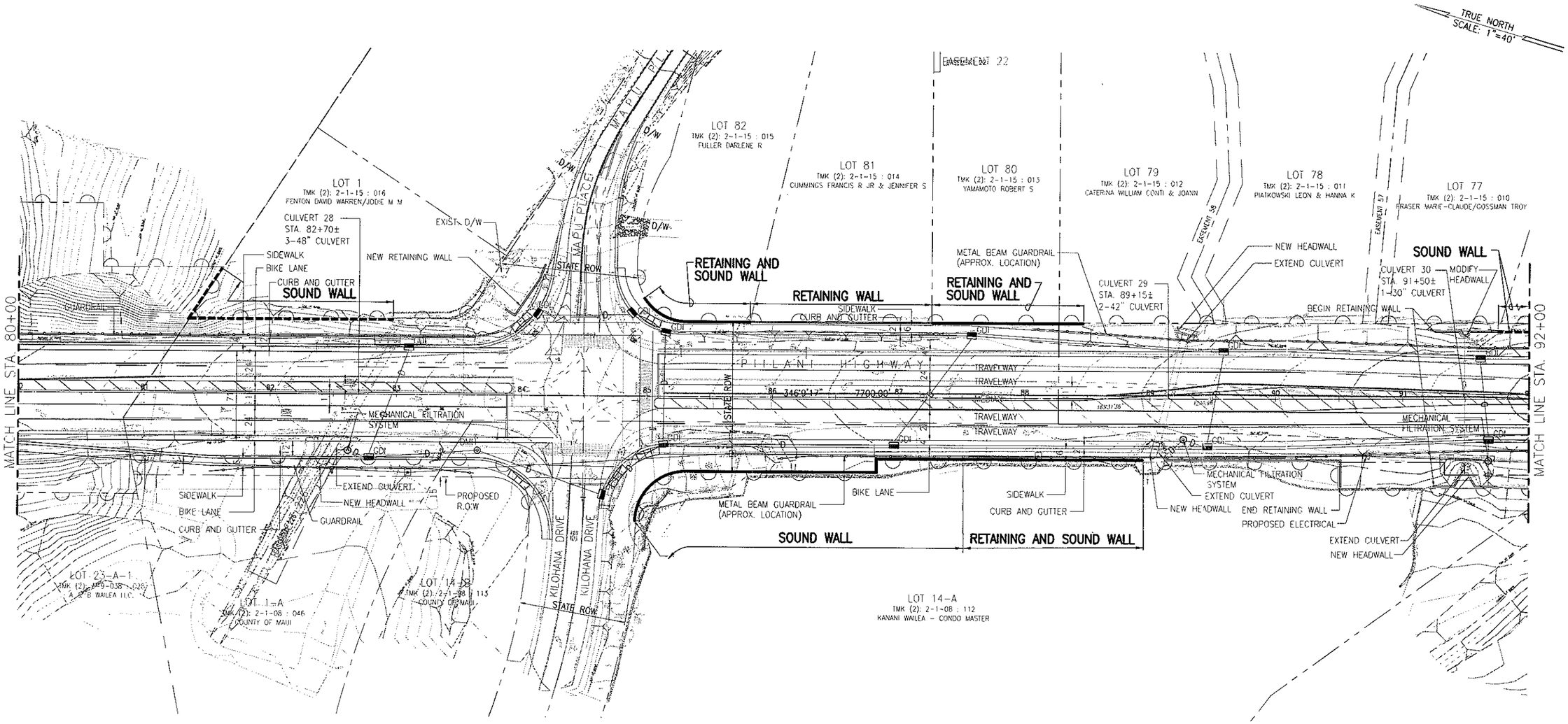
ROADWAY LANES	**** CY 2008 *****		CY 2022 (NO BUILD)		CY 2022 (BUILD)	
	AM VPH	PM VPH	AM VPH	PM VPH	AM VPH	PM VPH
North of Kilohana Street (NB)	502	1,043	1,020	1,760	1,410	2,280
North of Kilohana Street (SB)	941	837	1,550	1,515	1,910	2,055
Two-Way	1,443	1,880	2,570	3,275	3,320	4,335
South of Kilohana Street (NB)	296	821	710	1,480	1,100	2,000
South of Kilohana Street (SB)	798	572	1,370	1,145	1,775	1,685
Two-Way	1,094	1,393	2,080	2,625	2,875	3,685
North of Okolani Drive (NB)	290	770	705	1,425	1,095	1,945
North of Okolani Drive (SB)	759	549	1,330	1,125	1,690	1,665
Two-Way	1,049	1,319	2,035	2,550	2,785	3,610
South of Okolani Drive (NB)	214	711	475	1,205	865	1,725
South of Okolani Drive (SB)	723	461	1,220	815	1,580	1,355
Two-Way	937	1,172	1,695	2,020	2,445	3,080
North of Wailea Ike Drive (NB)	217	752	530	1,380	930	1,910
North of Wailea Ike Drive (SB)	723	461	1,300	875	1,670	1,425
Two-Way	940	1,213	1,830	2,255	2,600	3,335
South of Wailea Ike Drive (NB)	N/A	N/A	N/A	N/A	130	125
South of Wailea Ike Drive (SB)	N/A	N/A	N/A	N/A	85	155
Two-Way	N/A	N/A	N/A	N/A	215	280

NOTES:

1. "No Build" Represents Conditions without Honua`ula Project and without Additional Makena Resort Projects.
2. "Build" Represents Conditions with Honua`ula Project Plus Additional Makena Resort Projects.

APPENDIX F-1.

Sound Wall Analysis



PLAN – STA. 80+00 TO STA. 92+00
SCALE: 1"=40'

LEGEND

SOUND WALL MEETS HDOT CRITERIA

SOUND WALL DOES NOT MEET HDOT CRITERIA

0 1 2
LINE IS 2 INCHES AT FULL SIZE
(If NOT 2-inches , Scale Accordingly)

EXHIBIT 1

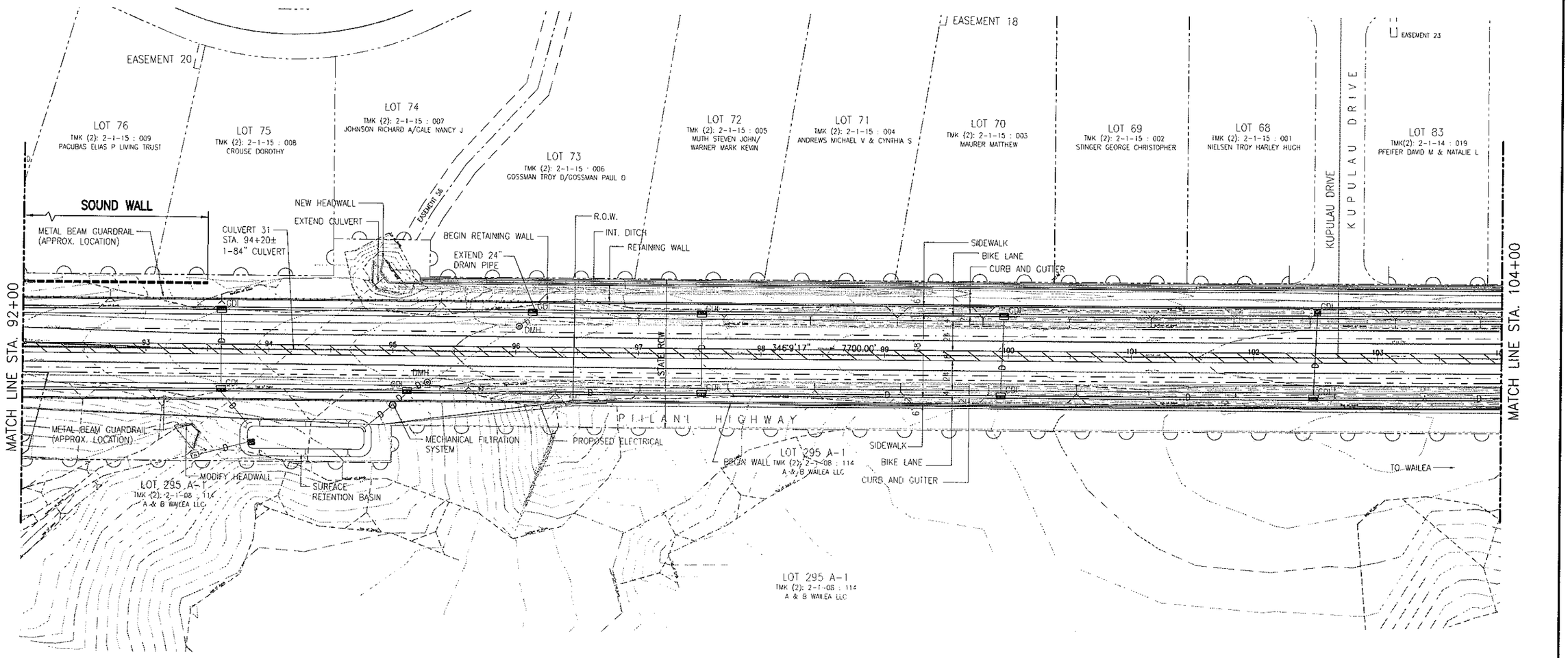
PIILANI HIGHWAY WIDENING
KILOHANA DRIVE TO WAILEA IKE DRIVE

SOUND WALL SITE PLAN
FROM STA. 80+00 TO STA. 92+00

DATE: JULY 29, 2010

JOB NO. 08-516

TRUE NORTH
SCALE: 1"=40'



PLAN – STA. 92+00 TO STA. 104+00

SCALE: 1"=40'

LEGEND

SOUND WALL MEETS HDOT CRITERIA

SOUND WALL DOES NOT MEET HDOT CRITERIA

0 1 2
LINE IS 2 INCHES AT FULL SIZE
(If NOT 2-inches ; Scale Accordingly)

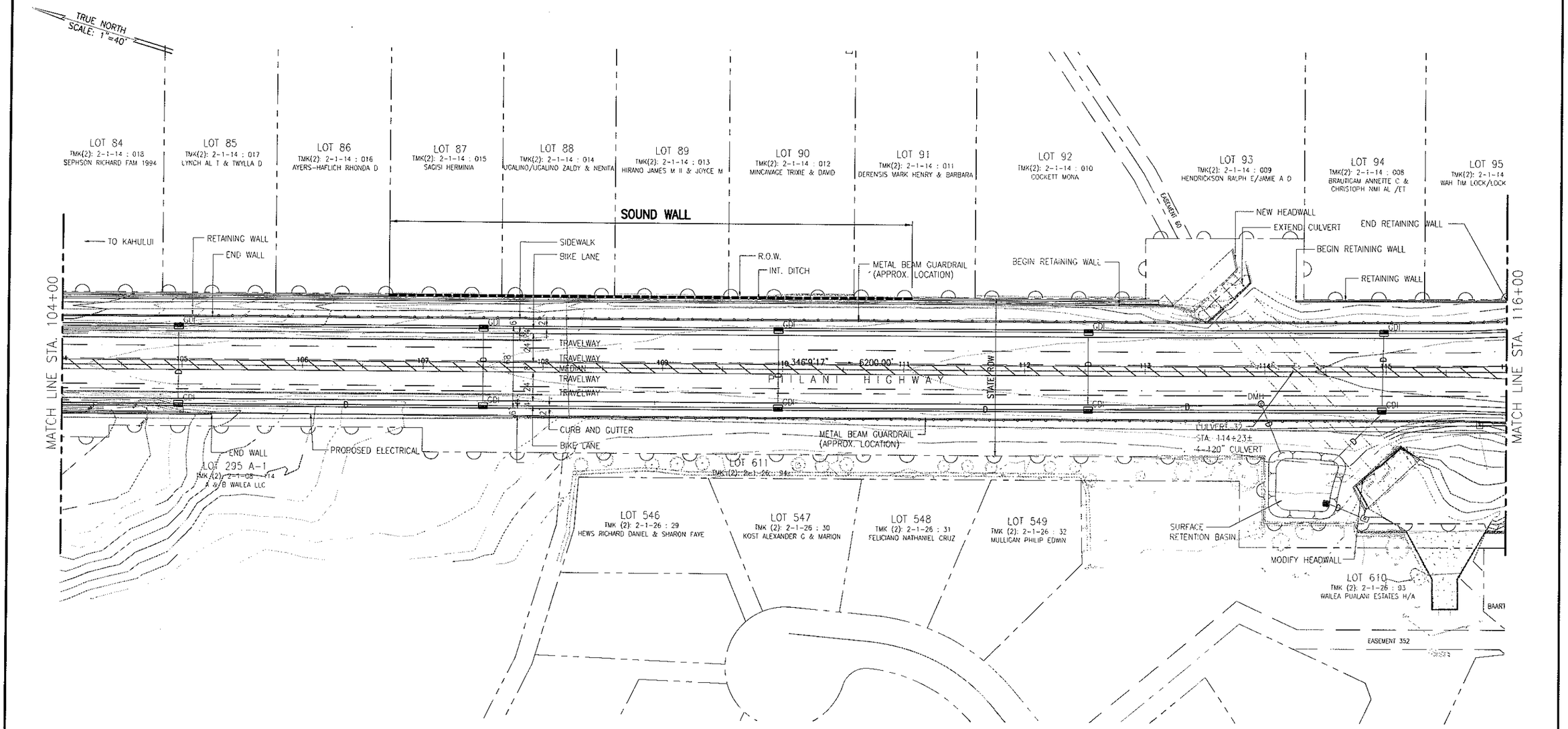
EXHIBIT 2

PIILANI HIGHWAY WIDENING
KILOHANA DRIVE TO WAILEA IKE DRIVE

**SOUND WALL SITE PLAN
FROM STA. 92+00 TO STA. 104+00**

DATE: JULY 29, 2010

JOB NO. 08-516



PLAN – STA. 104+00 TO STA. 116+00

SCALE: 1"=40'

LEGEND

SOUND WALL MEETS HDOT CRITERIA

SOUND WALL DOES NOT MEET HDOT CRITERIA

0 1 2

LINE IS 2 INCHES AT FULL SIZE
(If NOT 2-inches : Scale Accordingly)

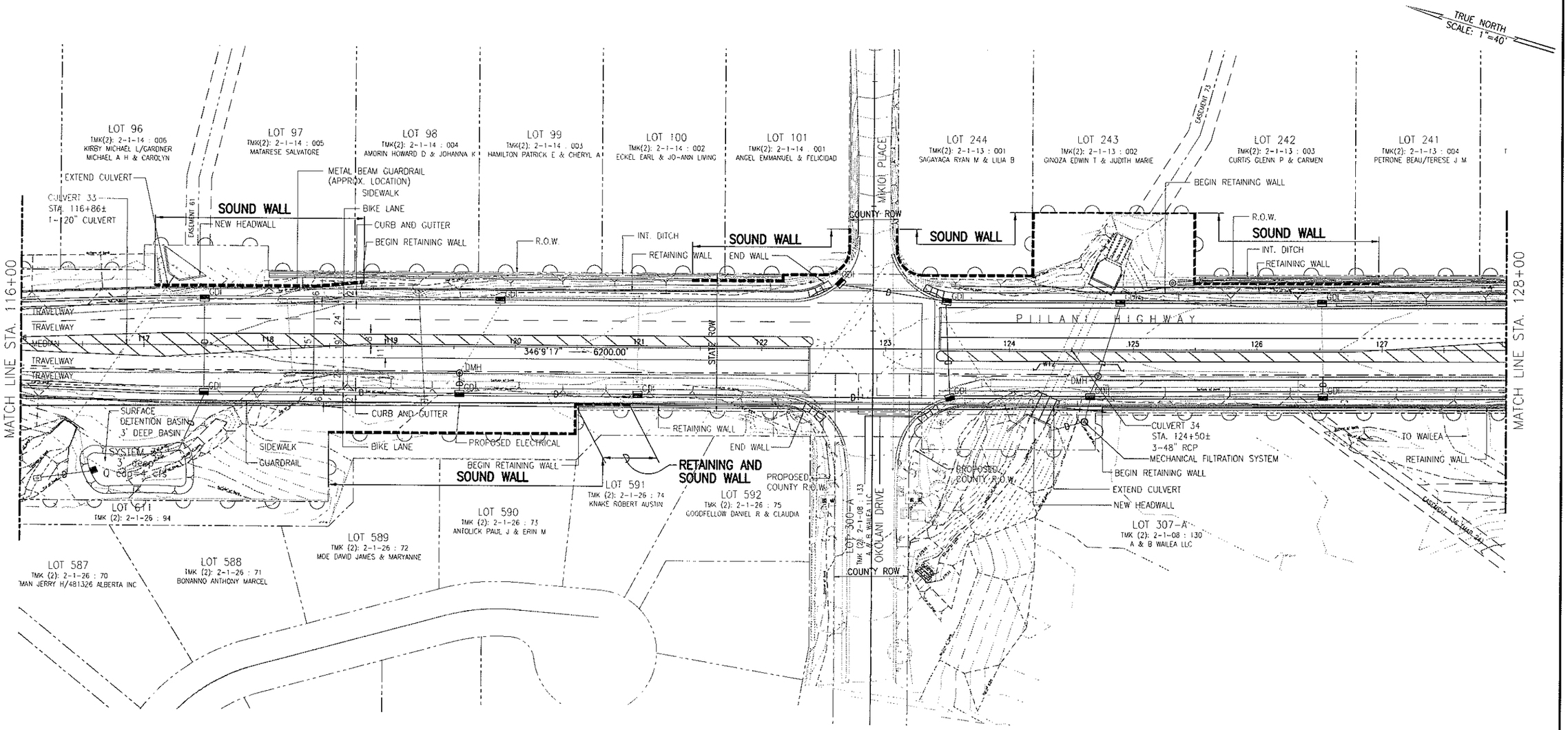
EXHIBIT 3

PIILANI HIGHWAY WIDENING
KILOHANA DRIVE TO WAILEA IKE DRIVE

SOUND WALL SITE PLAN FROM STA. 104+00 TO STA. 116+00

DATE: JULY 29, 2010

JOB NO. 08-516



PLAN – STA. 116+00 TO STA. 128+00

SCALE: 1"=40'

LEGEND

SOUND WALL MEETS HDOT CRITERIA

SOUND WALL DOES NOT MEET HDOT CRITERIA

0 1 2
LINE IS 2 INCHES AT FULL SIZE
(IF NOT 2-inches : Scale Accordingly)

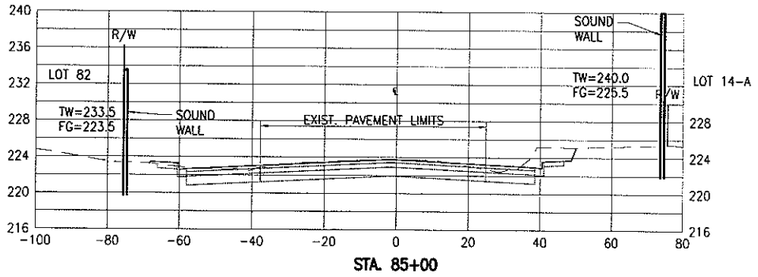
EXHIBIT 4

PIILANI HIGHWAY WIDENING
KILOHANA DRIVE TO WAILEA IKE DRIVE

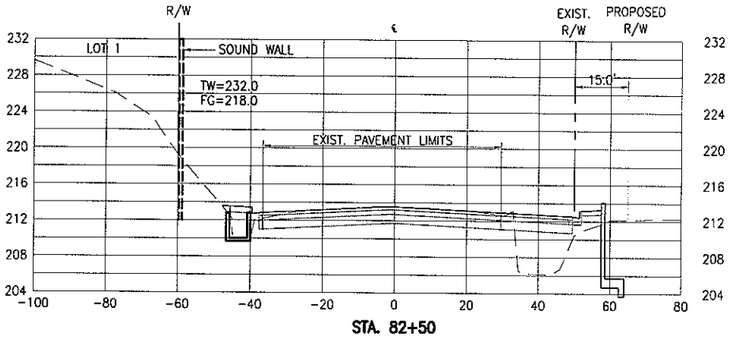
SOUND WALL SITE PLAN
FROM STA. 116+00 TO STA. 128+00

DATE: JULY 29, 2010

JOB NO. 08-516



STA. 85+00



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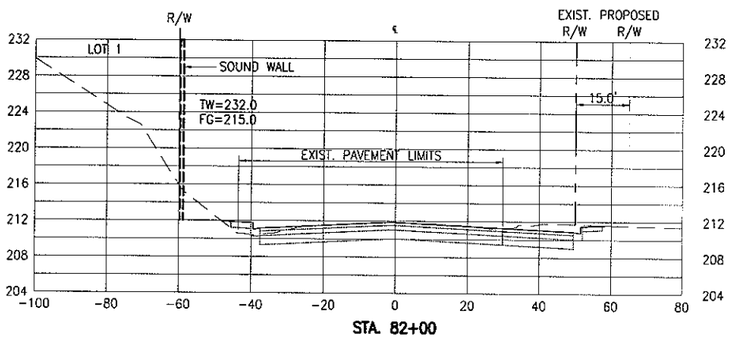
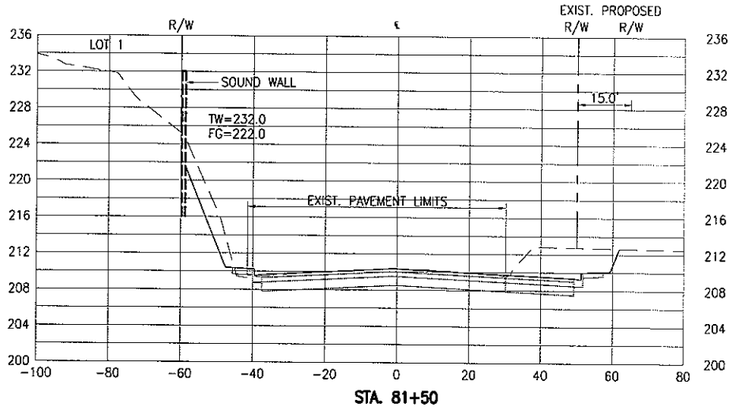


STA. 82+00



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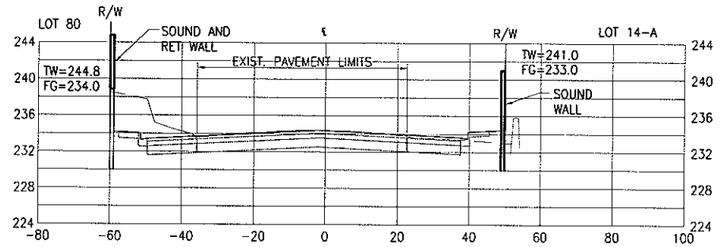
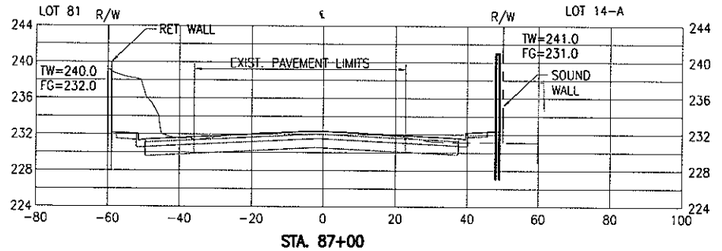
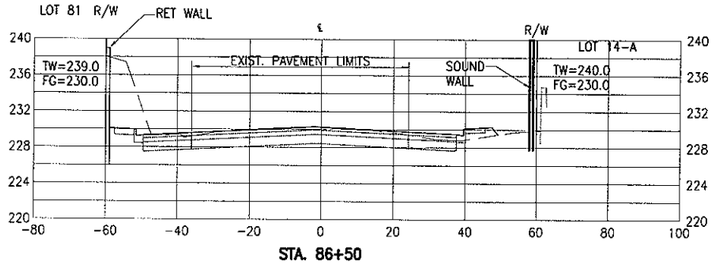


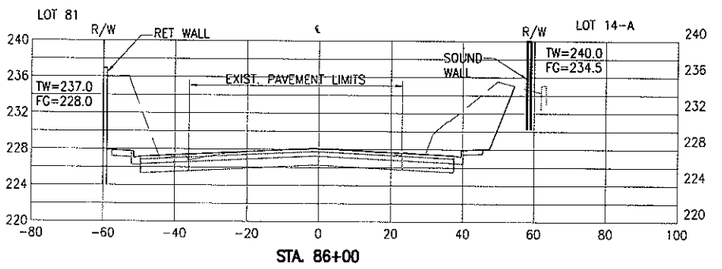
STA. 87+50



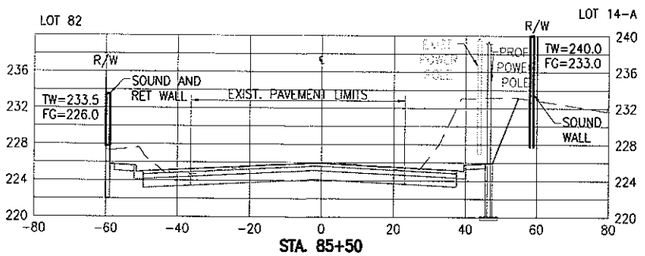
STA. 87+00



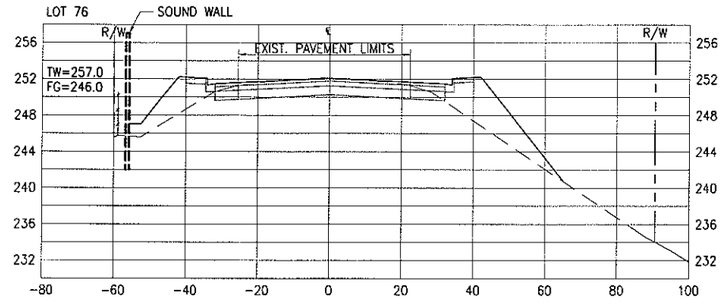
STA. 86+50



STA. 86+00



STA. 85+50



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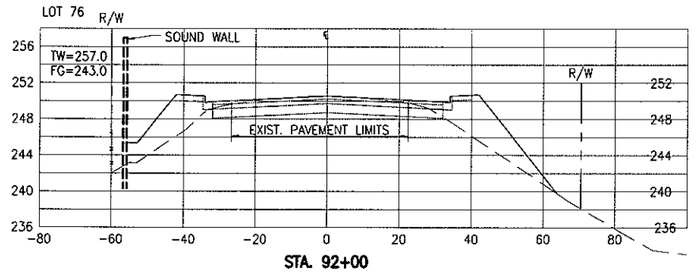
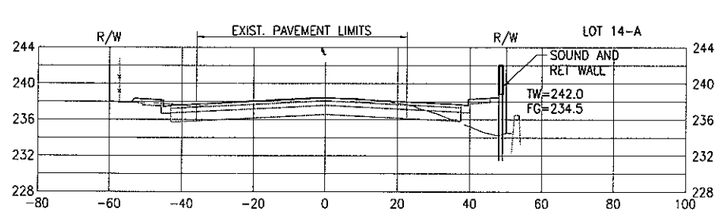
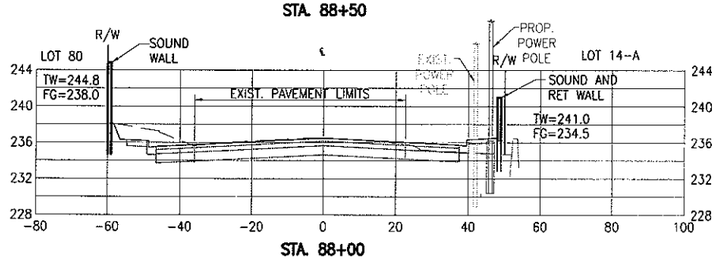


STA. 92+00



STA. 88+50



STA. 88+00

CROSS SECTIONS

SCALE: HORIZ. 1"=40'
VERT. 1"=16'

LEGEND

SOUND WALL MEETS HDOT CRITERIA

SOUND WALL DOES NOT MEET HDOT CRITERIA

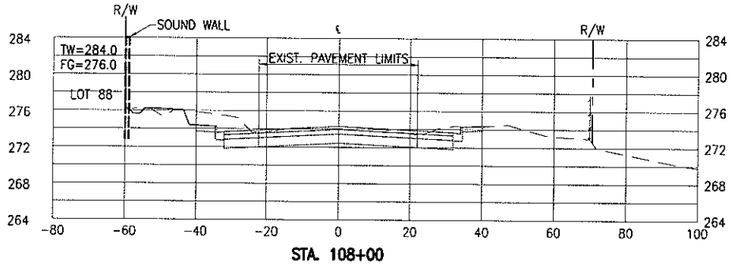
PIILANI HIGHWAY WIDENING
KILOHANA DRIVE TO WAILEA IKE DRIVE

0 1 2
LINE IS 2 INCHES AT FULL SIZE
(if NOT 2-inches : Scale Accordingly)

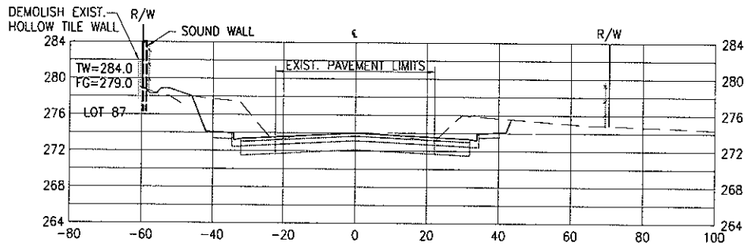
EXHIBIT 5

SOUND WALL CROSS SECTIONS 1

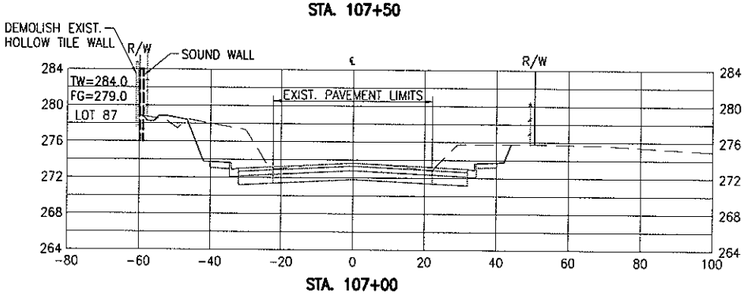
DATE: JULY 29, 2010



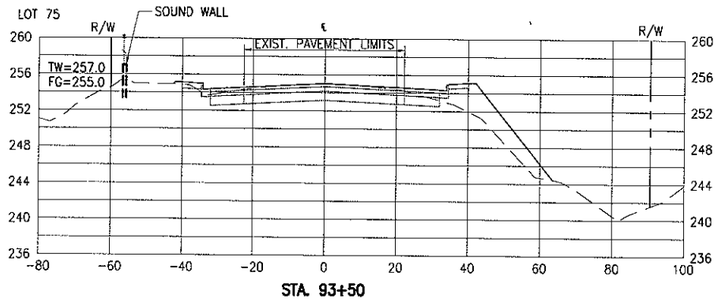
STA. 108+00



STA. 107+50



STA. 107+00



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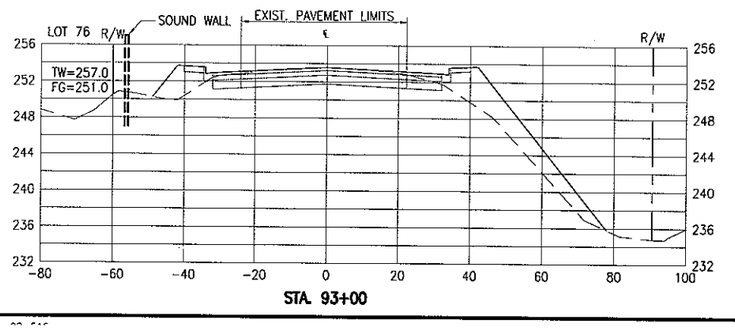
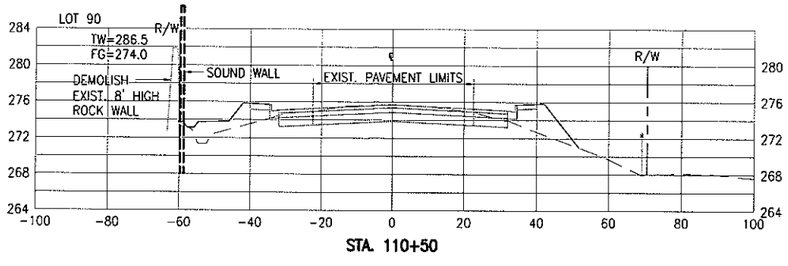


STA. 93+00



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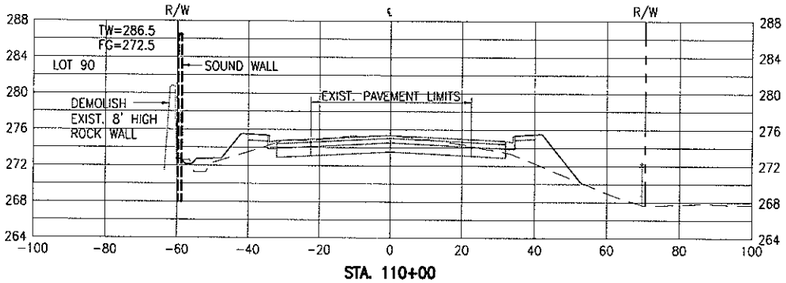

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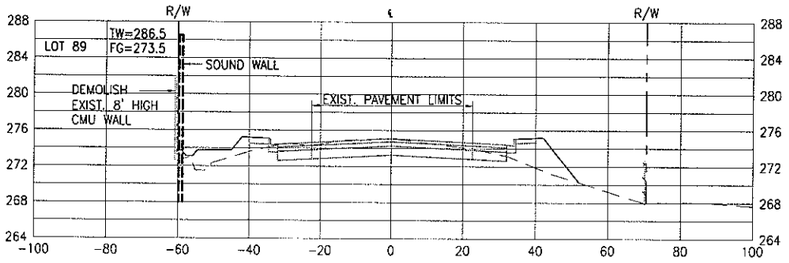

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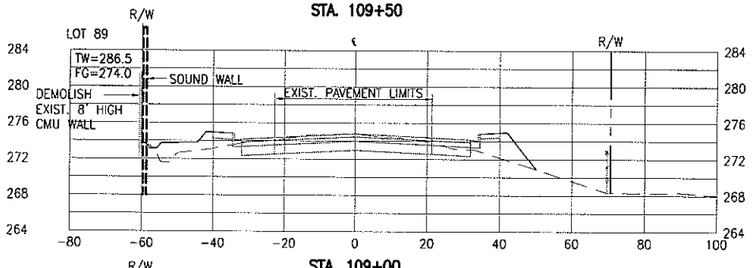

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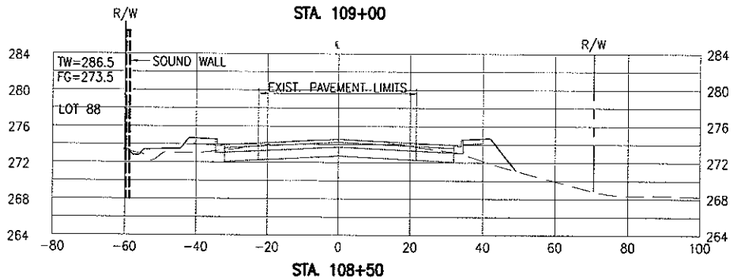

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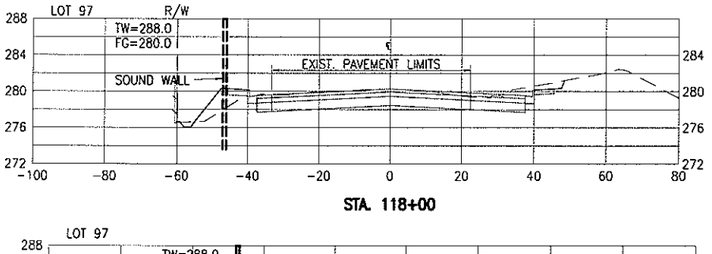
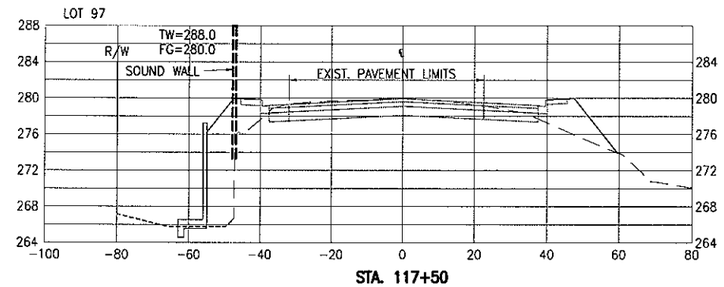
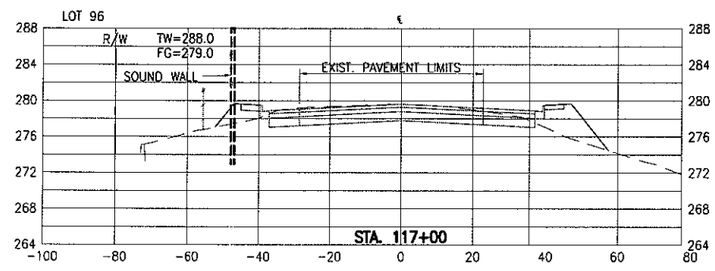


STA. 118+00



STA. 117+50



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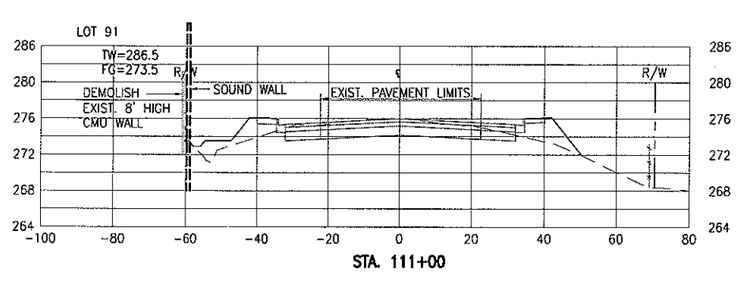


STA. 111+00

LEGEND

SOUND WALL MEETS HDOT CRITERIA

SOUND WALL DOES NOT MEET HDOT CRITERIA

CROSS SECTIONS

SCALE: HORIZ. 1"=40'
VERT. 1"=16'

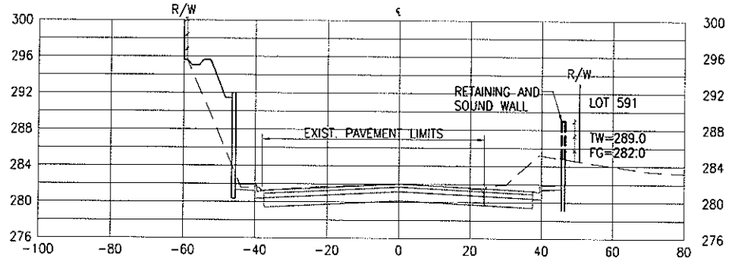
PIILANI HIGHWAY WIDENING
KILOHANA DRIVE TO WAILEA IKE DRIVE

SOUND WALL CROSS SECTIONS 2

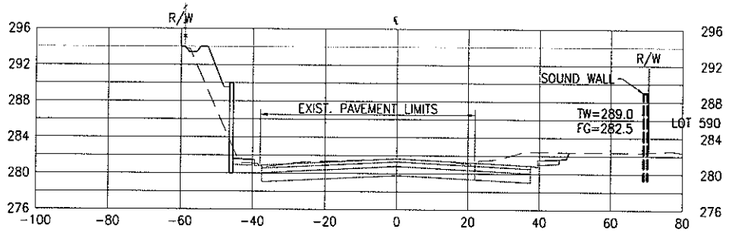
0 1 2
LINE IS 2 INCHES AT FULL SIZE
(if NOT 2-inches , Scale Accordingly)

EXHIBIT 6

DATE: JULY 29, 2010



STA. 120+50



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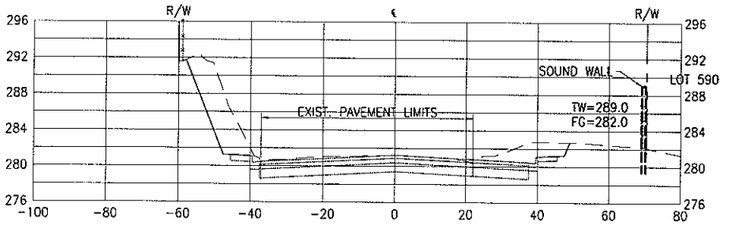

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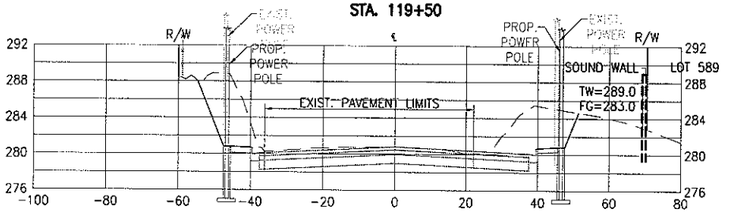

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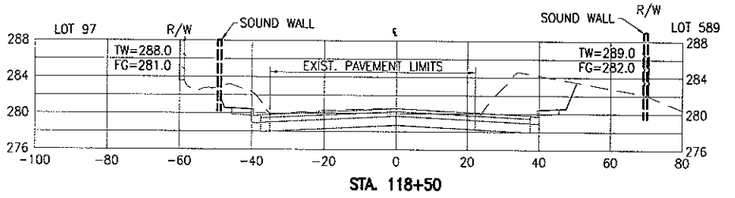

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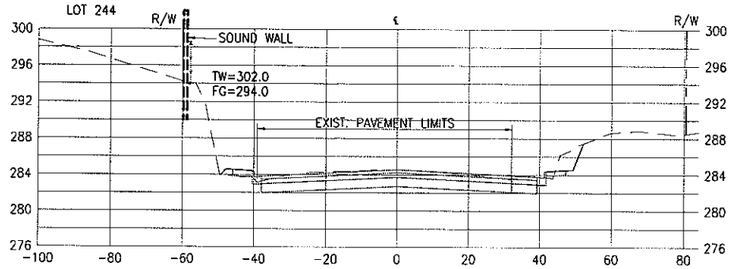

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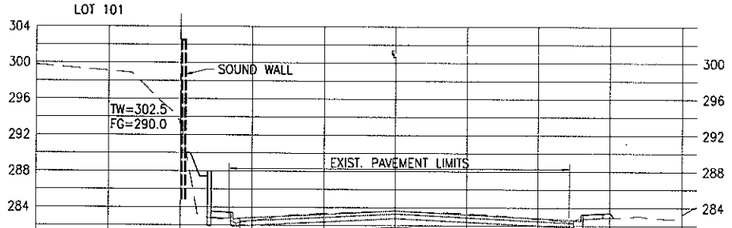

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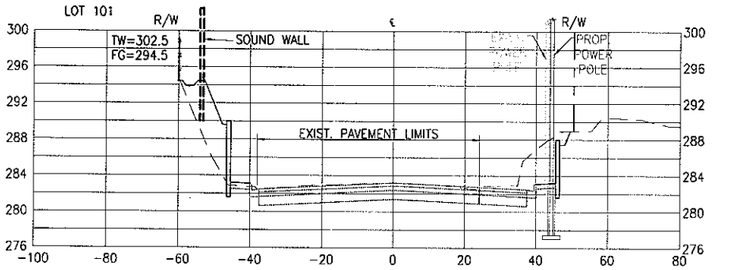

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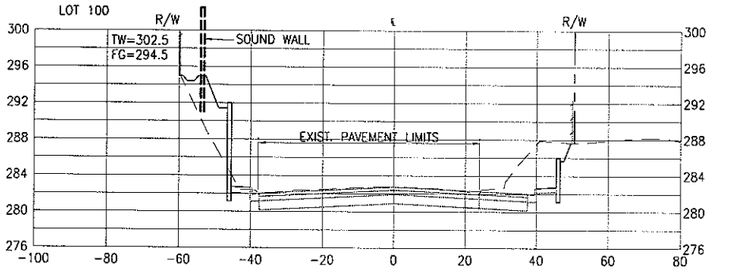
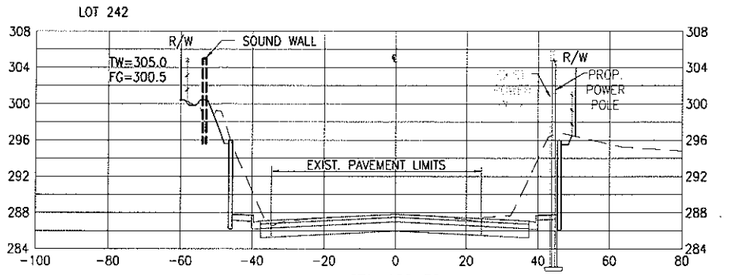


STA. 121+50



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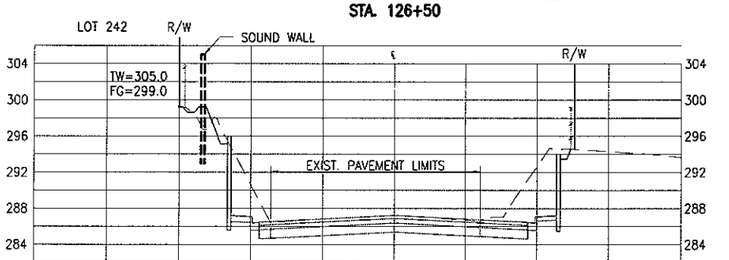

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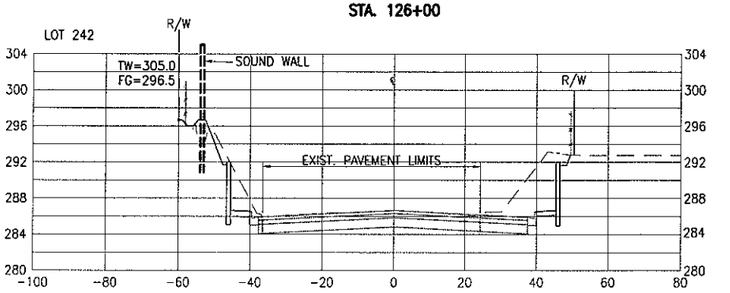

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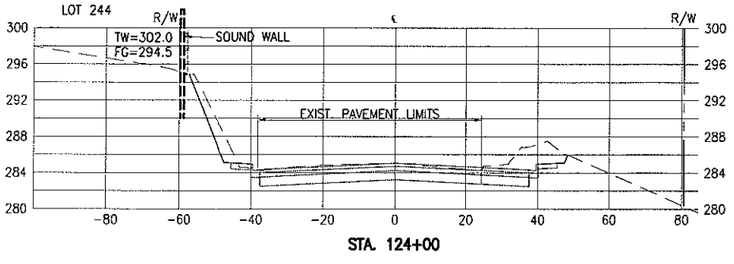

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LEGEND

SOUND WALL MEETS HDOT CRITERIA

SOUND WALL DOES NOT MEET HDOT CRITERIA

CROSS SECTIONS

SCALE: HORIZ. 1"=40'
VERT. 1"=16'

LINE IS 2 INCHES AT FULL SIZE
(IF NOT 2-inches : Scale Accordingly)

EXHIBIT 7

PIILANI HIGHWAY WIDENING
KILOHANA DRIVE TO WAILEA IKE DRIVE

SOUND WALL CROSS SECTIONS 3

DATE: JULY 29, 2010

APPENDIX G.

Department of Land and Natural Resources, State Historic Preservation Division Letter Dated July 16, 2009

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RUSSELL Y. TSUJI
FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

July 16, 2009

Mr. Mark Roy, Project Manager
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawai'i 96793
planning@mhplanning.com

LOG NO: 2009.0148
DOC NO: 0907PC30
Archaeology

SUBJECT: Chapter 6E-42 Historic Preservation Review – Early Consultation on the Pi'ilani Highway Widening to Four Lanes between Kilohana and Wailea Ike Drive Paeahu Ahupua'a, Makawao District, Island of Maui TMKs: (2) 2-1-008:046; (2) 2-1-008:113; (2) (2) 2-1-008:130; 2-1-008:131; (2) 2-1-008:999; (2) 2-1-014:999; (2) 2-1-015:999; (2) 2-1-026:094

Thank you for the opportunity to comment on the aforementioned project, correspondence for which we received on February 6 of 2009. Please accept our apologies for the lengthy delay in responding.

Based on the submitted document, the project involves widening improvements to the Pi'ilani Highway between Kilohana Drive and Wailea Iki Drive, as requested by the County of Maui in association with the rezoning application made by Honua'ula Partners, LLC. The proposed areas of effect are all within or immediately alongside an existing County roadway/road right-of-way. The proposed project is also located in an area where numerous isolated and clustered pre-Contact period human burials and other culturally significant deposits have been found. Given the above information, the most reasonable form of mitigation appears to be precautionary archaeological monitoring during all project related ground altering disturbance.

Therefore, upon review of any permit application associated with the proposed project forwarded to us by the County of Maui, we will likely recommend the following:

A qualified archaeological monitor shall be present during *those portions of the project which involve ground altering disturbance* in order to document any historic properties which may be encountered and to provide mitigation measures as necessary. *Please note that ground altering disturbance includes previously disturbed stratigraphy, as culturally significant subsurface deposits are often found in these contexts.*

As per Hawai'i Administrative Rules (HAR) §13-279, this means that prior to the commencement of ground altering disturbance associated with the proposed project, the project developer or developer's agent must submit an appropriately prepared *monitoring plan* to this office for review and acceptance. The plan must contain the following provisions:

1) Specify the kinds of historically or culturally significant sites or remains of sites anticipated and where in the construction area they are likely to be found;
2) Specify how such sites or remains of sites will be documented;
3) Specify how such sites or remains of sites will be treated;
4) Specify that the archaeologist (s) conducting the monitoring has (have) the authority to halt construction in the immediate area of the find in order to carry out the plan;
5) Specify that coordination between the archaeologist and construction crew has been scheduled so that all involved parties are aware of the plan and what it means;
6) Specify what laboratory work will be performed on any cultural sites or remains of sites that might be found in the project area;
7) Specify details concerning the archiving of any collections that are made;
8) Specify a schedule of report preparation and that the report will be submitted within the required 180 days after completion of the proposed undertaking.

A list of those meeting the requirements to perform such work can be obtained on the SHPD's website at http://hawaii.gov/dlnr/hpd/pdfs/2009-Permittee.pdf or by contacting our main office at (808) 692-8015.

If you have any questions or comments regarding this letter, please contact the SHPD's Lead Maui Archaeologist, Ms. Patty Conte (Patty.J.Conte@hawaii.gov).

Aloha,

Nancy A. McMahon

Nancy McMahon, Deputy SHPO/State Archaeologist
State Historic Preservation Division

c: Sinoto Consulting, LLC: akihikosinoto@aol.com
Jeff Hunt, Director, Dept. of Planning, FAX (808) 270-7634

APPENDIX H.

Cultural Impact Assessment

CULTURAL IMPACT ASSESSMENT

For the

PROPOSED PI'ILANI HIGHWAY WIDENING PROJECT

April 2009

Hana Pono, LLC

CULTURAL IMPACT ASSESSMENT
For the

PROPOSED
PI'ILANI HIGHWAY WIDENING
PROJECT

Prepared for:

Honua'ula Partners, LLC
1300 N. Holopono Street, Suite 201
Kihei, HI 96753

Prepared by:

Hana Pono, LLC
Keli'i Tau'a
and
Kimokeo Kapahulehua

April 2009

Hana Pono, LLC
2275 Apala Place
Haiku, Maui, Hawai'i 96708

Management Summary

Report	Cultural Impact Assessment for the Proposed Pi'ilani Highway Widening Project; specifically focusing in the moku (district) called Honua'ula District (now Makawao), Maui Island
Date	February 2009
Project Location	County of Maui; Pi'ilani Highway from Kilohana Drive to Wailea Ike Drive
Acreage	1 mile of an existing 2-lane road will be expanded into a 4-lane highway
Ownership	Honua'ula Partners, LLC
Project Description	Expansion of existing Pi'ilani Highway to 4-lanes
Region of Influence	Direct effect on Maui Meadows, Wailea Kanani, Wailea Pualani Estates, Kai Malu at Wailea, Wailea Gateway Shopping Center, and The Bluffs at Wailea Subdivisions with an indirect effect on the Mākena Community
Agencies Involved	SHPC/DLNR, Maui County Council, Maui County Planning Department, SHPD, HDOT
Environmental Regulatory Context	The Undertaking is Subject to both State and County Zoning Regulations, the Cleanwater Act, and Other Environmental Regulations
Results of Consultation	No concerns regarding Mauka-Makai Trails, Native Plants, Archaeological Sites, Current Gathering Practices or Access Concerns
Recommendations	Preservation Precincts for Native Flora and Archaeological Sites, Stewardships, etc…

Cultural Summary

The focus of this study is on the roughly 1 mile long straightaway of the Pi'ilani Highway from Kilohana Drive to Wailea Ike Drive, which is sandwiched between Maui Meadows Subdivision mauka (upward) of the Pi'ilani Highway and the following subdivisions makai (ocean side) of Pi'ilani Highway: Wailea Kanani, Wailea Pualani Estates, Kai Malu at Wailea, Wailea Gateway Shopping Center, and The Bluffs at Wailea. The widening of this section of highway addresses the anticipated increase in traffic in Wailea and Mākena.

This portion of land is at the tip of the traditional district of Honua'ula and Southwest district called Kula. Due to the location of the project area relative to the large mass of Haleakalā the daily trade wind is funneled from Kahului all the way through Mākena from the early afternoon into the wake of the sunset hour at South Maui. Along with these winds, the hot sun in Kihei and Wailea has baked the sandy earth that sits upon a solid rock foundation. In the area of the proposed widening, the cut along the sides of Pi'ilani Highway indicates that the foundation is bedded solid blue rock.

Figure 1: Blue rock foundation at project area

For years, the only way to get to Wailea 'Ike and Mākena from Kihei was by an ancient walkway starting at the ocean side of Kalama Park. As South Maui continually expanded, the residents found it necessary to find other methods and roadways to reach Mākena. Ancient methods of canoeing and coming down from Ulupalakua upon the footpaths continued but walking along the sea coast eventually gave in to horses and ox drawn carts. The same path gave way to a dirt road for Model T cars. The road was covered with sand and oil as Kupuna Clark cited until more developments took place beyond the park.

As Wailea kept on growing, it was deemed necessary to build Pi'ilani Highway. And now, with Honua'ula and Mākena Resorts on the planning books for more development, widening this corridor will assist traffic flow to and from South Maui.

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Cover Photo: Sunset from project area

Introduction

Under contract to Honua'ula Partners LLC, Hana Pono LLC of Maui, prepared this Cultural Impact Assessment (CIA) for the proposed expansion/widening of Pi'ilani Highway to Wailea Ike Drive in Wailea mauka (uplands), Makawao District, Maui Island. This CIA was undertaken in accordance to HAR Title 11 Chapter 200-4(a) and Chapter 343 of the Hawaii Revised Statutes. The content generally follows the guidelines for assessing cultural impacts as set forth by the State of Hawaii Office of Environmental Quality (OEQC 1997). This study includes a summary compiled from information acquired through archival research, literature search and oral interviews with persons knowledgeable with the immediate project area as well as the Honua'ula region.

Figure 2: View of project area

Project Area

The subject of our current study is comprised of a small strip of land running parallel with the Maui Meadows subdivision at the beginning of the township Wailea. The proposed project is being undertaken in conjunction with the proposed residential development project known as Honua'ula, which echoes the name of the traditional district.

The immediate boundaries of the project area are the existing Maui Meadows and a portion of the proposed Honua'ula development to the east, Kilohana Road to the north , and Wailea-Ike Drive to the south.

Since the cultural significance of an area must be assessed in the context of the surrounding greater region, the subject of our study will be the area of the traditional Honua'ula District. The moku (section) of Honua'ula lies between Kula of the north, Kahikinui of the east, the sacred islands of Molokini and Kaho'olawe of the west and the ocean to the south.

Methods

The scope of this report will be to compile a cursory summary based on various historical, cultural and ethnographical accounts and facts regarding Honua'ula. The information was acquired through archival research, literature searches and oral interviews with persons knowledgeable with the immediate project area as well as the Honua'ula region.

Chronological Background

Six time periods shall be discussed with a general overview of each providing the reader some background to get a bigger picture of how Hawaiian culture has been shaped by the various external influences. This discussion of mythical and documented ancient history will provide the reader with an understanding of how we arrived at present day.

Era 1: Mythical Creation

Traditional stories start with the creation chant called "Kumulipo." The Kumulipo brings darkness into light. Embedded in this all-encompassing chant includes the tale of the coming of the Hawaiian Islands through the mythical stories of Pele and another demigod named Maui who, with his brothers, pull up all the islands from the bottom of the sea.

The latest and last physical appearance of Pele occurred as late as mid-1800s when the Fire Goddess flowed from the top of the southern slopes of Haleakalā down through Honua'ula and landing at the surf of Mākena and Wailea.

In the Hawaiian Annual published by Thomas Thrum and James Dana's "Characteristics of Volcanoes", are reported Father Bailey's statements of his oral interviews explaining that the last flow had occurred in 1750 (Sterling 1998: 228).

Many of the lava flows in the summit depression and in the Ulupalakua to Nu'u area were dark black and bare 'a'a (rough, jagged type of lava landscape). The two freshest lava flows run near La Perouse Bay. The upper flow broke out of a fissure near Pu'u Mahoe and the lower flow broke out at Kalua o Lapa cone. Both flows contain large balls or wrapped masses of typical 'a'a found throughout Hawai'i.

Era 2: Pre-contact Migration – 0 to 1100AD

The occupation of the Hawaiian archipelago after its mythical creation came in distinct eras starting around 0 to 600 A.D. This was the time of migrations from Polynesia, particularly the Marquesas. Between 600 and 1100 A.D. the population in the Hawaiian Islands primarily expanded from natural internal growth on all of the islands. Through the course of this period the inhabitants of the Hawaiian Islands grew to share common ancestors and a common heritage. More significantly, they had developed a Hawaiian culture and language uniquely adapted to the islands of Hawai'i which was distinct from that of other Polynesian peoples (Fornander 1919: 222).

Era 3: Early Tahitian Migration – 1100 to 1400AD

This third period, between 1100 and 1400 A.D., marks the era of the long voyages between Hawai'i and Tahiti and the introduction of major changes in the social system of the Hawaiian nation. The chants, myths and legends record the voyages of great Polynesian chiefs and priests, such as the high priest Pa'ao, the ali'inui (Head Chief) Mō'ikeha and his sons Kiha and La'amaikahiki, and high chief Hawai'iloa. Traditional chants and myths describe how these new Polynesian chiefs and their sons and daughters gradually appropriated the rule over the land from the original inhabitants through intermarriage, battles and ritual sacrifices. The high priest Pa'ao introduced a new religious system that used human sacrifices, feathered images, and enclosed heiau (temples) to facilitate their sacred religious practices. The migration coincided also with a period of rapid internal population growth. Remnant structures and artifacts dating to this time suggest that previously uninhabited leeward areas were settled during this period.

The target area of study is in Honua'ula, which is an ancient name that was introduced to Hawai'i by Chief Mō'ikeha of Tahiti. The reason Chief Mō'ikeha decided to depart from Tahiti was to separate himself from his lover Lu'ukia who originally came from Hawai'i with her husband Olopana. Lu'ukia had created turmoil in Mō'ikeha's life and therefore the Chief felt that his separation from her would heal his wounds. (Sterling 1998: 214)

Era 4: 'Ohana – 1400 to 1600AD

The fourth period dates from 1400 through 1600. Voyaging between Hawai'i and Tahiti ended. The external influences of the migrating Polynesian chiefs along with internal developments within the culture resulted in sophisticated innovations in cultivation, irrigation, aquaculture, and fishing. These innovations were applied in the construction of major fishponds, irrigation systems, and field cultivation systems. Such advances resulted in the production of a food surplus that sustained the developing stratification of Hawaiian society into three basic classes: the ali'i (the chiefs), kahuna (the priests), and maka'ainana (the commoners). Oral traditions relate stories of warring chiefs, battles, and conquest resulting in the emergence of the great ruling chiefs who controlled entire islands, rather than portions of islands. These ruling chiefs organized great public works projects that are still evident today. For example, 'Umi-A-Liloa of Hawai'i constructed taro terraces, irrigation systems, and heiau throughout Hawai'i island, including the Pu'uhonua at Kealakekua. King Pi'ilani was inspired to construct a "King's Highway" that passed through Honua'ula as it encircled the entire island of Maui.

Era 5: Chiefly rule of the Ahupua'a – 1600 to 1778

In the fifth period, during the century preceding the opening of Hawai'i to European contact in 1778, the Hawaiian economy expanded to support a population between 400,000 and 800,000 people. The social system consisted of the 'ohana who lived and worked upon communally held portions of land called 'ili within the ahupua'a natural resource system. These families-- the building blocks of the Hawaiian social system--were ruled over by the stewards of the land, the chiefs along with their retainers and priests. The history books are filled with tales of battles among the chiefs from all islands.

Even during this period of chiefly rule, land in Hawai'i was still not privately owned. The chiefly class which provided stewardship over the land divided and re-divided control over the districts of the islands among themselves through war and succession. A single chief could control a major section of an island, a whole island or several islands depending upon his military power.

The chief divided his landholdings among lesser ranking chiefs who were called konohiki. The konohiki functioned as supervisors on behalf of the chief over the people that lived on the lands and cultivated them. The tenure of a konohiki was dependent upon his benefactor, the chief. Konohiki were often related to the chief and were allocated land in recognition of loyal or outstanding service to him. However, unlike elsewhere in Polynesia, the konohiki were rarely related to the maka'ainana or commoners on the land under his supervision. Thus, the konohiki represented the collective interest of the ali'i class over the maka'ainana as well as the individual interest of his patron chief.

The lands allocated to the konohiki were called ahupua'a. Ahupua'a boundaries coincided with the geographic features of a valley. The typical windward ahupua'a ran from the mountain to the ocean, were watered by a stream, and were bounded on both sides by mountain ridges. On the other hand, leeward ahupua'a rarely had permanent streams, thus the well-water upland areas became important in the leeward regions. The overall intent of either ahupua'a is that it would afford the 'ohana who lived in the ahupua'a access to the basic necessities of life-- marine foods from ocean reefs and streams, low lying wetlands for taro, fresh water, timber, and medicinal plants from the uplands and forests.

The konohiki supervised all productive communal labor within the ahupua'a month-to-month and season-to-season. He collected the annual tribute and determined if it was sufficient in relation to the productivity of the land. He regulated the use of land and ocean resources, administering the kānāwai (law) applying to the use of irrigated water as well as to fishing rights in the ocean. The konohiki was responsible for organizing communal labor for public works projects such as roads, fishponds, and irrigation systems.

The ahupua'a of the konohiki was further divided into strips of land called 'ili which were allocated to the maka'ainana (common Hawaiians). These land grants were given to specific extended family units of maka'ainana called 'ohana. The 'ili either extended continuously from the mountain to the ocean or was comprised of separate plots of land located in each of the distinct resource zones of the ahupua'a. In this way an 'ohana was provided access to all of the resources necessary for survival (Handy, Handy & Pukui 1972: 49).

Era 6: Captain Cook to present—1778 to present

In 1778, the arrival of Captain Cook drastically changed Hawai'i from a Stone Age Society to a Nation dependent upon imported goods and technologies. The importation of new animals and plants changed the islands and put a lot of stress on the eco-system that sufficiently provided for the Hawaiian people in ancient times. Captain Cook and those Westerners that soon followed brought diseases that the Native Hawaiians had no immunity against and the onset of several epidemics caused a major population decrease throughout the archipelago of Hawai'i.

The arrival of the Christian missionaries in 1820 caused another shift in the Hawaiian socio-religious system. The Hawaiians believed in many gods and now through the missionary teachings, they were taught that there was only one God. Along with these two major changes came the moving away from the barter system because the money system was introduced.

The success of King Kamehameha uniting the islands in the late 1800's established a ruling family for several years until a new government under King Kamehameha III established the Great Mahele that introduced private land ownership—a move away from the concept of land stewardship.

Private land ownership now brought new businesses to Hawai'i the first being the sugarcane industry and ranching followed by the pineapple industry. These businesses required labor that

started the immigration movement to Hawaii beginning with the Chinese, Japanese, etc... Hawai'i is said to be the melting pot of the Pacific.

The Name Pi'ilani

The usual custom of royal marriages required the bride to be secluded from all male company except the husband until her pregnancy was assured. This custom assured that the child born was of royal descent. When Kahekili's son, Kawaokaohele, chose his bride, Princess Kapalaoa of O'ahu she was subject to this hymeneal seclusion. During this time a strange incident occurred. In the early evening, the peace was shattered by the screams of Kapalaoa.

Due to the kapu the warrior guards were not able to approach the Princess, only her ladies-in-waiting could come to her aid. As they entered the darkened room, they beheld a fearsome sight.

Resting upon the princess was a huge dragon-like lizard. This form was one traditionally used by the God of Power and Destruction. It was Kū in his physical manifestation. Even as the women watched, the dragon slowly rose in the semi darkness and disappeared.

When the Princess Kapalaoa gave birth to a son he was given the name of Pi'ilani (translated to mean: Ascent to Heaven) to memorialize the visitation of the divine Kū. This tradition bequeathed to the royalty of Maui, their claim of divine descent and also the belief that their kingdom could never be conquered except by a descendant of Kāne, God of Life and Creation. Interestingly, Kamehameha I whose birth signified his descent from the Kāne lineage-- did take the Kingdom of Maui.

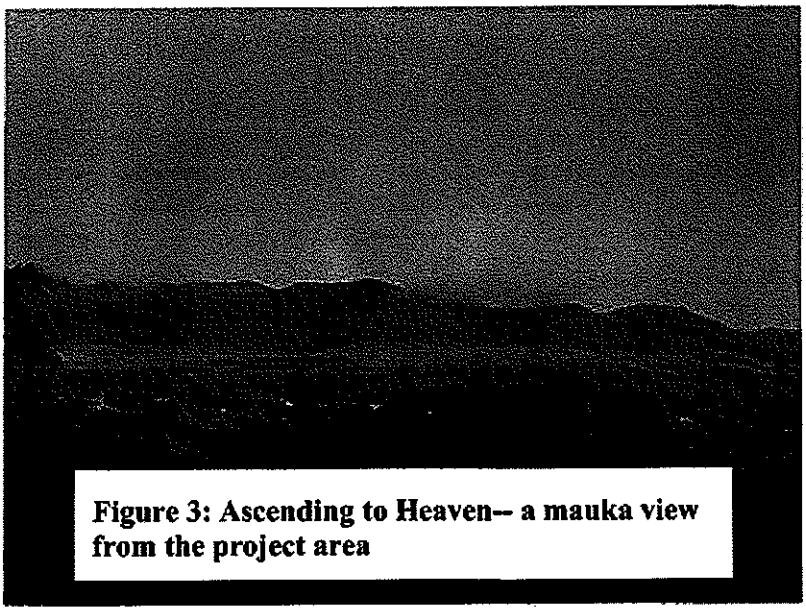


Figure 3: Ascending to Heaven-- a mauka view from the project area

King Pi'ilani was the 15th Mo'i (king) of Maui; he reigned in the 14th century at the heart of the innovative era. And like Kamehameha the Great of later years, he unified the island of Maui, Lana'i, Moloka'i and Kaho'olawe. The battles for unification of these four islands were followed by a long period of peace, stability, and prosperity at which time he dedicated his efforts to building the King's Highway. Also called the Pi'ilani Highway or the Alaloa (long road), it was intended to encircle the coastline of Maui connecting heiau and villages. The king was highly respected as a wise ruler who cared for his people by visiting them at their ahupua'a (land division). Because he liked to travel throughout his kingdom, the Alaloa was instrumental in his travels in and around the coastline of Maui. King Pi'ilani was not able to complete the Pi'ilani Highway in his lifetime, fortunately his son followed through on his behalf.

No other monarch is so revered by the people of Maui as Pi'ilani, and even in their mele (chant or poetry), the Island of Maui is often addressed as Na-Hono-A-Pi'ilani—the bays that belong to Pi'ilani.

At the time of King Pi'ilani's death, his kingdom encompassed all of what is called Maui County today. King Pi'ilani's children were: the oldest Lono-a-Pi'ilani whose mother was La'ie-lohelohe-i-ka-wai, next came Lono's younger sister, Pi'ikea, then another sister, Ka-la-'ai-heana. The youngest was Kiha-a-Pi'ilani, who was born and reared on 'Oahu.

Two Heirs to the Maui Kingdom

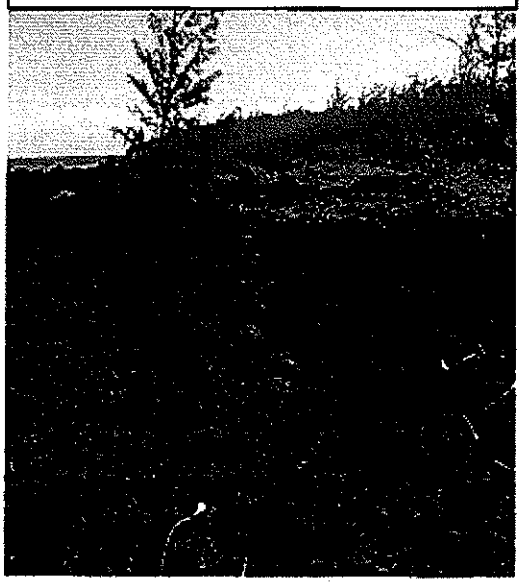
King Pi'ilani left two heirs to the kingdom, the oldest son and the youngest son. He wanted the two brothers to share the ruling powers between them. When King Pi'ilani died in Lahaina the kingdom of Maui became Lono-a-Piilani's as Kiha-a-Piilani was not present at the time of his father's death. Lono-a-Piilani wasted no time in establishing his authority and directing his younger brother to be submissive to him. However, the O'ahu elders who reared Kihapi'ilani made many predictions about his life that he would endure living in poverty and eventually would become a powerful ruler. In the first years of Lono's reign all the people in the kingdom were content. Lono took care of his youngest brother; Kiha returned the gesture by caring for the people of the kingdom. His older brother didn't appreciate that because he thought that his younger brother was trying to win the people over in order to stage a revolt against him. Lono kept a close eye on Kiha. Both brothers planted taro in the ahupua'a of Waihe'e. Kiha's taro patch exceeded his elder brother's in size, which made the king very angry. He therefore sought to kill his younger brother. Kiha fled and began his life as a maka'ainana (commoner). He lived in disguise and poverty for many years as predicted by the elders until one day he would become the predicted famous ruler. Kiha established an army on the Island of Hawai'i where his older sister, Pi'ikea had gone to live and was eventually able to overthrow his brother and become the 17th Mo'i(King) of Maui. (Kamakau, 1961: 22)

Alaloa, the Long Road

After establishing his authority and settling the people of Maui, Kihapi'ilani turned his attention to his father's "Alaloa". He extended the work of his father and continued the Alaloa Road so that it started up again in Ulupalakua and the new ruler was responsible to take it all the way to Hana and thereby completing his father's dream. In some areas, the road was paved with rock 4-6 feet and over 138 miles (222km.) long.

The early settlers in Hawai'i traveled on foot up and down the mountains and if they lived close to shore, they paddled from one part of the island to the other or completely around it. They also traveled from island to island on their canoes. By building the Pi'ilani highway on the island of Maui, the King probably involved the entire population of the island since it required a large work force to complete the road.

Figure 4: One of the remaining pieces of the Alaloa



In his lifetime, there was a modest population on the island and they probably had cleared out some type of walk way or path along the seashore and maybe up to the mountains. To build the Kings Highway would take a lot of rocks since evidence shows that in some of the areas of the remaining highway, the engineers of the King were selective in choosing the pahoehoe rocks (smooth lava rock). Even at the lava flow with 'a'a (jagged lava), pahoehoe were placed on them. If there was no pahoehoe rock, they used tools such as the Hawaiian stone adze called ko'i to break down those jagged edged lava so that one could walk on the road. If they needed to dig, they used another archaic tool called the 'o'o or digging stick to make their holes. The path along the ocean had rocks that were fetched from the seashore since they were smoothed and easier on the feet. When the road approached the streams, similar type of smooth rocks were taken from the riverbeds and placed on the roads. Otherwise, smooth chips of blue rock served as the foundation of Alaloa. Upon its completion, the road became the only ancient highway to encircle any of the Hawaiian Islands.

The present day Pi'ilani Highway starts from the western part of Maui lined up with bays of Hononana, Honokohau, Honolua, Honokahua, Honokeana, and Honokowai. It is said that the Hono A Pi'ilani (bays of Pi'ilani) could be seen from Kaho'olawe, Lana'i and Moloka'i.

Today, the route of Honoapi'ilani Highway stretches from beyond the bay areas cutting through Lahaina, continuing to 'Olowalu and circling the point at Ma'alaea on the other side of the mountain and runs right up to Wailuku town where it ends. Doing its course to Central Maui, a branch of the road takes a right turn and heads towards South Maui all the way to our ending target area of Wailea. Again, Pi'ilani Highway then leap-frogs up to Ulupalakua and stays its course to Hana. The present day namesake does not follow the exact course of the ancient Pi'ilani Highway, but it shares several parallel segments.

Pathways from Kalama Park, Kihei to Mākena

It is still common knowledge among kupuna (elders) who lived during the 1930s in South Maui that there was no existing road from Kihei to Mākena except for a walking trail along the shoreline. When the four-legged animal came to Hawai'i, the horse, donkey, oxen and mule were used extensively to transport supplies or to ride from Kihei to Mākena and out to Kaupo.

Upon interviewing one elder, a question was asked about a family that lived in Kihei. This was a familiar answer. "Go down and follow the road and you pass the four coconut trees. Then you come down to the plumeria tree. When you pass this street, you turn right. Dirt road. That's where they live." MD Albrono (Honua'ula Report: 6,9). This statement expresses how the Hawaiian people viewed their surroundings, mostly by the plants, stones and topographical feature that existed from before they were born. It was a simple life, without traffic lights and highway names.

In describing travel to Mākena, kupuna Eddie Chang says we came down from Ulupalakua. There wasn't a road until World War II when the military built the road to have access to Mākena. Supplies were shipped to Mākena landing. Kupuna reminded us that the landing was built before the Kahului Harbor. In fact, Mākena actually had two harbors one at the present landing and the other at the Mākena Church. (Honua'ula Report: 3,7)

Eventually, a good road was developed along the ocean side and called South Kihei Road. Later, the Pi'ilani Highway was constructed which connected to Honoapi'ilani Highway of West Maui starting at the base of Mokulele Highway above the South Kihei Road. It follows the same parallel route until it reaches Kilohana Avenue then later was extended to Wailea 'Ike Road.

In short, the above paragraphs provide a description of the rapid changes of the lifestyle of the people who were accustomed to walking the land rather than speeding along in vehicles that would get them to their destination. The Hawaiian people had a sense by walking the land barefooted that they would be in contact with the mana (life force, spiritual power of the land) that would invigorate their entire being which would keep them healthy, focused and in-tune with what the island provided them. Even today those who have attempted to walk the 'aina barefooted find how invigorating it is to travel at a speed that allows for careful observation.

On the other hand, the development of the modern roadways that went from Kihei through Wailea and reached down to Mākena made for easier access to all of the fishing, surfing and sun-tanning locations that South Maui has to offer.

Cattle Ranching and Hawaiian Planters

At the turn of the century 1900, Honua'ula was rich with pili-grass, tobacco, cotton, ilima, native plants, and trees, such as noni and kukui. Hawaiian planters populated areas surrounding the proposed Pi'ilani Highway Widening project. With the introduction of cattle and ranching in this region, changes to the environment have been documented.

> *In Honua'ula as in Kahikinui and Kaupo, the forest zone was much lower and rain more abundant before the introduction of cattle. The usual forest zone plants were cultivated in the lower uplands above the inhabited area. Despite two recent lava flows, which erupted in about 1750, the eastern and coastal portions of Honua'ula were thickly populated by Hawaiian planters until recent years. A number of families whose men are employed at Ulupalakua Ranch have homes near the ranch house. Close by these native homes are little dry land taro cultivated.* (Handy, p. 508)

Ranching has been blamed for many of the district's environmental problems. The cattle and goats stripped the land of its native flora while destroying ancient Hawaiian temples and gravesites. Ranching operations took over land previously owned by Hawaiian families. Some Hawaiians left the area and were not aware of it when the ranchers took their lands through the process of "quiet title" or adverse possession.

Impact of Modern Developments

In the 1930's, the township of Kihei stopped at Kalama Park. There was no access, in terms of roads, beyond that point. At that time the land Southward was, in simple terms, a kiawe forest.

In the 1960's, when water was piped into the dry South Maui, suddenly Kihei became a worthy destination for sun-lovers. The growth in South Maui between the 1960's through to present day has considerably changed the landscape of the once vacant kiawe forest. The tourist industry took advantage of the pristine beaches of South Kihei, Wailea and Mākena. The residential developments south of Kalama Park are mostly populated by malihini (newcomers). The sun, sand and surf lured many people from abroad and the continuing development provided homes and jobs for them to stay.

Conclusion

The current cultural assessment undertaken in conjunction with the proposed Pi'ilani Highway widening resulted in finding no significant cultural concerns or impacts within the area of potential impact. Also, there are no indigenous plants that will be affected by the widening project. The report does refer to King Pi'ilani and his son Kihapi'ilani who were responsible for building the great Alaloa road. The expansion of the Pi'ilani Highway will, in some way, continue the work of our beloved King Pi'ilani from Maui's ancient history.

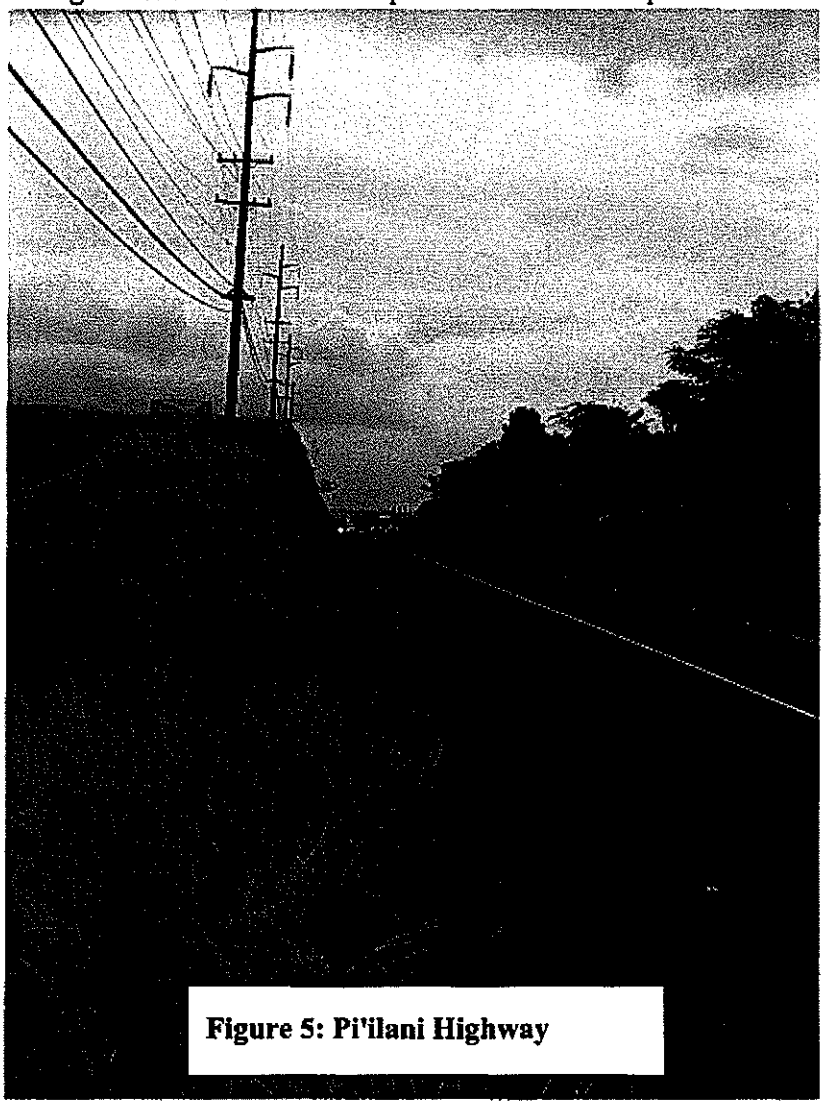


Figure 5: Pi'ilani Highway

As with all developing societies, transportation is one of the central components. King Pi'ilani understood the value of "paved" roads and easy travel.

Kimokeo Kapahulehua and I (Keli'i Tau'ā) as Hawaiian practitioners send our Mahalo Akua, Nā Aumakua, Nā Kupuna, Nā Makua a me Charlie Jencks (Thank God, Ancestral Gods, Elders, Parents and Mr. Jencks) for inspiring us to provide this sincere and honest cultural report. The road widening development will open up south Maui from Kihei to Mākena to new opportunities and new challenges. We hope the developers will tread with as much care as they have shown during the planning process. Also, if found, we desire that the native plants can be kept intact as much as possible to retain the unique identity of the region. By expressing these thoughts, we now can close this report me ke aloha pumehana (with our fondest love and support) and the wisdom of our kupuna who said, "E ho'olohe i ka leo o ka 'aina" (Listen to the voice of the land).

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Interviews:

Joann Amoran
Herman Clarke
Lehua Clubb

Appendix A: Interview Transcripts

Interview: Johanna Amorin
By Keli'i Tau'a

November 5, 2008

KT: Keli'i Tau'a
JA: Consultant Johanna Amorin

KT- I'm sitting here with?
JA- Johana Kuuleilokelani Shin-Amorin.
KT- Born in?
JA- Born on Oahu.
KT- Your native extraction is?
JA- Mama- pure Hawaiian. Daddy- pure Korean.
KT- Her name was?
JA- Mama's name was Hannah Kahanahaipule Moses.
KT- Ahh, so the Moses was what ethnicity?
JA- Pure Hawaiian because of great ancestor changed a Hawaiian name into an English name for biblical reasons but the family is pure Hawaiian.
KT- Wow. All though you were born on Oahu you said you've been living in Kihei in particular an area that we are doing research for which is Kilohana and further south to Wailea Ike which is going to be part of the Wailea 670 now known as Honuaula to have access road to the different developments that will be there. So, in terms of that, how long have you been living in that area?
JA- I live on Akala Drive which is the first street up into the Maui Meadows subdivision and I have been there since December of 1973.
KT- So you saw a lot of change from that time?
JA- Yes. I've seen a lot of growth, South Maui I believe, districts on Maui.

KT- When you came to Maui you weren't-were you conscientious of not only the influx of new residents for this island but ideas which created changes in the 'aina or the land?
JA- Culture is very important to me, living in a place that I could call home. Infrastructure, we have some problems but you know the government, all governments, all phases you need to get together and fix the problems where in the future I think the majority of the people of Maui will benefit. And it's all about the majority.
KT- So, in that area from the time you moved there, we who are of the islands have our own characteristics about us of how we love different things. I think it echoed very loudly when a group of Hawaiian people committed to get Kahoolawe back to the people in the State and that's when the term 'aloha aina' resounded loud and clear that we the people of the islands need to respect and love the land. Is this what you're saying about how you feel about where you come from now in Kihei?
JA- Kihei where I live, my resident, my aina, I love the area. All of my children were born and reared in that house. They enjoy the shoreline, the beaches, the swimming, the resources, they respected the culture. But today there's a lot of growth as I said but whatever is available should be enjoyed by everyone but also respected.
KT- So you are reinforcing that as a development comes about that there should be a passage where the public can have access to the beach.
JA- I believe that the public should have access to the beach. The beach- it's environment does not belong to any private owner, it should be available to whoever wants to get to the shoreline.
KT- So you didn't tell me how old you were when you moved to Maui.
JA- Well, I've been on Maui since 1972, married a Maui boy I was 30 at the time and today I'm 65, my Medicare year.
KT- Yes.
JA- I have 3 loving sons. I have 3 mo'opuna; one grandson and two granddaughters my youngest one blonde hair grey eyes. So there's a whole array of culture within our families and I'm sure I speak for most of the families who have been native to Maui or Hawaii nei.
KT- Can you recall the language being spoken in your household where you were raised?
JA- Being that mama was Hawaiian daddy was Korean when we went to grandma's house the influence was Hawaiian. When we went to daddy's mother's house it was Korean. But within our own household we were told to speak English and sometimes Pidgin, you know being educated you knew when to speak Pidgin.
KT- Yes, so there's a value to all communicable languages to understand one another.
JA- Yes, and again the cultures in Hawaii Nei. My upbringing was among all different cultures and the respect and they were, you don't get huhu(angry)with any one particular you just felt this ohana-ship within yourself to get along with your neighbors and I teach my children the same thing, "Watch what you say!" and "You're not better than anyone else." And "Everybody has the right to grow old and live a happy life."
KT- So by that philosophy that you grew up, where did your kids have to go to school?
JA- My children were all born on Maui and my husband went to Catholic school and so the beginning of my 3 they went to Catholic school in Kahului and then some of them went into higher education in Wailuku at St. Anthony. My eldest graduated from St. Anthony, my 2nd graduated from Baldwin and my 3rd son graduated from Maui and it's only because of the division with our residence.
KT- So do you feel the neighborhood around you provided enough culture for one to go and enjoy the neighborhood into the kiawe forest or down to the ocean that if someone was very

interested they could have learned a lot from just being around in what was happening in you ahupua'a or your moku of Honuaula?
JA- Yes, the Hawaiian culture lives within my being and it's a reflection of my past and it's in the house and the children learn from that in the schools they had the opportunity to learn Hawaiian studies and they all did and when they were 5th graders they went to Kamehameha for Explorations and it was one of the proudest things to be a native Hawaiian and to be able to learn more about the culture. They enjoy the beaches that surround them and just living on the aina, living in Hawaii and having a lot of respect and for your neighbors too, and being in sports and getting to be good neighbors, my children had all of that, all of that.
KT- You know there isn't a lot of streams running down close to Maui Meadows but close to Kamali'i School is a small ravine where they found some petroglyphs. By us researching Maui, most of the streams that flow down from Haleakalā down to the ocean there are pocket areas where people of ancient times have put their artwork or their communications on rocks. Are there any kinds of Hawaiian, for lack of a better word, sites that you can think of in the area that we are looking at in the upcoming development that you might want to point out that you're sure that the developer targets that to stay away from desecrating any areas. I'm discussing stone walls of ancient times, different artifacts that have been found.
JA- Well, just sharing with my past and my family my husband actually worked for a surveying company when we first moved to Maui Meadows in fact in the Mākena area surveying company and he would see heiau's(temples) and things that were there and I'm sure the company had studies done or any development that we have especially in the mauka areas of Kihei that's not developed we have the authorities, we the planning department and all the agencies that need to do studies before development is done. I have a lot of respect for these departments and what they do. We also have some renowned Hawaiian cultural experts who live on Maui and together we will preserve, we will preserve because that is our job.
KT- So if I heard you correctly your husband participated in surveying some areas in where we're speaking of that were identified as Hawaiian temples otherwise known as heiau's.
JA- Yes and this was a long time ago, this was probably in the middle '70's- during the 1970's, I believe, he used to work for A&B for this surveying unit and a lot of it is respected because you're part of the culture and when you see something like that the company knows about it and studies are done. But I understand also as a planning commissioner that the big development that takes place in Mākena there are studies and I feel very relieved to understand that the people that go in they are very thorough with what they do and it's all about preserving and protecting the rights of the Hawaiian people.
KT- Yes. As you were raising your family at your present residence, what were some of the fun activities that you and your family could go enjoy within your neighborhood circle which I'm referring to; Kihei, Wailea, Mākena and so forth, what did the kids love going and doing?
JA- Well the beaches and when we had grandma coming over and grandpa coming over way back in the '70's, the late '70's we would ride out to the point, Mākena Point and go and check the scenery out there by La Perouse Bay and walk among all of that lava, you know, and they were exposed to that and the beautiful scenery out there. The resorts have taken over a lot but a lot of it still remains but I understand the parks are still there for those who want to enjoy and I believe everyone should continue to enjoy, you know it's not for one it's for all.
KT- So when you were participating with the planning commission what was the major concern of those who sat on the Board with you?

JA- We come together as a body of 9 people to make good decisions for the development, the projects that come before us and my aim is to do the right thing for the majority of the people not the new and the investors that come over but the long term to preserve what we can and smart development to make sure that the infrastructure takes place, it's always taken a back seat to development. There are-and again the government needs to work together and the State. Look at Lahaina everything is just delayed or set back, who's fault is it? I guess we have to get somebody who can really scream out and be heard, you know it's all about that voice.
KT- Who was the mayor at the time you participated on the planning commission?
JA- I was fortunate I had Alan Arakawa when I first became a commissioner and when I left it was our current mayor Charmaine Tavares.
KT- Those are pretty much the kind of questions I wanted to ask you. If you have any thoughts about anything else you would like to share and have us included in this kind of report that you see in front of you go ahead and say what's in your gut.
JA- I believe in my culture, I love my culture; My grandma, my mama. I've seen where I've come from, low-income housing, I've worked hard to maintain a better quality of life for myself but I never forget where I came from and to preserve my culture in whatever way I can. Who will benefit? My children and everyone else; our neighbors, the people who really want to be here who takes pride in our aina, in our culture, it's there for everyone. Growing up in Hawaii it was never just being Hawaiian, you're Filipino, you're Chinese, I'm Korean, you're Caucasian, you're a whole mixture, this is the melting pot of the world and it's for everyone who wants to be here to enjoy but it's with respect. Thank you.

Interview: Herman Clark
By Keli'i Tau'a

October 30, 2008

KT: Keli'i Tau'a
HC- Consultant – Herman Clark

HC- This house here was the first house here in Kihei but we had a lot of old houses here and there scattered.
KT- Okay.
HHC- Used to be a piggery across here.
KT- Okay when you say "this place" what is-what did they call this place before? Is there another name outside of Kihei? Is there a district name?
HC- Kenolio Street.
KT- Kenolio Street, okay.
HC- That's what it was. Kenolio because Kenolio used to be way down in the back of Maui Lou working for Harold Rice. Harold Rice had a piggery back there.
KT- Right, Honoulu Ranch.

HC- Yes. And down side where the stream is Crozier had a rock crusher inside there crushing rocks.
KT- Okay.
HC- That's that stream, you know, going out.
KT- Yes.
HC- Okay. So, Mama Sarah when-she passed away already so I know all the old people and most of them all passed away. My father and my mother, they passed away.
KT- What is your full name?
HC- My name is Eugene C. Clark Sr.
KT- Where did Mama and Papa come from?
HC- Okay my mother is from Kauai.
KT- Okay, so Chinese?
HC- Chinese-Hawaiian. They own taro patch in Hanalei. And my cousin, my mother's brother's daughter, is Kalehua...I can't think of her married name right now, she married too many times you know what I mean?
KT- Kalehuawehi?
HC- So my mother's oldest niece like, the brother's daughter, so she knows a lot of things over here because when she was a little girl she came here and stayed with us. And you know, we grew up as the same age.
KT- Yes, and your father?
HC- My father was Sergeant Clark.
KT- He was an army man?
HC- He came here to instruct the Hawaiian National Guard back in '35. We came here in '35 when the airport was-from the mud flats by right across of the power plant. So then we stayed in the Hawaiian Homestead where the 344 Off guard used to have their camp, Paukukalo. And then from there when the war broke out we lived by the end of the pali before the new road went over. We stayed there for 6 years.
KT- By Ma'alaea?
HC- Past Ma'alaea, you know going to Lahaina before Ukumehame. So had old house over there, the Mahi's were staying there off and on like a beach house.
KT- Yeah?
HC- So my father got that place there from the State and we was raised down there like as a kid.
KT- So where did you go to school?
HC- At St. Anthony School. We caught the bus, the railroad bus.
KT- Railroad bus?
HC- Uh huh at that time railroad bus. (Laughter)
KT- So that was owned by the Sugar Plantation?
HC- By Kahului Railroad.
KT- Kahului Railroad. But Kahului Railroad was part of A&B.
HC- Yes, yes.
KT- So the railroad came all the way to here?
HC- To Lahaina and then we would catch and then go to school and go home on the bus too.
KT- Oh, over there! But it didn't come here to Kihei?
HC- No not to Kihei. By the end of the Pali Road and that's why it goes that way there the old days. That's the old road now I'm not talking about the new road.
KT- Right. So why did mom and dad move to Kenolio Road?

HC- Figure he bought the place through auction through the State you know the taxes or whatever audit.
KT- So when he moved here what was he doing, what kind of work?
HC- My father retired in '47 from the army then he was the harbor division foreman. Then when the big planes started to fly in he was a customs inspector. He was a smart man that's why they call him Sergeant Major.
KT- So you went to school St. Anthony and you always lived here?
HC- Yes.
KT- Earlier you were talking about breaking rock here in Kenolio.
HC- Yes, yes, clean up the property.
KT- How many acres is this?
HC- Just about 1/8 acre shy from a whole acre.
KT- So over here used to be all rocks?
HC- All rocks, blue pohaku and I learned how to at 11 years old. I used an 18 pound sledgehammer. I dig 'em out, I put the bar in there I move 'em, I move 'em, I move 'em. I crack 'em all then I get this old pickup truck, my father myself and my brother we converted that 1934 Chevrolet into a truck.
KT- Okay.
HC- And then I put all the rocks on it and I stuck it all behind by the end of the property. Then was so high already- was about 8 feet high already so my father decides to give to the County because he was good friends with the County and all that. So he tell them come get them and they made the stone wall in Kalama Park. You know where the parking lot all the blue rock?
KT- Right, right.
HC- I cracked all that for 2 ½ years. I come home after school I crack rocks.
KT- Oh my, that's just like hard labor.
HC- But I learned. You know you learn.
KT- What did you learn?
HC- I learned a lot of stuffs that's why.
KT- So for the young people to understand what you said because today young people are different they don't look at labor as…
HC- Yes, yes. But when you help the family out you do what you have to do. When you come home after school mama says, "You eat little bit, you do your homework when you pau your job outside the yard. Then you study you do your homework." That's how our life was back then the old days.
KT- So how old are you now?
HC- Seventy-seven, I still going yet.
KT- Yes.
HC- I help a lot of people out.
KT- How do you mean you help people?
HC- Getting well.
KT- What do you do that people will get well?
HC- I can feel their body through reflexology touch the body and all that.
KT- How did you learn that?
HC- That was given to me when I was in the hospital from a helicopter accident. I was in Castle Memorial Hospital, my mothers oldest brother came there and he said, "Jean you still have a job to do." That's what happened.

KT- How old were you then?
HC- I was in my late 30's.
KT- Why were you on the helicopter?
HC- Why, because I was doing some job up in Waikamoi and the helicopter down draft and ran into the cliff.
KT- Wow.
HC- So I got out of that and everything and I fight my way through.
KT- Only you survived or...
HC- Everybody survived, the pilot survived and everything but then afterwards the pilot went to Alaska and died. He had another helicopter accident.
KT- Oh my gosh.
HC- Yeah, so I was doing a little demolition work up in that area there.
KT- So you said uncle gave you the gift?
HC- My mothers oldest brother Rudolf. He's the one came to the hospital saying, "Jean you still have a job to do yet."
KT- So is this Chinese?
HC- Chinese-Hawaiian.
KT- No. So is what you do Chinese or Hawaiian or...
HC- I do Chinese and Hawaiian way.
KT- Oh, okay. So it's your own way that's the gift passed to you.
HC- Yes that's right I worked. I had an office in Kahului A&B Building with Christina Chang and a couple of other psychologist and A&B doctors. Then I said I do most of the job paying the rent for it and then I got out, that's why I opened a health spa at Kealia Beach Plaza. I used to do seaweed wraps and lomilomi and all of that. I helped a lot of people. Then the hydrotherapy tub I put them in there and I have to ask them if they're diabetic or whatever I can't leave them in there too long in there because it's going to drain, you know. So I have to take them out within 10 minutes or 5 minutes just to loosen up the toxins from their body. Then I put them in a room, I put somebody else in there, I clean the hydrotherapy tub, keep it clean and all. Then I put a new one in there again. That's how I am.
KT- When you were growing up here in Kihei and now you've seen a lot of changes.
HC- Yes.
KT- What were some of the old places that our elders used to go? Do you know of any heiau's in this area?
HC- Yes used to be heiau's down-side back of Maui Lu and all that used to be heiau's.
KT- Wow.
HC- And then down Mākena.
KT- The area that we're doing this study for is where Kilohana Street which goes up to Maui Meadows and goes across to Mākena. They want to build(widen) the road there.
HC- Yes.
KT- As far as you know-well kupuna say never used to have a road beyond Kalama Park.
HC- No, never.
KT- Can you remember what was happening on that side?
HC- Okay, this was the main road you would go down to Kihei.
KT- This-meaning Kenolio Road?
HC- Yes, yes. Never get the front street in the south road no more this was the main street. This was only sand and oil, sand and oil. They throw the oil they throw the sand on it. Then only few

houses over here down to Maui Lu and then it cuts back down. Go by where Maui Lu used to be and then go short distance and then get sand again before Azeka's and all that. Before you go to Maui Sunset and all that sand and oil, sand and oil that's how it was.
KT- Did you remember some of the families?
HC- Well families...what I remember is more like Mrs. Saffery, old lady Saffery she died already. And then Isaacs and then I remember the old Koa House and the fish pond.
KT- What about Akina's?
HC- Akina's, yes Akina's was further down and they had the construction. Old man Frank Akina and then Alec Akina run the bus. When he started with the bus was old banana station wagon taking the children from here to old Kihei School right here. This was the first school over here.
KT- Oh, okay.
HC- And then inside the schoolyard there was the teacher's house to stay in. That's how I know everything that way there, you see? And then they went open the road gradually. Usually it was all back to this way here, back to this road and then everything went change, gradually change, that's all I remember down there. Then during the war the pier in front of the ABC Store used to be HC&S Store used to be the Post Office and the store. Johnny Ventura was the manager for the store and the Post Office. I don't know if you remember that?
KT- Yes. Well the other kupuna I interviewed told me that story.
HC- And then had the pier across where the Navy boat was stationed across there. They call that the crash boat.
KT- Okay.
HC- They the one was pulling the barge out when the plane dropped. They practiced bombs on it going towards Kahoolawe. If they hit the barge they know what number, what plane hit it- who's the better pilot, right? (Laughter) That's the way I look at it. So I didn't care because there were no explosives in it was all water bombs-500 pounders. That's why I get two outside there.
KT- Yeah I see that.
HC- That's all water bombs. And so my father went put that up when I brought it back from the kiawe trees way back there. So we make one mailbox in one and the other one is a landmark right. And that's how it is.
KT- So, after you finished St. Anthony what did you do?
HC- No, I went to Maui Vocational that time. Then I went to take up the machinates, I went to Pearl Harbor and worked the next day. I was sixteen and a half. I told them I wanted to go. I told my ma I'm going, daddy I'm going. So my mother's oldest brother pick me up down the airport. Next morning he took me down to Pearl Harbor where we sign up for work. The next day I work.
KT- So how many years you worked there?
HC- I worked in there 3-4 years then I went to Ammunition Depot in Nanakuli side.
KT- That was during the war already.
HC- Right, right, right and then the Korean War.
KT- And then you returned here to Maui.
HC- Yes.
KT- So, as a young boy you saw many of the changes taking place.
HC- Yes, all over.

KT- Did you see any activities or people going up to where I described where they want to put in the new road by Kilohana Street?
HC- No.
KT- So all of that was just barren, nothing?
HC- Yeah, that's right nothing at all.
KT- Only kiawe.
HC- That's right all kiawe. All through here was all kiawe and all boulders. This over here of course here was farms.
KT- Oh, okay what did they plant?
HC- At that time this was on the corner lot, they had 7 acres see. And then the next notch was 7 acres, then the next one was 7 acres-one subdivision was. What most of their farming of planting squash and tomato and whatever because the water was very little bit coming down from Ulupalakua. No water at all, you know. So we the last house here, if we going to take a shower we cannot, we gotta wait. If we have open water first they get the water before us so we put a 500 gallon water tank up. And then we fill 'em up during the night and that's what we use for drinking and cooking and all that my mother until we dig a well here.
KT- So you didn't see too many people paddling canoes during your time?
HC- No, no.
KT- This Kihei Canoe Club is a recent activity.
HC- Right, right. I know Bishop used to be with the Pioneer Federal Bank I think was. He helped out with the canoe club because I gave some coconut trees to him for plant where the canoe club. My heart is always good for help out you know. That's how I am.
KT- So how many children you have?
HC- I had six. I lost one, my youngest boy.
KT- And they all living on Maui?
HC- Yes, everyone living on Maui here.
KT- How many boys and how many girls?
HC- I got three boys and two girls left.
KT- Have they learned what you do?
HC- They really learn a lot from me and they know a lot of things around too, see.
KT- So they'll be able to do what you do to help people?
HC- Yes they do that. I taught them how to be mechanics. I taught them how to be welders and everything. I did everything while on earth what I could. Because you know when you get hardship, you get hardship.
KT- Yes. Who did you marry?
HC- I married a Mahi. One of the Mahi girls from Iao Valley, Margaret.
KT- Oh so that's a big, big, big family.
HC- Yes. (Laughter) Big family I tell you braddah from the Big Island. Her father was a fireman from Wailuku Fire-he started in Paia Fire Department then he moved to Wailuku. And they have an estate up in Iao Valley. Then Becky Min, the oldest sister, sold the property across the river. It's across the river I call it Golden Bridge before where I go meet my wife, my girlfriend. I do bouncer work and everything in Maui here.
KT- So a lot of different jobs you had?
HC- Yes, yes. I wasn't ashamed of work that's why. Till today because I barely can see now I just do my thing inside this house and that's all. And I'm glad I met Bully and helping him out now.

KT- So what is your diagnosis of what's happening now with him?
HC- With him, his energy, because he was shut down two kidneys okay. And then that went put him downhill very fast that's why I keep him going. Once you get everything flowing good, energy, he going be different man.
KT- Well, his mind is going real fast so I'm always getting, "Go do this. Go do that." So I'm thinking he's well already.
HC- Yes, yes. No he is well. I'm going to tell you that there.
KT- He's getting better but he still could use a lot of more help.
HC- Yes, yes a lot of help yeah. Because you know when you get poison through your body it takes time to get it out of your blood stream. Okay I don't know if you know Stanley Biga?
KT- Yes.
HC- The father-eighty, right?
KT- Yes.
HC- He goes to dialysis three times a week he comes to me now twice a week. Friday, tomorrow, he sees me tomorrow morning at 9 o'clock. And he knows a lot of changes too around. Did you talk to him already?
KT- No, I haven't had a chance.
HC- Well he knows because he was surveying for the County. He was a surveyor then he worked for the State.
KT- So his body break down too?
HC- His kidneys shut down too but now his kidneys working and his sugar count now is up by my doing my work. Because me one man I concentrate to get you well because I help babies out too. Sometimes 1 week-2 week old babies I help out. Doctors they don't know the family bring 'em to me I said, "If you don't want to hear them cry go outside wait." (Laughter) Right? But no I do it right in front of them and they watch me, yes. Because here my sister sold the property to the church and all that and they want to put a-I was talking to Bully about it. He said no they can't do it because this the main highway going to come they going to take 15 feet from each property to widen the road up, right. So with kaho the minister there, Mau, you know I tried to get it back but Bully tell me get another property and exchange with him be better. And that's why I'm talking to my attorney about that. Because I want the property back because my mother and father comes and visit me all the time and my youngest son all buried out in the ocean outside here. So I don't want to let go the place but my sister did that. The same as Bully he told me the sister done that to him. So that's bad because my sister went change everything went take my mother to the mainland when my father died. Then she never say on pull here or there then every six-eight months she come home. She don't tell me nothing. My mother only went to fourth grade in Kauai, smart woman but she's a quiet one, you know I mean she don't say nothing. But my sister worked for the attorney up in Sand Diego and changes all everything and my mother go sign but she don't know what she's doing, she don't know. So I talked to Dick Mcarthy who's my attorney and I said, "I feel real unhappy because mommy and daddy always come and see me three times a month come visit me every time, every time, three times a month." Because I have to sit up and sleep on my chair because my eyes bleed you see so the doctor said you cannot be laying down.
KT- You gotta let it drain.
HC- Drain, yes, yes. If not the thing is going to burst so that's why I do that. So I still want to get this place back. I talk to Mau he don't want to release it he said he wants to put a school here and all that but then Bully tell me they can't do it. That's what Bully tells me now, you know

what I mean? So how I feel about it the church should release it so I just looking for an empty lot, a little bigger for they can build a school for them. But what area I can't say yet. My attorney's looking for it and he's going to look for it.
KT- So some of the places can you remember any significant places-now it's changed to Wailea but before that did you go down at all during your younger days to Wailea, Mākena…
HC- To Mākena, oh yes! Before we go down to Mākena was all down by the beach side you go sand road.
KT- How did you go?
HC- With a truck. (Laughing) Go all the way down to La Purouse Bay.
KT- So all dirt road.
HC- All dirt road then when you come down to the lava flow it's all, you know gravel like from the rock.
KT- So how far could you go?
HC- Up to La Purouse Bay where old man Sam Po used to stay and take care the house for Robinson. I don't know if you remember Robinson?
KT- That Sam Po is the one that…
HC- Caretaker.
KT- Yeah but he was interviewed in a book called Sights of Maui. He was a big man, his wife was big.
HC- Yes, yes. And he used to throw net a lot in Mākena Beach and that's how all the farmers used to come down bring vegetables he go throw net catch manini and stuff exchange. That's how it was.
KT- So the farmers from Kula?
HC- Kula, yes.
KT- Wow.
HC- I remember all that.
KT- And they used to have to walk down or the car come down?
HC- Ah they come down through where Chang's come down that old…that road from Ulupalakua come down.
KT- Oh, okay.
HC- You know where Chang's house used to be, Debbie Chang?
KT- Yeah, now it's their gravesites over there.
HC- Yeah used to be an old store over there, Chang's Store yes.
KT- Oh that's Eddie Chang's father then.
HC- Right, Debbie Chang's father.
KT- Yeah. You can remember that, huh?
HC- Yes.
KT- So you folks used to just go camp overnight or you come back come home?
HC- No we always come home, we always come home. But sometimes we as boys, we go and camp all one night you know. Because we go diving, we young yet, we like dive and bring fish home for eat. That was our, my mother said you always, if you going for something you always don't say you going fishing or whatever you say holoholo that's the Hawaiian way. You come home with fish, with squid like that there but never say you going fishing for fish or squid because you going come home white washed. Right?
KT- That's what they said.

HC- I know! (Laughter) Just like I've been on Kaho'olawe before the war back in the 30's back in '38-'39 there.
KT- What did you do there?
HC- I loved to fish with my father. I put the, I take a tube I put a little ply board make it round tie 'em up with the tube put my okala inside there and swim up to shore and I go throw net. Young, I was young age yes. My uncle made me a throw net so he taught me how to throw net and I catch Moe, Holehole. I not going throw on any kind fish I look. He said, "You look for that fish, you look that fish the color you can tell. But when the fish stay over there all get coral head. You try go pick up the net you no go stick your hand inside there-too much puhi. (Laughter) Broke the coral the net stay tangled with and then you can get 'em." That's what he tell me so that's how I do. No go stick your hand inside there because all white water yeah?
KT- Yeah.
HC- So you been on that island too?
KT- Nope, I've never been.
HC- Oh that island's beautiful island. I know I've been on that island many times with my father.
KT- Always to go fishing?
HC- Fishing yes. That's why I love my fishing. I love my diving. I don't get myself into trouble, hang around and no do nothing. It's everything is work and fish weekends when my father goes it's always weekend.
KT- By the way, how often does Kimokeo have to visit you? Twice a week or...
HC- Usually I want him to see twice a week to get that blood flow...
KT- Circulation.
HC- Yeah that's right, yes. That's very important you know that because the energy flows, the oxygen flows through the body. When you don't have oxygen flow you downhill, yes, very downhill that's why.
KT- Well you've really helped him because I saw the change.
HC- Well I'm glad to help him you know that and I take 'em like a brother for me. Yes. And then you know when he was in the hospital my attorney call me up, Dick Mcarthy, he said he need to be helped on. But I cannot go to the hospital because they don't want me to go up there and go work on him. So I said, "As soon as he come out he come down here." Yeah that's how he came down here.
KT- Good.
HC- Then he tell me he feels much different now, he feels real different now.
KT- Yeah, he was trying to take the world on his shoulders but now he learned to slow down little bit take care home base first.
HC- That's right, yes. Well, like me you know I can't see but I still help people out.
KT- That's amazing. So now it's all touch.
HC- Well I do massages; I do lomilomi and all that. I do adjustments and all too. And then in '98 before my boy died I went up to Spokane, Washington and fixed a broken hip with a woman who called for me and I saw the x-rays and all that. I put her broken hip back I stay one month up there I have to work twice a day so don't get blood clots. Until today every Sunday she called me up, "Jean I'm all right and I'm walking, I'm dancing." I said, "Good." And nothing is bothering here and I'm really happy about that.
KT- What a great gift your uncle gave you.

HC- Yes, yes. My uncle, you know, he was a patriarch for the Mormon Church. But even my wife is Mormon but I stay home I do my own pule that's where I felt. I'm a Catholic, my wife is a Mormon. I pray for my-when I was single, yes I go to church but ever since I can't drive now and all that there no I stay home I pule myself.
KT- So what religion are your children?
HC- All Mormon. The wife wanted them to be baptized in the Mormon Church but I said it's up to them, you know what I mean? It's not my choice.
KT- Yeah.
HC- The mother who suffers, you know. Now she's what 72 I think now and she still baby sits, she loves to baby sit. She comes on weekends, she come home tomorrow she watch me I get my niece here- Leilani I think you met her.
KT- Yes.
HC- She watches me, wash the clothes and all that for me. Before I can wash clothes I can see the numbers yeah. Now I cannot see (laughter) kinda hard yeah? And like before you know the mud flats went dry up we get that red dirt come through here go all the way to Kahoolawe. We like drive on the road you gotta stop no can see nothing. Yes, you gotta stop.
KT- I'm sure you grew up where there were a lot of Hawaiian stories.
HC- Oh yes.
KT- Today people call it ghost but you know it's not ghost.
HC- No it's not, no.
KT- Describe it in your own words what were they, what were these things?
HC- Well the way I feel because all the old Hawaiians- Charlie Aikala comes to me and Helen Kenolio they all like come sit down and talk with me and drink one cold beer. (Laughter) And you know Charlie Aikala, he like his fishing too. That was him too see. And we talk story, David Chang, I took care of his two children a girl and a boy. I took care because he got divorced from Esther Chang. And we all meet, sometimes we meet down by the VFW Hall before the road no go through yeah stay block off you see so we gotta go around. So that's old timers, all the old timers and I'm happy they-get some more I kind of forget their names the older ones you know. And then with the big rays and all that there like this guy here he Japanese guy Blackie used to have piggery down here-Goya whatever his name was. Yeah I don't know if you ever talked to him before.
KT- No I didn't.
HC- Yeah, that's all old timers. But the place is all developed now with houses or condominiums coming up. Too much down here and we don't have too much water our water pressure dropped down quite a bit. And how the County making that problems, right? Why somebody getting paid under the table? That's what I feel, I feel something that it's wrong. That's how I feel brother, I going to tell you that here, it's too much. And the traffic and the road is not set for all the traffic and all that there on the South Kihei Road and that's how I feel. Why they should develop so much in Kihei? Like sometimes I think number 2 Waikiki we going be.
KT- Oh no, you don't want that to happen.
HC- No I don't want that to happen, I tell you that there.
KT- But I guess this is such a lovely place that's why everybody wants to come.
HC- Yes, yes. But it's all right but give a chance for the locals too. A lot of places I know a lot of white man who got money and you cannot even go down to the beach to go and swim and walk on the sand. They're all trying to put a stop to that. That's no good, the beaches all for everybody.

KT- Oh, used to be the fisherman.
HC- Fisherman, yes, yes. He's a good friend of mine I help him out too see when he's hurting and all that. One time he had tapeworm he tell me, "Jean, how in the world I can get the tapeworm?" I said, "Okay you listen to me what I going to tell you go take." I said, "You go to Star Market they were selling the dog tapeworm pill. You only take one." That's when I had my health spa, see in '80. He took the pill tell me, "Jean I thank you now I no feel itchy and all that there." He said the tapeworm was all coming out. I said what the dog take you can eat too you know that. That's medicine. But I said you drink hot tea too to help it out. That's all it takes, natural stuff.
KT- Wow.
HC- And then Cameron the son, when he fell down he had a blackout of everything I worked on him too but now I hear he's in Hale Makua I think now, yes Cameron. And then the sister I don't know where the sister moved to because one football player went buy the property yeah. That's why it's all cleaned up with all grass.
KT- Oh yeah, who's that.
HC- I can't think of the name but I read about it.
KT- Yeah, I forgot. Kimokeo's good friend, our friend we went to do the blessing there-I forgot his name. But you take care of many people but are you healthy yourself?
HC- I'm healthy except for my eyes, that's the only thing. I take care a lot of people a lot of people from all over the world. I went up to Germany work on two doctors in Frankfurt Hospital. I work on the Naomi Judd, you know the mother and daughter used to sing at Nashville, you ever heard the name?
KT- Naomi Judd.
HC- Uh huh. When she had liver hepatitis C I was sent there special from Jimmy Boren I help her out. Within three days you going to see some changes in you and she's a registered nurse too. And you know, you know what she told me, "Jean are you married?" I said, "Yes I can't lie to you." "I would have married you." (Laughter) I laugh like hell! I said, "No I can't marry you I help you out that's all." Yes, and then I work on a lot of other people. I tell you have papers about me helping so much people. Mr. Sugarman, Bully knows Mr. Sugarman.
KT- Yep, I know him.
HC- Oh you know him? He knows about my life too, I help him out too. I help the father out, I help the stepmother out.
KT- So does it make you happy that you have this gift that you can help others.
HC- Oh yes, yes. I always like to help people out. That's one thing with me I always like to help because I never say no. Because, funny, I thank the Lord for giving me the gift my mother's side had, my father's side had too. My father's grandfather was a healer too and probably I got it see when I was a young boy I was asthmatic. I huff and puff, I huff and puff and I can't even run around, I can't play sports. I always sit down by the flagpole in the school and just read, read. I cannot play baseball or run around, no I only sit down and read. Until the day I got married at 25 I got rid of the asthma. Till today I'm not whole I tell you, till today.
KT- What were your interests, what were you reading?
HC- I just read whatever I opened the page. I don't remember everything and mostly was Catechism.
KT- Studies then you were reading your studies.

HC- Yes, and that's where I was. We come home we gotta pull weeds but me I no pull weeds I go hammo rocks at 11 years old. I don't run around with gangs, I don't play with other children I work. Then you know the old Kihei School here?
KT- Yes.
HC- They see me how I work cracking rocks and all that and one was Kenolio's son and tell me, "Jean boy you're a strong boy." I said, "My mind is to help and clean up the property." That's how I felt. Even my own children I no let them go down the pool hall and all that, no. Think about your hands and what your hands bring in for you. Fishing, I take them on my father's boat going fishing and we always get extra fish we sell for make expense back for repair the boat, paint the boat and all that there. And get extra money I give them. That's how life was. Same with catering, I cook for the Stouffer Hotel for 22 years doing luaus. One night we had to do four luaus in one night.
KT- Wow.
HC- All different areas, you know they have their own conventions yeah and we put pig in there. One time I have to put pig, turkey, fish, lobster tails and all that and each one comes out at a certain time not all at one time with the pig. They're surprised because my grandfather them whack me on the fanny when you don't do it right. (Laughter) That's old days, right?
KT- Yep.
HC- You learn. You have to learn to earn your own things not like today the children, no. All my children work. All of them work and their children work because I tell them, "If you no teach them the right way they'll be hanging around in the streets and they get in trouble." And that's the way I look at it.
KT- So when you were living here did you go mauka? Did you go Ulupalakua or usually you just stay down and go to the ocean instead of go mountain?
HC- Once and while when I like chase girls up there I go up Ulupalakua. Other than that I stay the ocean side. (Laughter)
KT- So, can you remember when the deer started coming in because now it's infested with deer.
HC- Ah, the deer was coming in-I think was back in the late '80's. That's the last time I remember because they was raising sheep's up there then the deer came in. Whoever brought it-I don't know who brought it and that's terrible now.
KT- It changes the land.
HC- Yes, yes, they eat everything up. They even come to Keawekapu now and they come by George Sugarman's house, I know that. Did you ever interview him?
KT- We used to go over but there wasn't a reason to interview him.
HC- Well anyway, because he asked me a lot of questions I tell him too, see.
KT- Yeah, he did a nice article on you I remember.
HC- Yes, yes. I help so much people out I help many, many people and they thank me for it and I don't charge them, God gave me the gift that's all. I don't even put calabash bowl out, you know what I mean? No. I just thank the Lord that he gave me the gift. A lot of energy even for my eyes and all that but I still for my own house I can see what I want to do. I know how it feels. That's why I told Bully I want the house back again from the church. He said, "Well, Jean you go look for one property and you exchange." I got to talk to my attorney about that. I feel sorry my sister went sell that because Bully went through the same way too. That's what he told me his sister went sell.
KT- So the property you talking about it right back here.

HC- Right here, this whole section here. We worked hard, my father worked hard. He paid about three thousand for this property and we put the first house on this property here in Kihei. That's why it's like a landmark.
KT- Why do you have the description of the teeth on your wall?
HC- I buy the whole set when I used to work with the doctors up in Kahului. So I study about that, the gums and all that because it all works under the feet. I know every portion of the body, people cannot believe me.
KT- So that's what they call reflexology.
HC- Reflexology, yes, that's why. Well you know, when you work on body you have to really study. You have to know the body how it flows. That's why the doctors tell me I know more than them at times, that's right. Everything is they take x-rays and all that to know what the problems is but I know every part of the body where it goes what glands goes and here and there. So you have to study all that there and all I tell them what to pick up at the health food stores certain, certain medicine all natural no chemicals with it and that's the proper way. How long you studied medicine?
KT- Not that long.
HC- But you teach that?
KT- No I teach Hawaiian culture, Hawaiian Language, Hawaiian Dance.
HC- Oh, I think my granddaughter going there I think if I'm not sure. This one here, Ornellas, my oldest daughters daughter Alena. I know she was going to school joining Hawaiian language and all that. I don't know which school, I never ask her. She comes down here she's 18 now she comes check on me and all that.
KT- Did you folks have Hawaiian activities before when you were growing up for the community?
HC- No, we didn't.
KT- Were the families in this area close?
HC- No, all far apart.
KT- But did you get together where there's an ohana feeling among the people?
HC- The only thing when we was growing up is Uncle Charlie and Aunty Helen Kenolio. We go down the house, we go meet and they talk in Hawaiian and they try to teach me, the mother try to teach me. But my mind was work and go fishing and bring home kau kau, that's how my mind was working. I know my father was having hard time, military man, eh. At that time when we moved to this island he only had $32.00 a month so it's hard time you know what I mean, support 6 of us that's why we go work. My sister- she go during the war-my father was military police we caught her with the hula skirt up on Market Street taking picture with the serviceman and she was 20. "Oh you get home. Boy, don't let daddy grab you!" (Laughter)
KT- She was trying to make some money, right?
HC- Make some money, yes. But see my brother and myself and you remember. He was working for the park department then he went fly to Molokai they died in a plane crash. You know, he was running for Councilman?
KT- Yep.
HC- Him, my brother and myself we can go into the military camp and go polish shoes and go polish buckles and all that and we make our own spending money and come home and you give 'em to your mother. Handful of quarters or dimes or nickels or whatever, you make what you can. That was our chance to do that. That's when Wailuku Elementary School was the

headquarters company, my father was stationed there so he get us to go and go shine shoes up there and everything.
KT- So that school they build just like bunkers.
HC- Yes, yes, yes.
KT- So that was the headquarters?
HC- Yes, the headquarters, the military headquarters so nobody know eh. (Laughter) Then had the Iao School but here was Wailuku Elementary School because get the rock in the front yeah, so that's how it is.
KT- Well, I think you've answered all the questions I appreciate you taking the time out to answer.
HC- Well you know, when we lived up in Wailuku next to the Wailuku Gym we stayed there for a little while. Then I used to take the bicycle go on Vineyard Street to the bakery and pick up fresh loaf bread and buns. You know the kind square buns? You know, and bring home that's what we eat before we go school. Five o'clock I go paddle the bicycle go there and cheap that time they even put the butter inside the bread already! Oh the ono the bread, you like rip 'em and...smell good the bakery.
KT- But early you had to go?
HC- Five o'clock yeah, just the right time.
KT- What time school starts?
HC- Oh school start was 8.
KT- So you get up early to go?
HC- Oh, I'm an early bird. Even now still 4 o'clock in the morning I get up, I'm up already.
KT- When you get up what do you do?
HC- I check on this bed here that needs to be cleaned. I tell Leilani come here change everything because somebody be coming in, that's how I am. Then I spray the room because she have to help me clean the room up and get all the old oil out because I don't use the old oil because come tacky, you know stuck to the body. But see I use other cream I get from New York, it's good for everything. Cost money but can't help it. You do your work right you'll be all right.
KT- Well I appreciate you helping Kimokeo.
HC- Well, I remember the old house where his office used to be, you know the Whaler's Foundation?
KT- Yep.
HC- Used to be the koa house down there and had the stores on the side and then the Whaler's had this old boats come inside The Boston Whailers come inside. And get the railroad track on the side of the rocks and had a big winch a hand crank and that's how it was. Then they come, they exchange with food. They glean the bladder where they cook the oil in this big wok-big, big wok. I remember seeing all that there. And then the old house I remember how the people used to go upstairs not from inside you know, from the outside they walk upstairs.
KT- What was upstairs?
HC- Rooms, rooms, had rooms upstairs. And then when the war broke out the military went in there and they bust up the place. Get plenty old books and all that inside there but you know how these haoles is, they don't care. And that's the way it was down in Kihei.
KT- That's a great story for us to write up. We want to go type it out and come back, read it back to you so that it's correct what you said we can include in the report that we're writing.
HC- Yes, all right. I still think a lot of things in Kihei area yet because Kihei was a beautiful place. And old Azeka's Store started right across Kalama Park where Kentucky Fried Chicken

is. That's where the old Azeka's Store used to be, the first one with meat and all that. And then where the restaurant there, I don't know what restaurant is there now with Kentucky Fried Chicken but on that property there used to be an old plantation house. The wahine deliver the liquor to your house and you pay her. Uncle Alec Akina used to order from her all the time. (Laughter) Even they have when in the Akina's place, Alec Akina but he leased it out to Naomi from Maalaea, yeah? You remember that?
KT- Yep.
HC- And then across of that used to be Kamaole I used to have a big pier the neighbor went put for they can climb up the rope, the net go up or they climb down to go into the landing boats. I remember all that.
KT- Wow, them were the days.
HC- That's right. And the Navy went fix up the place there and then they had officers quarters on the hill where-I don't know who bought that house there from the State or whatever, you know, where Aunty Helen used to stay. Helen Kenolio and the girl and the boy, yeah? I know the girl married Alo, I'm not sure from Wailuku. The boy is not married I think he still in the old house yet the boy. Akina, I used to help Akina a lot you know, Alec Akina.
KT- To do what?
HC- We pay buses and all that when I was a young boy. Yes, Alec Akina and then with the brother Frank Akina who had the construction trucks-the marine trucks when he was hauling rocks down in Pier 1. I still remember all that, I used to help him fix the trucks too. He bring 'em to me I fix 'em.
KT- So they're the ones that had the business here in Kihei?
HC- Yes, yes, yes. They had the business in Kihei. Frank had the, doing the trucks to haul the rocks to Pier 1. And then when the harbor broke they hauled all the rocks down there from the plantation. And then Alec had the bus. His first bus was the banana bus, you know only Kihei School. He no go to Baldwin High School until afterwards then he bought some bigger buses when he went to Baldwin High School.
KT- Now it's a big company.
HC- Yes and Butchie runs that and with his wife Sandy. That's Alma's sister from Waiehu. I know all them, you know, I still get good memory yet I think.
KT- You sound like it, you're telling me everything.
HC- I went go down to with my niece, went down to go Foodland but you know I get my handicap sign so I can go. Coming back we come back to the South Kihei Road I look all these buildings coming up by Debbie's place. "Oh" I said I shake my head, "Why the County allow all these things here now?" Why they up the road first right? Leave the beach side alone and the makai side alone. That's all the investors coming and then our water is shut down slowly and then we gotta cut back 10% I hear. Cannot do nothing like that so I don't know what this earth is going to turn to, too much people. And these investors, that's all they like the looking for money, money, money, money and the poor people no can afford. So the County looking for money, the people cannot get the money how they going move into those kind houses? So the County have to learn how to slow down and that's how I feel. I don't know how you feel but?
KT- We got to have you run for office.
HC- I'm too old already. (Laughing) I just like see Obama get in. I want him in. I think he's going to get in but I dream he going be assassinated. Funny I feel that energy, he got to watch himself.

Interview: Lehua Clubb

By Keli'i Tau'a

October 31, 2008

KT: Keli'i Tau'a
LC- Consultant

KT- First give me your complete name.
LC-My name is Jenavive Monika Kaleilehua Clubb.
KT- Where does the Clubb come from?
LC- My ex-husband, I was married for 12 years. All of my children are from him.
KT- So what is your maiden name?
LC- My maiden name is Ke'aulana.
KT- Ah, and this is what island name?
LC- Oahu, Laie.
KT- Okay. So, we don't…
LC- But my mother is a Mahi, from here.
KT- Oh, that's what I wanted to…
LC- Yeah, and my tutu is a Wilcox from Ulupalakua.
KT- So that's really a connecting point because on our telephone conversation you and I had you were relating Mahi along the Maalaea.
LC- Iao Valley.
KT- Iao Valley, also some at the Pali going towards Oluwalu you made mention of that.
LC- No, not me.
KT- Oh okay, Iao Valley. So there's a company up there Iao Ag, I forgot the name, but she's a Mahi.
LC- Maybe Margaret, I don't know, I really don't know.
KT- But what is the business up there?

LC- To be honest I have no idea. I have never gone there, I don't know anybody over there.
KT- Okay, no problem. Let's come back to why we're here. As I shared with you we're writing up a cultural assessment for Honuaula Development Company because they have been asked to develop a road from Kilohana which is the road right as we come up from Mapu up to where we are sitting in the neighborhood of Mapu. From Kilohana all the way to Wailea Ike. Therefore one of the requirements is to do a cultural assessment and part of that cultural assessment definition is to interview people like you who have lived on the aina and know a little bit about the area. So from the time, when did you move into this area?
LC- Into the Meadows, about '76.
KT- '76?
LC- Yeah we bought this place.
KT- When did the Meadows open up?
LC- I think probably in the mid 60's.
KT- So there were very few houses then?
LC- Yeah. What happened is okay my-what do you call my, the man I lived with since 1970 but we're not married, what do you call-my significant other. Okay. He came, he's a carpenter, and he came here to build. By the way he built that house and this house and I also have a house in Hawaiian Homestead you know. And I was thinking maybe I should take you down there for the interview maybe it would be closer for you but then I thought oh well, never mind because over here is okay.
KT- So Hawaiian Homes is Waiehu?
LC- The first one, in fact I'm the founder of the first one where you see all the owner builders.
KT- I applaud you because it's a good stopping point for many young families to get going and put their lives and their finances together.
LC- But that is how I met Everett you know in 1995.
KT- Oh, and that's what put you into your present employment?
LC- Oh no, no I worked over here 20 years already, yeah.
KT- But you had a close relationship with him.
LC- Through that. Let me start because it seems like you're jumping around because be go in chronological order then I feel better I'm okay. I was born in in Honolulu, you want the year?
KT- So where is that?
LC- in Honolulu in Palama.
KT- Okay.
LC- Okay and we lived there until my mom decided to sell and we moved up to Kaimuki, okay father had died already. And so we moved up to Kaimuki and from Kaimuki her and tutu had a hukihuki thing because they both went how do you say together in a house, buying together-partnership. And so they got into an argument and so mama sold her half out and then we moved to Nanakuli. So I did not know, I went into a culture shock, it was very bad. It made me feel very, very emotional.
KT- Describe that.
LC- A culture shock? Oh boy.
KT- Well, from your perspective, why was it a culture shock?
LC- Because when we moved to Nanakuli we didn't have no electricity; we used to have an outside toilet, we used newspaper for wipe your okole; and we used to have to go down to the park to go get water to wash the dishes and if you wanted to cook with the water you had to wait for that water to settle the brackish to go down.

KT- Wow it was still in that year?
LC- Yeah so that was in what…I don't know 40 something.
KT- So was that Homelands?
LC- Yeah my mother had 2 acres. And then she gave 1 acre away because it was too much and now today it's a half-acre and my brother lives on it. Buffalo Keaulana is my brother. He's very famous, he's a famous surfer in Makaha.
KT- We're smiling because we were there with him in Japan.
LC- Oh yeah!
KT- Yeah, last year.
LC- Oh, he's so sweet, he's a man of few words though.
KT- Yeah, so he brought his entire ohana I'm surprised you weren't there.
LC- No, he tells me to go keep his wife company but wala'au nui(talk a lot) so I just don't.
KT- I've known him since Hokule'a.
LC- Oh yes that's right he was one of the first guys yeah. My brother and I are very close, we really love each other.
KT- So he hung on to be staying there…
LC- Yeah he's on my mother's property. And in '70 something Austin-his name is Austin(my significant other) came here to build a house for-maybe you know him Bill Crabtree. He was a teacher at Maui High School. His house is the second to the last when you're coming in over there. So he said, and we lived in Makaha on the beach we had a house on the beach but he said, "You want to come to Kihei? You want to come it's really nice over here." I said, "Whatever for! The kids don't-we don't want to move." He said, "No it's just like Makaha. It's dry, plenty kiawe trees, and the water is very pristine. It's really nice, you'll love it and there's air, plenty air comes from the Kula mountain." So I said, "Well I'll try it." So summertime I came and it was summer but it was nice and as long as you were in the shade it was nice and cool. So then I talked to the kids and of course they didn't want to come because you know when you're settled yeah born and raised they didn't want to. But anyways, eventually they did come and we have been here ever since and they all love it and I have to give him a lot of credit because… Because of his carpentry I have what I have today and he has been a big part of our family. But for myself I decided to go into politics because I'm the chairman of the Union at our hotel. And like I said it's been 20 years there and I got involved in politics that way through the Union. Then I found out that without politics you can be turned down, I mean you know you just have to, I mean politics is why you have your job, you know. And so I thought I would get involved that way. I tried OHA but I was very inexperienced, I just said well you know let's give it a try and see what happens and of course nothing happened. But I went to Nanakuli and everybody was there for me you know because of my brother. Anyway it didn't- it was just like a phase of like a beginning of getting into politics and then I think it was a few years later when the Union asked me to run and put my name out because Nishiki was going to be against me anyway. So he said if you got your name out and the following year I could run because Michelle Anderson was-we didn't know at the time that she was going to take his place. If you have to erase stuff you can you know. I don't know how you do that but…
KT- Whatever you say and you feel it's okay, it's going to come like that.
LC- Okay. And so when I was out there holding signs and putting out brochures and the Union helped me a lot, and because you know we're special interest I mean everybody's special interest. They like to say they're special interest groups, every group is a special interest group,

it doesn't matter where you come from if you're in a group you're special interest. Um, but when I was running…
KT- So may I now ask you some things that I would like to see get on this interview?
LC- Okay.
KT- So you're here representing you as a special interest group but I'm going to pose it this way as a Kanaka maoli-as a Hawaiian. Therefore, it behooves us, Kimokeo and I to ask you the kind of questions that would relate to how you feel about the ʻaina that you are kind of your kuleana because you're a participant in this aina. So going to that again we are getting information from people about this place. So culturally, what have you picked up that is significant in this ahupua'a, in Honuaula that you have learned or you have experienced?
LC- For one thing, in Honuaula my tutu owned 80 acres from Ulupalakua down.
KT- Oh, okay so who is this?
LC- This is Annie Wilcox. And that is William daughter and my tutu is Maholeokalani she was one of the princess' that he married. And the reason I know that is because Mr. Purdy, years ago when they used to have rodeos- he, I rode a horse with him and he showed me where the acreage was and it is in Honuaula as you come down from Ulupalakua. But my uncle sold it he's, you know, whatever. But at that time Kihei was nothing just bald, just nothing. In fact when we moved here it was only the road. That's all the developer put in here was the road and then the land, you know it was going for super cheap. So anyways, culturally…
KT- So just for information sake, because Kimokeo and I are doing what we're doing we are coming across many significant sites of settlements from ancient times. So you came during the time, your ohana came during the time that it didn't appear like there was too much here but there was really a lot…
LC- But when you went to look you saw a lot within.
KT- There is, there is. So it's okay from what you've said but I'm just trying to put history together for this report that your timeframe if you weren't able to just look in front of you and just see things. Now we're working in Mākena, they're cutting back all the kiawe and people are saying, "Oh my gosh." And you should go, you should go where the golf course is and what we're pulling out of there.
LC- Yeah I see. I heard that Kimo was up there.
KT- Yeah, he and I are. That's where I'm going after because he and I are partners.
LC- Yeah I know you are and I knew he was moving the rocks but I didn't…
KT- They were moving the rocks for Maluaka but he just gave me an update and now they're not going to move it from above the golf course which is F9 they call that but now we're further south and there is some amazing cultural stuff…
LC- Further south, yeah. But there was a lot from Puʻuolai all the way up coming around. You know there's a lot it was very, very populated there were thousands of people living there.
KT- Right, villages, villages galore.
LC- Yeah it was villages, you know, mountain and fish so that I know from my tutu.
KT- So did tutu talk to you about it?
LC- Oh yeah, in fact the word Mākena she said that has no real meaning because Mākena was the name of a Captain that owned a ship and the Hawaiian people liked him and he was an Irishman. So that's where the word Mākena came from but it was Captain Mākena.
KT- So I wonder if that's where Mākena came from too, you know.

LC- Yeah I think so, Captain Mākena. But I don't, you know I'm not a historian or whatever so I can't follow up but most of us Hawaiian stuff we go by word of mouth, nothing is really on palapala.(paper)
KT- So that's a very important point you made in why we do these kind of cultural interviews because written word by non-Hawaiians they don't get the depth or the feel of the people so they never captured. And even though it's generations down because it's passed down like how you're pointing out-one word out of you, in my eye's, would be more valuable than tons of writings from others who just try to look at surface.
LC- Well I'm one of those too. But I think my age can tell you that there's a lot of things that I know that this generation doesn't know and that's what you're probably after.
KT- Right. So reflect upon what you've heard, what people were saying about this significant place.
LC- Yeah my mom-my tutu talked about Ulupalakua and how they used to, they were the gardeners or the ones that had the fruit or whatever and they would trade with the fishermen in Mākena because Mākena was a very progressive fishery, I mean that's where you got the fish from. So that's where the trade was, the taro patch, the loi's and stuff like that in those days. And I think that people had to eventually leave because of the volcano when the lava came down and everything was dispersed. The little things that my tutu told me, or my mother told me, is just about that except I think because my tutu had a- I think, I know of four uncles: Fred Wilcox, Edward Wilcox, Paul Wilcox and another Wilcox but they were all my mother's brothers. And she was a girl and at 15 years old my tutu pulled her and went to live in Honolulu because there was nothing here for them. So myself, I don't know that much about Maui because I wasn't born and raised here I only know what my mother and my tutu told me. As far as Honuaula and them doing the research and stuff like that I admire Kumu Tau'a for doing that and bringing enlightenment to us the people. Because when I look out there I only see bushes, you know, I don't see anything else but they walk the area and they can speak about the area because they know about the cultural stuff that I don't know because I'm more modern.
KT- But Lehua, kupuna.
LC- Tell me where you want me to go now because I'm drifting.
KT- The tidbits that we have discussed really will be valuable. For example…
LC- Okay dad, thank you for the OFF because I told him to get OFF because the flies was around the place.
KT- (Laughter) She's so modern here.
LC- I am, I am modern and it's hard for me because I don't hang around- you know I don't hang around you guys. You see when I was raised in Nanakuli my Uncle Tommy Hiona was a kumu hula, you ever heard of him?
KT- Of course.
LC- Okay, he was a hula teacher and he lived with my tutu on Emma Street in Honolulu and we used to be afraid because he would chant, you know they do hula chants and for us when you're little and you hear that kind of stuff you get scared and you run away.
KT- So during that lifetime you're no different than me growing up here in Kula. When I started hearing the…(chanting sounds) it was chicken skin spooky.
LC- Exactly.
KT- But now because information has gotten down and we've learned what it is the fear is removed because knowledge takes away fear.

LC- Yeah, and it does and it gives you the confidence. You know because for me it reminds me, if you were to do a chant it would remind me and it just covers your body you know. Because for some reason or other something like that happened.
KT- Here is a question: Maui Meadows now is a quaint neighborhood of... you know how many people live in Maui Meadows?
LC- No.
KT-Can we venture that there might be 200 homes or more?
LC- Oh, even more than that.
KT- Okay so let's go up a couple of hundred. From that amount and that number anywhere from 200-500...
LC- When we moved here there was only about 40 houses.
KT- Okay. So do you know of any other Hawaiian families that live here?
LC- To be honest, no.
KT- Okay, you don't know and you don't see, right?
LC- No.
KT- Again that's very significant.
LC- I see there might be a Filipino-there's filipino's here but I have not seen or met because I'm thinking as the roads go. Johanna, you know Johanna? I don't think she is...is she Hawaiian?
KT- I'm not sure.
LC- Johanna Amorin, I think she's Filipino but she belongs to the Kaahumanu ladies so she must have some Hawaiian. Yeah that't the only one that I know of.
KT- How old is she?
LC- I think she's my age maybe younger.
KT- You see her around?
LC- Well because we're with the Kaahumanu ladies, the club.
KT- If there's a chance that you come into contact can you let me know if she'd be interested in doing what we're doing because we're gathering information.
LC- Oh sure, she's like me. In fact she was on the planning commission. Yeah and that was her last year and she's very involved in community stuff. I am a part of the committee on aging so there's a lot of things that we enact things for the kupuna mostly for their safety and well being.
KT- So you are at retirement age, why are you still working?
LC- Because I want to.
KT- Which is another attitude which is non-Hawaiian because Hawaiian would prefer not to be working, right?
LC- Yeah that's true, that's not a Hawaiian thing. Umm, and the other non-Hawaiian thing is I never took care of my grandchildren because I was a working mother. I would baby sit once and a while or something like that and he would watch the kids or something because he was working. And I used to tell my kids you're allowed to have only 2 each-any of you have any more than that I disown you. I have 5 children, they each have 2 kids but one disobeyed me but she had 2 boys then she had a girl so I forgave her. (Laughing) But it was because I have 5 children and I had to take care of them by myself and I knew what it was like, hard times yeah. I know what it is to be without and I know how it is to have and I misquoted myself to you when I said I know how to be poor and I know how to be rich. But I know how to have and I know what is have not. In Nankuli when we first moved there it was like a have not and but you cope with it, you know. I mean you do, you go down the beach you pick up opihi, limu you pick up lipoa, you know. And then my brother would catch manini and any kind of fish and bring it

home you know just whatever to eat. You don't have it nowadays, my kids don't have it: you know Ina, you know ina-wana,(urchin) you know those, well you're from Kula so I don't know if you know that.
KT- Of course, I should have brought it for you!
LC- All the old stuff, you know, and there's no one except that when my son in-law or daughter or whoever go to Hana then they'll bring out some opihi from the people, that kind of stuff. And I know all the old, you know the limu and things like that but my kids-well only this one, this is my keokeo one you know. And my mother, when she was alive, would take her to the beach in Makaha and they would go and pick up limu and she knows about that kind of stuff but the other ones weren't interested. And then my boys go spear fishing and...
KT- So you don't walk the beaches over here?
LC- I did at one time but now my legs...
KT- So when you were going what types of environment plans...
LC- You really want me to say?
KT- Well, you don't have to tell me where but...
LC- No, no not where but I walked the trail from Marriott now, the one used to be called Intercontinental.
KT- Yeah.
LC- And all the way to Kea Lani, they have a sidewalk over there and it's been there for years. But do you know that the reefs are dead?
KT- Yup.
LC- It's just completely, it's all pink and you see little or maybe ina in the little rocks and that's it but the rest is just 'um, it's not there. And then when I was running for office I went to look at the reefs and the law is that after every 15,000 or 1,500 feet there was supposed to be a gateway or a trail to the ocean. In Mākena they block it all you can't-they block you don't know where it is they take the sign down. But I was able to go into this place in this yard sort of because this Hawaiian boy was working on a house behind and then the haole guy threw me out and said I didn't belong there. But what it is is the house is like almost close to the ocean and there's a law that you're supposed to be so many feet back but this house was almost close to the water. But it's on a flag lot and then I found out that that's what they do, they gate their homes because they don't want you to know that they have swimming pools even that's right close to the ocean. If you were on a boat you could probably see it from the outside but that's how it is in Mākena right now when you see the houses that are gated you already know that something in there is not supposed to be. But as far as Honuaula and cultural things I believe, Tau'a, that with you and Kimo going there and finding these things that I never saw or actually I never was really into it because ever since my tutu and my mother's gone I never went into the Hawaiiana because my uncle- we spoke Hawaiian- I always remember You know that kind of things or else little things like that if you remember but if you speak I'll catch a word or two from it and then I'll know, you know. Like when I took the elders up to the golf course to see where Everette was going to rezone and I think Kimo was surprised because I said, and he looked at me like that, you know, because he was talking about a heiau over there and he was telling the one old lady said she had to use the bathroom and so I didn't know, you know, how do you say-shall I say it or should...So then I thought of my Hawaiian and then he understood and then he said, "Okay the bathroom is over there." So I politely cut into his testimony or whatever he was talking about. But I was very happy to be involved with old folks because they have a lot of history. You know when I was little in my home, or when I went to visit my tutu or my uncles house or my tutu's house in

those days it's so strange because Maui people when I speak to them for instance Akahi (who wants to be the king) he said oh his mother used to tell him go outside because they didn't want him to learn Hawaiian. That is absolutely a no, no where I come from. Our parents wanted us to learn to speak because the po'e(people) came and told us you couldn't, you ban the language right they didn't want you to but my family was, they were very cultural. My uncle still did the dance, he didn't-he wasn't disobeying but he still kept his culture and my mother and my tutu and my aunts used to all speak Hawaiian in the living room, wherever. If they didn't want you to hear what they were saying they would say, they would tell you what is the word-your young ears are not, you're not supposed to be here.
KT- Kuli ka pepeiao. I know, I need to work on my Hawaiian, Kumu...:O
LC- Yes and they would tell you to please leave the room but it wasn't because they didn't want to teach you Hawaiian. They spoke Hawaiian and then they spoke to you Hawiaian and then they expected you to speak back. I mean that was the way it was even though the po'e came here and said, you know you're not supposed to use that language. In our household my mother and my grandmother still spoke Hawaiian and wanted us to do it because they used to call it mother tongue they never called it the language or olelo Hawaii. It was always your mother tongue, "You learn to speak your mother tongue." That was my mother's words and when, if they were in the living room talking, or we used to call it the parlor remember those days? Umm, if I came in the front door you have to bend down and make sure and say kalamai because they cannot block your eyesight. If I'm talking to Tau'a right now my grandchild is supposed to bow down and say excuse me until he was out of sight. That was the kind of culture that I was brought up in it was all about respect. There's something else but mostly I remember respect and my kids, I have raised them the same way, it's all about respect-respect your elders and that was the strictest.
KT- So how do you see that applying to respecting..
LC- The land.
KT- Here, especially the area that we're talking about from Kilohana to Wailea Ike.
LC- To me Tau'a my personal opinion is I never was into that kind of stuff because Hawaiian Homes was given the kaka lands, you know the kukai lands, you couldn't plant on it because that what it was about. If you couldn't plant sugarcane on it, it wasn't worth it. Just like now Waiohuli, you couldn't plant pineapple and sugarcane and that's why the Hawaiians have but now they're million dollar estates up there. So I never really went into looking at the land culturally until I came here because in Nanakuli I already knew that there was bad lands, you know you couldn't plant you had to bring in dirt if you wanted that kind of stuff. But I didn't know anything about cultural until I came here and the things that you and Kimo are doing is very important in a sense that that's all we have left. So if you want to keep that as sacred, whether it was just a house before that was on there or anything, it's significant of the past and so if we can hold it then that's the right thing to do and that's what I believe. And I believe that very strongly because that's all we have. You took my language away; once you take my language away you take my culture away. I never taught my kids Hawaiian because...
KT- Where did you learn what you just said because it's been repeated now in this era by those who are teaching language and culture? But did you grow up with that philosophy?
LC- No I didn't grow up with it I grew up with the culture.
KT- Just that idea that just came out of your mouth.
LC- When you lose your language you lose your culture?
KT- Right.

LC- Where did I hear it?
KT- It's something that you just adopted recently.
LC- To me it's just common sense, yes.
KT- Well I'm glad because there are many kupuna of the past have said that and I just want to keep reinforcing that the reader of this report or if it's an oral report will be hearing it.
LC- Will be?
KT- Will be hearing what you've just said. So we've extended our stay here but are there any other things that you want to say.
LC- I don't know what do you want me to say?
KT- I think you've said very valuable things that we will include into the report but the question is anything else that is related to this particular area that we're researching.
LC- I think, Tau'a, like what you said, what you and Kimo are doing is a blessed-even in a sense that you are taking time out in your life to do something like that for the future of our children to learn and to know that there are or there once was remnants of our past. And that to me is wonderful because I never came close to that kind of stuff and that's what I mean when I say that I'm very modern. You know when a Hawaiian like when they have those, how do you say, those yeah when they fight and they always grumble here and they grumble there and they want to be in the Hawaiian kingdom and they want to be this and that. When you walk from Kula down to Wailuku-when you walk; when you own (or when you have because we never owned anything) when you have a lo'i and you're working your taro patch; when you go in the water and you catch the fish the way the old folks did *then* you can tell me that you're a part of that society of the way that it used to be. But down come to me and hold a flag upside down and ride by in your car and have a television and have electricity in your home because that's where I know what poor was. That's what made me more of a Hawaiian because of the way that we lived at that time to see that okay now we have to go and pick the ulu from the tree; we have to go look for the mountain apple and we have to plant what we need to here when we were in Nanakuli. You may say that that was poor, I was poor living that way but that was a way of life of survival and there was, when you really think about it now, it was nothing because it's just the way that you had to live and there's nothing wrong with that. Maybe my kids would be ashamed if they had to bring their kids home or their friends home because there's the haves and the have-not's or whatever but I didn't look at that but I'm glad that I went through a life of that kind of living and then now here I am. So when you come to me or when I hear these clubs that, "Oh Lehua, you gotta sign here you want to be the Hawaiian Kingdom or you want to be this or whatever." I don't believe that anymore unless you show me that you are truly one. Because to me Tau'a you are Hawaiian I tell you why because you speak the language and you are doing everything within your lifestyle within your position to bring some of the past back to us. Even me talking to you I have some past, I'm sorry if I'm not bringing enough of it but I'm so happy that you're doing this because children have to know what their kupuna's went through. Some people maybe had a harder life than me because I was born right after the war and I remember my mother put me under the sewing machine, you know the kind with the paddle, so that when the bomb come I'll be okay underneath the sewing machine. And I saw the bombs and the flairs and stuff and my brother Bruff went on the roof and my mother got mad because the warden came and the warden came he had that black thing on his arm with a flashlight and he said, "You get down." You know all that kind of stuff and those were the days and I lived through all of that but you know of forget it. You live day by day and nowadays I think people live day by day because they have to live check by check and I'm just fortunate that I don't have to work but I want to work

because it keeps my mind sharp. If I stay home, what I going pull weeds? Forget it I'm not gonna! But I still eat poi and I eat sardines and it's really strange because-why is it that we're all into cans? After the war we started canned sardines and the corned beef and all that but yet our forefathers had raw fish. You know you caught from the ocean and the ina and wana and I still remember that but yet we still had spam and corned beef and I just wondering if that came from out of the war?
KT- Yes it did and those are killers so that's why our people are dropping.
LC- Diabetes and all of that. But thank you so much for even thinking about me Tau'a. It makes me feel like gee, what does he want? What does Tau'a want with me because I have no significance, I'm not nobody special but I am outspoken and I do fight for what I think is right.
KT- That's the Hawaiian way of just comfortably saying without being ho'o- that you like life and you've enjoyed life.

APPENDIX I.

Traffic Impact Analysis Report

TRAFFIC IMPACT ANALYSIS REPORT
PI'ILANI HIGHWAY WIDENING
WAILEA, MAUI, HAWAII

FINAL

July 21, 2009

Prepared for:

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TRAFFIC IMPACT ANALYSIS REPORT
PI'ILANI HIGHWAY WIDENING
Wailea, Maui, Hawaii

FINAL

Prepared for

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July 21, 2009

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AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

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FINAL

TRAFFIC IMPACT ASSESSMENT REPORT

PIILANI HIGHWAY WIDENING

Wailea, Maui, Hawaii

I. INTRODUCTION

This report documents the findings of a traffic study conducted by Austin, Tsutsumi & Associates, Inc. (ATA) to evaluate the traffic impacts along Piilani Highway between Kilohana Drive and Wailea Ike Drive. This assessment is based upon the traffic impacts resulting from proposed developments in the vicinity of Piilani Highway between Kilohana Drive and Wailea Ike Drive.

A. Background

The developers of Honuaula, Wailea Resort and Makena Resort have reached an agreement with the State of Hawaii Department of Transportation (SDOT) to widen Piilani Highway from two-lanes to four-lanes between Kilohana Drive and Wailea Ike Drive. Hereinafter, the Piilani Highway Widening shall be referred to as Project.

B. Location

The stretch of Piilani Highway that is being widened is an approximate 1.5 mile long stretch along the southern shore of Maui with the terminus of Piilani

Highway in the Wailea Resort. The following subdivisions border the Piilani Highway Widening:

- Maui Meadows Subdivision and the proposed Honuaula (formerly known as Wailea 670) development to the east.
- Wailea Resort to the west.

Figure 1 shows the location of the studied segment of Piilani Highway that will be widened.

C. Study Methodology

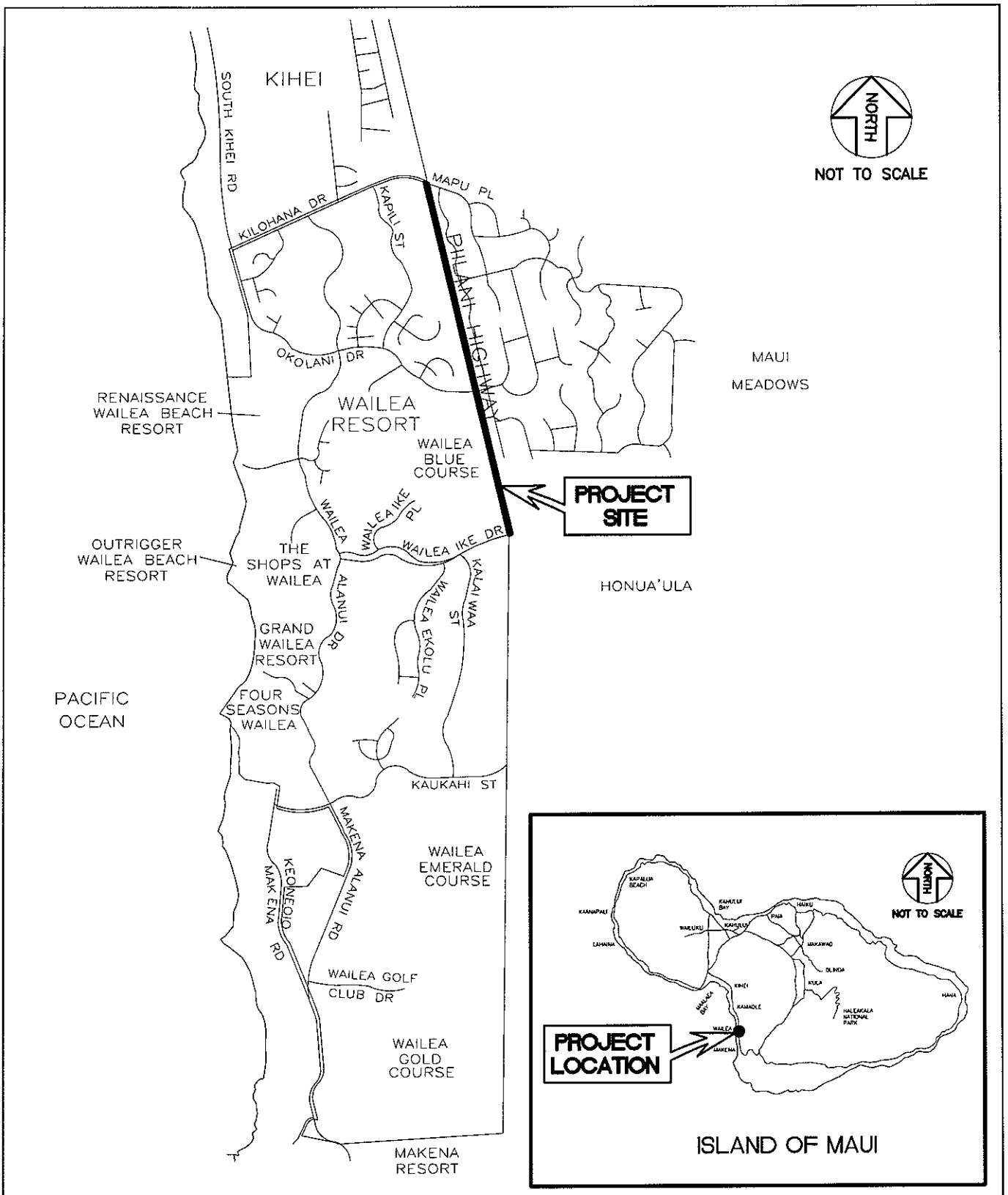
This study will address the following:

1. Existing traffic operating conditions at key intersections within the study area.
2. Traffic Projections for Year 2016 and 2022 includes traffic generated by an annual defacto growth rate consistent with the Maui Travel Demand Forecasting Model and known developments in the vicinity of the Project. These known developments in consideration are projects within Honuaula, Wailea Resort, and Makena Resort that are currently under construction or are known new/future developments that are expected to affect traffic demand and operations within the study area.
3. Identify potential traffic conditions for Year 2016 projected traffic without the Piilani Highway Widening, Year 2016 and 2022 with Piilani Highway Widening.
4. Recommendations for roadway improvements or other mitigative measures, as appropriate, to reduce or eliminate the adverse impacts resulting from traffic generated by the surrounding developments.

II. EXISTING CONDITIONS

A. Roadway System

The following are brief descriptions of the existing roadway network in the vicinity of the Project:



PIILANI HIGHWAY WIDENING

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, HAWAII

FIGURE 1

LOCATION MAP

Piilani Highway - is generally a four-lane, undivided, north/south State arterial highway providing access to Kihei and Wailea from areas north of Kihei. Piilani Highway narrows to a two-lane highway at its intersection with Kilohana Drive/Mapu Place until its terminus at Wailea Ike Drive. Piilani Highway begins at its intersection with South//North Kihei Road and ends at its intersection with Wailea Ike Drive, with provisions to extend the highway further south. Left-turn storage lanes are generally provided at major intersections on Piilani Highway. The posted speed limit on Piilani Highway is generally 40 miles per hour (mph). The speed limit on Piilani Highway is 45 mph in the northbound direction from Wailea Ike Drive to Kilohana Drive; the southbound speed limit on this segment decreases from 45 mph to 25 mph as it approaches Wailea Ike Drive.

Kilohana Drive - is a two-lane, undivided, east/west roadway that connects South Kihei Road with Piilani Highway, intersecting Piilani Highway across Mapu Place, which provides the north access to Maui Meadows residential subdivision. The posted speed limit on Kilohana Drive is 25 mph.

Mapu Place – is a two-lane, undivided, east/west roadway that provides one of two access points from Piilani Highway to Maui Meadows residential subdivision. The posted speed limit on Mapu Place is 25 mph.

Okolani Drive - is a four-lane, divided, east/west roadway between South Kihei Road and Wailea Alanui Drive. Okolani Drive narrows to a two-lane undivided roadway east of Wailea Alanui Drive to its intersection with Piilani Highway directly across of Mikioi Place. The posted speed limit on Okolani Drive is 30 mph.

Mikioi Place – is a two-lane, undivided, east/west roadway that provides one of two access points from Piilani Highway, across Okolani Drive, to Maui Meadows residential subdivision. The posted speed limit on Mikioi Place is 25 mph.

Wailea Ike Drive - is a four-lane, divided, east/west County collector roadway that narrows to a two-lane roadway just before its connection to Piilani Highway. Wailea Ike Drive is the main entrance to the Wailea Resort and connects Piilani Highway with Wailea Alanui Drive. Its vertical alignment is a relatively steep

grade with a posted speed limit of 30 mph. Wailea Ike Drive, from its intersection with Wailea Ekolu Place to Wailea Alanui Drive, has a major drainage channel in its median area.

B. Study Intersections

Piilani Highway/Kilohana Drive/Mapu Place - forms a signalized cross-intersection. The lane configuration at each approach is as follows:

- Northbound approach: Striped as an exclusive left-turn lane and a shared through/right-turn lane.
- Southbound approach: Striped as an exclusive left-turn lane, a through lane and an exclusive right-turn lane.
- Eastbound approach: Striped as a shared left-turn/through lane and an exclusive right-turn lane.
- Westbound approach: Striped as a shared left-turn/through lane and a channelized right-turn lane. However, during observations, the westbound approach operates as a shared left-turn/through lane and an exclusive right-turn lane.

Piilani Highway/Okolani Drive/Mikioi Place - forms a two-way stop-controlled cross-intersection with Okolani Drive and Mikioi Place as the stop-controlled approaches. The lane configuration at each approach is as follows:

- Northbound and southbound approaches: Striped as an exclusive left-turn lane, a through lane, and an exclusive right-turn lane.
- Eastbound and westbound approaches: Striped as a shared left-turn/through lane and an exclusive right-turn lane. However, during observations, the westbound approach operates as a shared left-turn/through lane and an exclusive right-turn lane.

Piilani Highway/Wailea Ike Drive – does not have any intersection control and provides the following lane configuration at each approach:

- Southbound approach: Striped as an exclusive free right-turn lane.

- Eastbound approach: Striped as an exclusive free left-turn lane.

Figure 2 shows the existing roadway system and the existing lane configuration at the study intersections.

C. Existing Traffic Volumes

The following are the study intersections, in which data was collected:

- Piilani Highway/Kilohana Drive/Mapu Place (Signalized)
- Piilani Highway/Okolani Drive/Mikioi Place (Unsignalized)

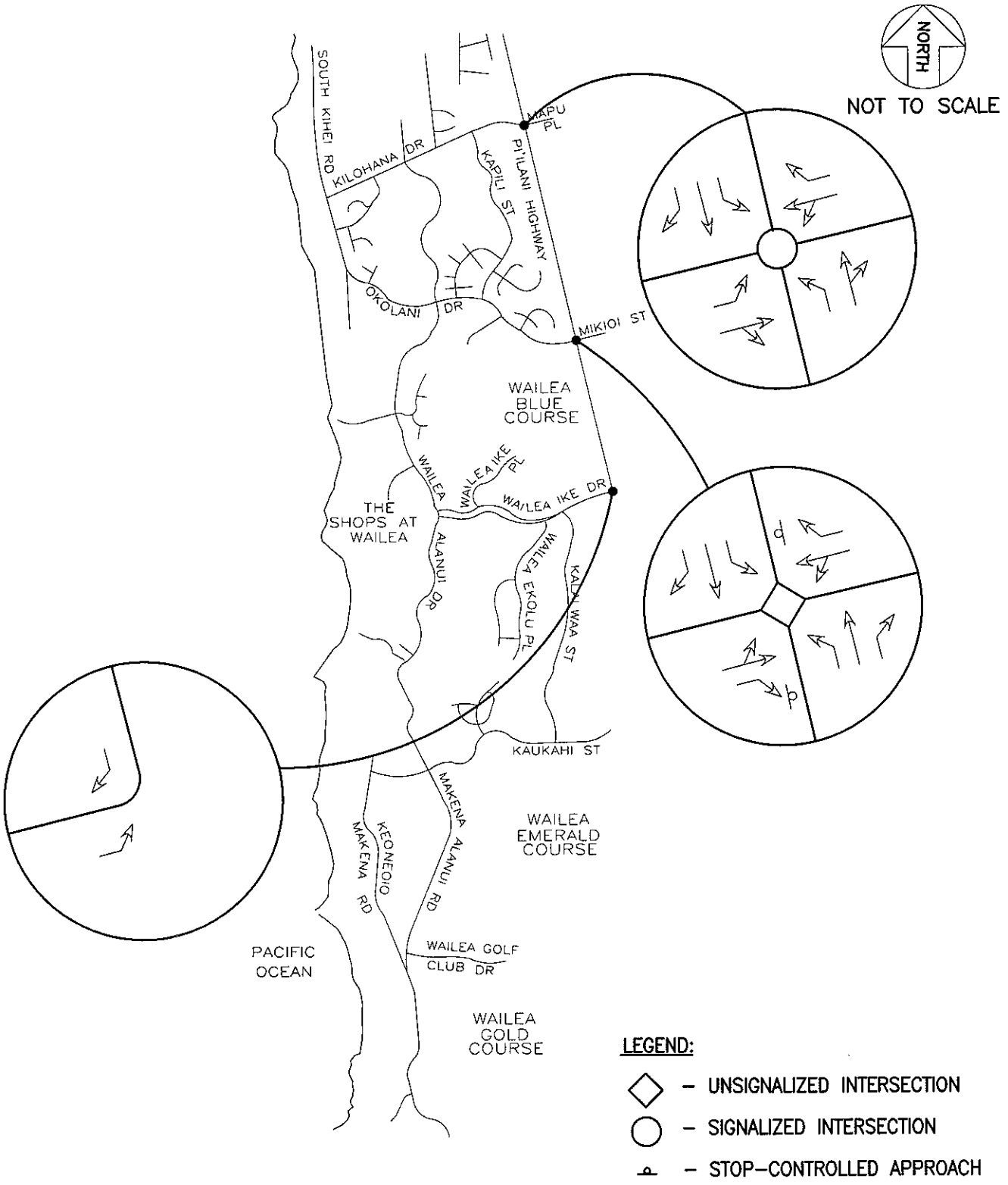
The AM and PM Peak hour turning movement data utilized in this report were collected on Tuesday June 24, 2008 and Wednesday June 25, 2008. Based on traffic count data, the peak hours of traffic were determined to be from 7:00 AM to 8:00 AM and 4:00 PM to 5:00 PM on the weekdays. Traffic count data was not collected at the Piilani Highway/Wailea Ike Drive because existing volumes at this intersection are free flowing through volumes only. The traffic count data is provided in Appendix A.

D. Existing Traffic Conditions Analysis and Observations

Level of Service (LOS) is a qualitative measure used to describe the conditions of traffic flow at intersections, with values ranging from free-flow conditions at LOS A to congested conditions at LOS F. The Highway Capacity Manual – Special Report 209 (HCM), dated 2000, methods for calculating volume to capacity ratios, delays and corresponding Levels of Service were utilized in this study. LOS definitions for signalized intersections are provided in Appendix B.

Methodology

Analysis for the study intersections were performed using the traffic analysis software Synchro, which is able to prepare Highway Capacity Manual (HCM) reports. The reports contain quantitative delay results, as based on intersection lane geometry, signal timing, and hourly traffic volume.



PIILANI HIGHWAY WIDENING

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
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FIGURE 2

EXISTING LANE CONFIGURATION

Field Observations

The general paths vehicles utilize when traveling between areas north of Wailea and south in Makena are Piilani Highway, Wailea Ike Drive, and Wailea Alanui Drive. Therefore, the Wailea Alanui Drive/Wailea Ike Drive intersection turning movement volumes are the higher volumes.

During the AM peak hour of traffic, queuing was observed on the northbound through movement at the Piilani Highway/Kilohana Drive/Mapu Place intersection, however, all vehicles were able to clear the intersection within one signal cycle length. During the PM peak hour of traffic, the northbound and southbound through movement volumes were noticeably higher than the AM Peak hour of traffic at the Piilani Highway/Kilohana Drive/Mapu Place intersection. The through traffic at this intersection was higher, but experienced little delay, with vehicles clearing the intersection within one signal cycle.

The eastbound and westbound volumes at the Piilani Highway/Okolani Drive/Mikioi Place intersection remained fairly low with no more than 3 vehicles queued at the stop sign.

Results of Intersection Analysis

The analysis and observations described below are based on prevailing conditions during the time at which the data was collected. Hereinafter, observations that are expressed as ongoing and current shall represent the conditions that prevailed at the time at which the data was collected.

Piilani Highway/Kilohana Drive/Mapu Place

At the signalized intersection of Piilani Highway/Kilohana Drive/Mapu Place, all movements operate overall at LOS D or better during the AM and PM peak hours of traffic.

Piilani Highway/Okolani Drive/Mikioi Place

At the unsignalized intersection of Piilani Highway/Okolani Drive/Mikioi Place, the eastbound left-turn movement operates at LOS F during the PM peak hour of traffic due to minimal gaps in the northbound and southbound approaches. However, as a condition of the Kai Malu Development, a traffic

signal is proposed at the Piilani Highway/Okolani Drive/Mikioi Place intersection to alleviate the eastbound left-turn delay. All other movements operate at LOS D or better during the AM and PM peak hours of traffic.

Figure 3 shows the existing traffic volumes and LOS at the study intersections.

III. FUTURE TRAFFIC FORECAST

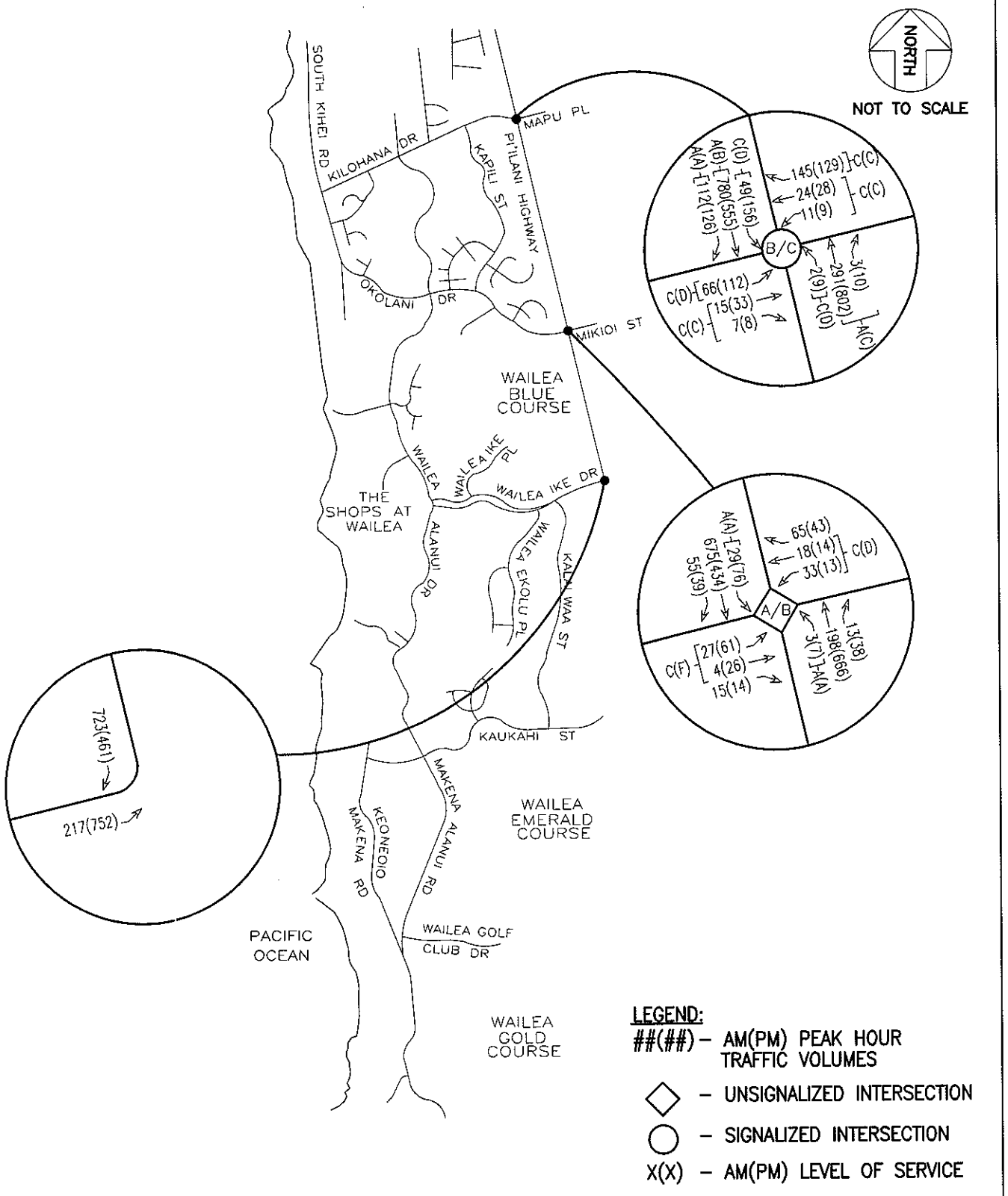
The Year 2016 was selected to reflect the completion year of Phase I of Honuaula which includes the creation of a tee-intersection at the Piilani Highway/Wailea Ike Drive intersection. Year 2022 was selected to reflect the full build-out of known developments in the vicinity of the Project. Traffic projections were formulated by applying a defacto growth rate and trips generated by known developments in the vicinity of the Project.

A. Defacto Growth Rate

The growth rate of an area is the percentage by which an area will grow over a period of time. The Maui Travel Demand Forecasting Model was utilized to determine a defacto growth rate in the vicinity of the Project. Since Honuaula, Wailea Resort, and Makena Resort are the main projects proposed in the Wailea/Makena area, data from the Maui Travel Demand Forecasting Model was adjusted to project growth excluding these three projects. The results from the Maui Travel Demand Forecasting Model show a defacto growth rate of approximately 0.5 percent per year. Therefore, a defacto growth rate of 4.0 percent for Year 2016 and 7.2 percent for Year 2022 was applied to existing traffic volumes.

B. Traffic Forecasts for Known Developments

Peak hour vehicular trips were estimated by applying appropriate trip generation rates from the Trip Generation, 8th Edition, published by the Institute of Transportation Engineers (ITE) and the Resort Residential Trip Generation Rate Development prepared by Parsons Brinkerhoff Quade & Douglas, Inc. dated October 2, 2006 as accepted by the SDOT, (herein after referred to as PB resort rate). Vehicular trips generated from the known developments were



PI'ILANI HIGHWAY WIDENING

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, HAWAII

FIGURE 3

EXISTING CONDITIONS
TRAFFIC VOLUMES AND LEVELS OF SERVICE

distributed to the roadway network based on distribution obtained from the Maui Travel Demand Forecasting Model.

Honuaula is generally comprised of the area east of Piilani Highway and Wailea Ike Drive, south of Maui Meadows Subdivision and north of Makena Road. By Year 2016, Honuaula proposes to construct 26,000 square feet of Office Space, 74,000 square feet of Commercial space, 75 Multi-Family Affordable Units, 158 Multi-Family Market Rate Units, 40 Multi-Family Townhouse Units, and 127 Single-Family Units. By Year 2022, Honuaula proposes to construct an additional 375 Multi-Family Affordable Units, 42 Multi-Family Luxury Units, 60 Multi-Family Townhouse Units, and 273 Single-Family Units. Table 1 shows the proposed development for Honuaula. An estimation of the percentage of internal trip capture was obtained from the ITE Trip Generation Handbook, Second Edition, which was determined to be approximately 15 percent. The internal trip capture was only applied to the PM peak hour of traffic since commercial areas are typically closed during the AM peak hour of traffic. The 15 percent internal trip capture rate was applied to the number of residential trips and the result was applied to the commercial trips, in order to match the number of internal trips traveling between the residential areas and commercial areas. Internal trips are assumed within Honuaula.

Wailea Resort is generally comprised of the area west of Piilani Highway, north of Makena Road, east of Makena Ala Nui Road and the Pacific Ocean, and south of Kilohana Drive. Currently, Wailea Resort has constructed most of its parcels. By Year 2016, the Wailea Resort proposes to construct 12,000 square feet of Grocery space, 30,850 square feet of Retail space, 12,200 square feet of Office space, 8,340 square feet of Restaurant space, 64 Multi-Family Units, and 234 Single-Family Units. By Year 2022, the Wailea Resort proposes to construct additional 100 Multi-Family Units. Table 2 shows the proposed development on the remaining parcels of Wailea Resort.

Table 1 Proposed Development for Honua'ula		
Land Use	**Units**	**Quantity**
Year 2016		
VMX (Office Building)	SF GFA	26,000
VMX (Commercial)	SF GFA	74,000
MF Affordable	DU	75
MF Luxury	DU	158
MF Townhouse	DU	40
SF Lots	DU	127
Year 2022		
MF Affordable	DU	375
MF Luxury	DU	42
MF Townhouse	DU	60
SF Lots	DU	273
TOTAL VMX (SF GFA)		100,000
TOTAL RESIDENTIAL (DU)		1150

DU = Dwelling Units
SF = Single-Family
MF = Multi-Family
VMX = Village Mixed Use
SF GFA = Square Feet of Gross Floor Area

Table 2 Proposed Development on the Remaining Parcels of The Wailea Resort		
Land Use	**Units**	**Quantity**
Year 2016		
SF-8 (SF Affordable Units)	DU	95
MF-6 (SF Lots)	DU	57
MF-10 (SF Lots)	DU	10
MF-10 (Condominiums)	DU	36
MF-10 (Grocery)	SF GFA	12,000
MF-10 (Retail)	SF GLA	30,850
MF-10 (Office)	SF GFA	12,200
MF-10 (Restaurant)	SF GFA	8,340
MF-16 (SF Units)	DU	18
MF-7 (MF Units)	DU	75
SF-S (SF Lots)	DU	38
SF-11 (SF Lots)	DU	16
MF-15 (MF Lots)	DU	72
MF-12/13/SF-7A (MF Units)	DU	300
MF-12/13/SF-7A (Hotel Rooms)	ROOMS	60
MF-12/13/SF-7A (Retail)	SF GLA	20,000
MF-9 Hoolei (MF Units)	DU	120
MF-8 Kai Malu (MF Units)	DU	153
Wailea Gateway (Specialty Retail)	SF GLA	32,000
Grand Wailea Resort Renovations	ROOMS	310
Wailea Blue Golf Club (Shopping Center)	SF GLA	23,000
Wailea Blue Golf Club (18-Hole Golf Course)	HOLES	18
1 Resort & Residences, Wailea (Hotel Rooms)	DU	290
1 Resort & Residences, Wailea (Condominiums)	DU	40
Year 2022		
Business I (MF Units)	DU	100
Business 2 (Storage)	SF GLA	50,000
Business 2 (Office)	SF GLA	40,000
TOTAL DWELLING UNITS (DU)		**1,150**
TOTAL RESORT HOTEL UNITS		**640**
TOTAL COMMERCIAL/BUSINESS (SF GFA & GLA)		**228,390**

DU = Dwelling Units
SF = Single Family
MF = Multi Family
SF GFA = Square Feet of Gross Floor Area
SF GLA = Square Feet of Gross Leasable Area

Within the Wailea Resort, some individual parcels were under construction at the time of data collection or existing developments that are proposed to be renovated.

- Under construction were the Kai Malu (MF-8) and Wailea Gateway Projects. Since traffic studies for these Wailea Resort developments were completed, trip generation volumes and distribution were obtained from the Traffic Impact Analysis Report for Wailea MF-8, dated May 13, 2004 and the Traffic Impact Analysis Report for Wailea Gateway, dated March 6, 2006, both prepared by Phillip Rowell and Associates. Since the data collection efforts, both projects have been completed. Kai Malu (MF-8) is located south of Okolani Drive, east of Wailea Alanui Drive, and west of Piilani Highway, with access from Okolani Drive. Kai Malu (MF-8) proposed to construct 153 multi-family units. Wailea Gateway is located on the northwest corner of the Piilani Highway/Wailea Ike Drive intersection with access from Wailea Ike Drive. Wailea Gateway proposed to construct 32,000 square feet of commercial space to be utilized by businesses, restaurants, and retail shops.

- The existing Grand Wailea Resort proposes to renovate two existing restaurants, construct 310 additional hotel rooms, an additional bar, a new cultural center and garden, and additional parking spaces by Year 2016. The Grand Wailea Resort is located south of the Shops at Wailea, east of the Pacific Ocean and west of Wailea Ala Nui Drive. Trip generation volumes and distribution were obtained from the Traffic Impact Report for the Grand Wailea Resort Renovation, dated January 2009, prepared by Wilson Okamoto Corporation.

- The 1 Resort & Residences (formerly Renaissance Wailea Resort) proposes to redevelop the existing 349 hotel units to provide 290 resort hotel units and 40 residential condominium/townhouse units by Year 2016. The 1 Resort &

Residences is located north of Wailea Elua, east of the Pacific Ocean, south of Wailea Ekahi, and west of Wailea Alanui Drive. At the time of data collection, the former Renaissance Wailea Resort parcel remained vacant and therefore, trip generation volumes for the proposed redevelopment were obtained from the Traffic Impact Report 1 Resort & Residences, Wailea, dated March 2009, prepared by Wilson Okamoto Corporation.

- The existing Wailea Blue Golf Course, currently located off of Kaukahi Street, proposes to relocate the existing clubhouse, and provide approximately 8,000 square feet of commercial space, 10,000 square feet of office space, and 5,000 square feet of restaurant space by Year 2016. The Wailea Blue Golf Course clubhouse and additional commercial/office/restaurant space is proposed to be located at the southeast corner of the Wailea Alanui Drive/Wailea Ike Drive intersection, near the existing Matteo's Restaurant.

Makena Resort is comprised of the area east of the Pacific Ocean and south of Makena Road. By Year 2016, Makena Resort proposes to construct 312 Multi-Family Luxury Units and 87 Single-Family Luxury Units. By Year 2022, Makena Resort proposes to construct additional 167 Multi-Family Luxury Units and 283 Single-Family Luxury Units. Table 3 shows the proposed development for Makena Resort.

Table 4 shows the Known Developments Land Uses and Trip Generation for Year 2016 and Table 5 shows the Known Developments Trip Generation Rates for the known developments which utilized the ITE Trip Generation, 8th Edition and PB resort rates.

Table 3 Proposed Development for Makena Resort		
Land Use	**Units**	**Quantity**
Year 2016		
M-2/M-3 (SF Resort)	DU	28
M-4 (MF Resort)	DU	29
M-5 (MF Resort)	DU	110
M-7 (MF Resort)	DU	35
M-9 (MF Resort)	DU	10
M-12 (MF Resort)	DU	54
S-5 (SF Resort)	DU	1
S-6 (SF Resort)	DU	40
Hotel (MF Resort)	DU	44
Maluaka (SF Resort)	DU	13
Maluaka (MF Resort)	DU	2
H-2 (SF Resort)	DU	6
H-2 (MF Resort)	DU	28
Year 2022		
M-5 (MF Resort)	DU	22
M-6 (MF Resort)	DU	69
M-8 (MF Resort)	DU	12
M-9 (MF Resort)	DU	13
S-2 (SF Resort)	DU	17
S-4 (SF Resort)	DU	22
S-7 (SF Resort)	DU	4
M-1 (SF Resort)	DU	9
M-10 (MF Resort)	DU	31
M-11 (MF Resort)	DU	20
S-1 (SF Resort)	DU	90
S-3 (SF Resort)	DU	28
U-1 (SF Resort)	DU	113
TOTAL RESIDENTIAL (DU)		850

DU = Dwelling Units

SF = Single Family Homes

MF = Multi Family Homes

Table 4
Known Development's Land Uses and Trip Generation in Year 2016

	AM PEAK HOUR			PM PEAK HOUR		
	IN	OUT	TOTAL	IN	OUT	TOTAL
YEAR 2016 WAILEA RESORT *						
SF-8	20	57	77	64	37	101
MF-6	13	37	50	41	23	64
MF-10	118	98	216	207	242	449
MF-16	6	17	23	15	8	23
MF-7	8	34	42	33	15	48
SF-S	10	27	37	28	16	44
SF-11	6	15	21	14	7	21
MF-15	7	33	40	31	15	46
MF-12/13/SF-7A	49	118	167	227	174	401
MF-9	11	49	60	47	23	70
Wailea Blue Golf Club	72	34	106	140	149	289
SUBTOTAL	**320**	**519**	**839**	**847**	**709**	**1556**
YEAR 2016 MAKENA RESORT **						
M-2/M-3	8	5	13	7	6	13
M-4	3	4	7	4	6	10
M-5	10	15	25	18	20	38
M-7	4	4	8	5	7	12
M-9	2	1	3	1	3	4
M-12	5	7	12	9	10	19
S-5	1	0	1	1	0	1
S-6	12	7	19	10	9	19
Hotel	4	6	10	7	8	15
Maluaka	5	2	7	3	4	7
H-2	5	5	10	6	7	13
SUBTOTAL	**59**	**56**	**115**	**71**	**80**	**151**
YEAR 2016 HONUA'ULA ***						
VMX (General Office Building)	57	7	64	19	89	108
VMX (Commercial)	100	62	162	303	313	616
MF Affordable Housing	8	34	42	33	15	48
MF Townhouse	5	20	25	20	9	29
SF Detached Housing	35	24	59	30	29	59
MF Luxury Villas	15	21	36	28	26	54
SUBTOTAL	**220**	**168**	**388**	**433**	**481**	**914**
YEAR 2016 TOTAL	**599**	**743**	**1342**	**1351**	**1270**	**2621**

* Wailea Resort Trips generated by these developments were estimated by applying appropriate rates contained in the Institute of Transportation Engineers, Trip Generation, 8th Edition.

** Makena Resort Trips generated by these developments were estimated by applying Parsons Brinckerhoff's (PB) 2006 single-family and multi-family resort residential trip rates.

*** Both ITE Trip Generation Rates and PB rates were used to generate trips

Note: Does not include trips generated by Kai Malu Project (MF-8), Wailea Gateway, Grand Wailea Resort Renovations and 1 Resort & Residences, Wailea. Volumes obtained by Traffic Studies.

Table 5
Known Development's Trip Generation Rates

Land Use	Independent Variable (X)	Average Daily Weekday Rate	AM Peak Hour of Traffic		PM Peak Hour of Traffic	
			Rate	% Entering	Rate	% Entering
Single-Family Detached Housing (ITE Land Use 210)	DU	Ln(T) = 0.92Ln(X) + 2.71	T = 0.70(X) + 9.74	25%	Ln(T) = 0.90Ln(X) + 0.51	63%
Residential Condominium/Townhosue (ITE Land Use 230)	DU	Ln(T) = 0.87Ln(X) + 2.46	Ln(T) = 0.80Ln(X) + 0.26	61%	Ln(T) = 0.82Ln(X) + 0.32	67%
Supermarket (ITE Land Use 850)	1000 SF GFA	Ln(T) = 66.95Ln(X) + 1391.56	3.59	63%	10.5	51%
Retail (ITE Land Use 814)	1000 SF GFA	Ln(T) = 42.78Ln(X) + 37.66	Ln(T) = 4.91Ln(X) + 115.59	48%	Ln(T) = 2.40Ln(X) + 21.48	44%
General Office Building (ITE Land Use 710)	1000 SF GFA	Ln(T) = 0.77Ln(X) + 3.65	Ln(T) = 0.80Ln(X) + 1.55	88%	Ln(T) = 1.12Ln(X) + 78.81	17%
Restaurant (ITE Land Use 932)	1000 SF GFA	127.15	11.52	52%	11.15	59%
Shopping Center (ITE Land Use 820)	1000 SF GFA	Ln(T) = 0.65Ln(X) + 5.83	1.00	61%	Ln(T) = 0.67Ln(X) + 3.37	49%
Mini-Warehouse (ITE Land Use 151)	1000 SF GFA	Ln(T) = 1.01Ln(X) + 0.82	0.15	59%	Ln(T) = 1.02Ln(X) - 1.49	51%
Office Park (ITE Land Use 750)	1000 SF GFA	T = 10.42(X) + 409.04	T = 1.37(X) + 124.36	89%	T = 1.22(X) + 95.83	14%
Golf Course (ITE Land Use 430)	HOLES	35.74	2.23	79%	2.78	45%
Multi-Family Resort Residential * (PB Trip Generated Rate)	DU	N/A	0.22	40%	0.34	49%
Single-Family Resort Residential * (PB Trip Generated Rate)	DU	N/A	0.46	58%	0.46	50%

DU = Dwelling Units
SF GFA = Square Feet of Gross Floor Area
T = Number of Trip Ends
X = Independent Variable

Source: Institute of Transportation Engineers, Trip Generation, 8th Edition.
Source: * Parsons Brinckerhoff's 2006 single-family and multi-family resort residential trip rates.

C. Planned Roadway Project

As a condition for the development of the Kai Malu Project (MF-8) the Piilani Highway/Okolani Drive/Mikioi Place intersection will be signalized and the eastbound approach will be restriped to provide an exclusive left-turn lane and a shared through/right-turn lane. At the time of the data collection efforts, the Kai Malu Project was under construction. Since then, construction has been completed and some of the units have recently been occupied.

III. TRAFFIC CONDITIONS AND ANALYSIS

A. Year 2016 WITHOUT Project Traffic and Analysis

Since it is a condition of the Kai Malu Project (MF-8), it is assumed that the signalization and re-striping of the Pi'ilani Highway/Okolani Drive/Mikioi Street intersection will be completed by Year 2016. The following are conditions of the study intersections due to the defacto growth rate and known developments.

Piilani Highway/Kilohana Drive/Mapu Place

With a defacto growth rate of 0.5 percent per year along Piilani Highway and the known developments in the vicinity of the Project, the Piilani Highway/Kilohana Drive/Mapu Place signalized intersection will operate at LOS F and over capacity conditions. Currently, Piilani Highway is a four-lane roadway and narrows to a two-lane roadway at the Piilani Highway/Kilohana Drive/Mapu Place intersection where it remains as a two-lane roadway to its terminus at Wailea Ike Drive.

Piilani Highway/Okolani Drive/Mikioi Street

The Piilani Highway/Okolani Drive/Mikioi Street signalized intersection southbound through movement will operate at LOS F and over capacity conditions during the AM peak hour of traffic. During the PM peak hour of traffic, the northbound through and southbound left-turn movements will operate at LOS F and over capacity conditions.

Piilani Highway/Wailea Ike Drive

With completion of Honuaula Phase I, the east leg of the Piilani Highway/Wailea Ike Drive intersection will be constructed forming a tee-

intersection, with Piilani Highway being the stem of the tee. Due to a high southbound right-turn (1210 and 880 during the AM and PM peak hour of traffic, respectively) and eastbound left-turn (525 and 1305 during the AM and PM peak hour of traffic, respectively) the intersection will warrant a traffic signal, in accordance with the HCM. However, without the Project, the signalized intersection of Piilani Highway/Wailea Ike Drive will operate at LOS F and over capacity conditions during the PM Peak hour of traffic.

Without the construction of Honuaula, the Piilani Highway/Wailea Ike Drive intersection will not require any intersection control and will have the following lane configuration:

- Southbound approach: Provide an exclusive free right-turn lane.
- Eastbound approach: Provide an exclusive free left-turn lane.

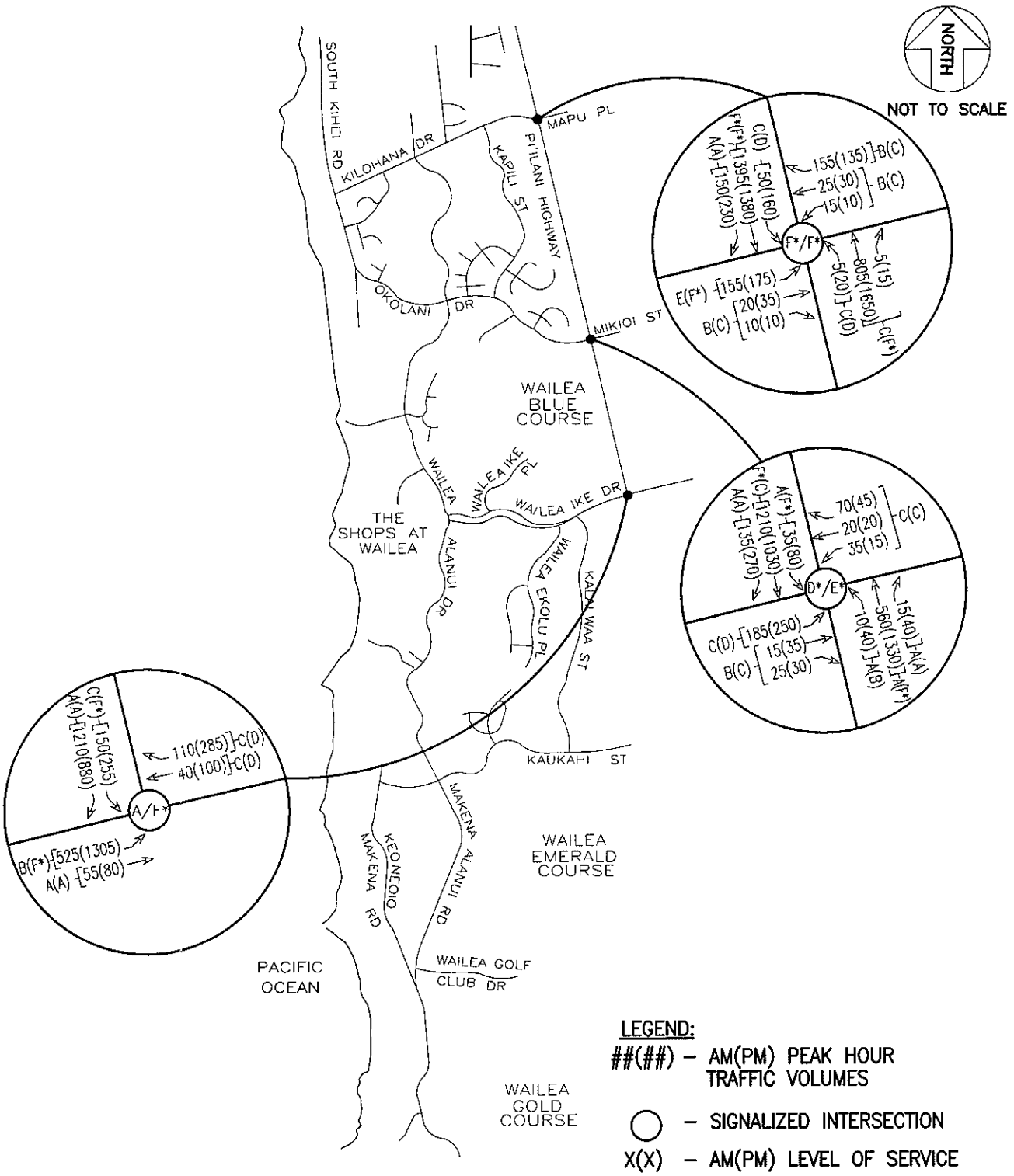
Figure 4 shows the Year 2016 Without Project Traffic Volumes and LOS at the study intersections.

B. Year 2016 WITH Project Traffic and Analysis

Since the study intersections will operate at over capacity conditions as a result of defacto growth and known developments, the Project is required by Year 2016. Therefore, the following are the recommended lane configuration at the study intersections with the Project:

Piilani Highway/Kilohana Drive/Mapu Place

- Northbound and Southbound Approaches: Provide an exclusive left-turn lane (with a protected left-turn signal phase), two exclusive through lanes, and an exclusive right-turn lane.
- Eastbound Approach: Remain as an exclusive left-turn lane and a shared through/right-turn lane (with a permissive signal phase).
- Westbound Approach: Provide a shared left-turn/through and an exclusive right-turn lane (with a permissive signal phase).



PI'ILANI HIGHWAY WIDENING

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FIGURE 4

BASE YEAR 2016 WITHOUT PROJECT
TRAFFIC VOLUMES AND LEVELS OF SERVICE

Piilani Highway/Okolani Drive/Mikioi Place

- Northbound and Southbound Approaches: Provide an exclusive left-turn lane (with a protected left-turn signal phase), an exclusive through lane, and a shared through/right-turn lane.
- Eastbound Approach: Provide an exclusive left-turn lane and a shared through/right-turn lane (with a permissive signal phase).
- Westbound Approach: Remain as a shared left-turn/through/right-turn lane (with a permissive signal phase).

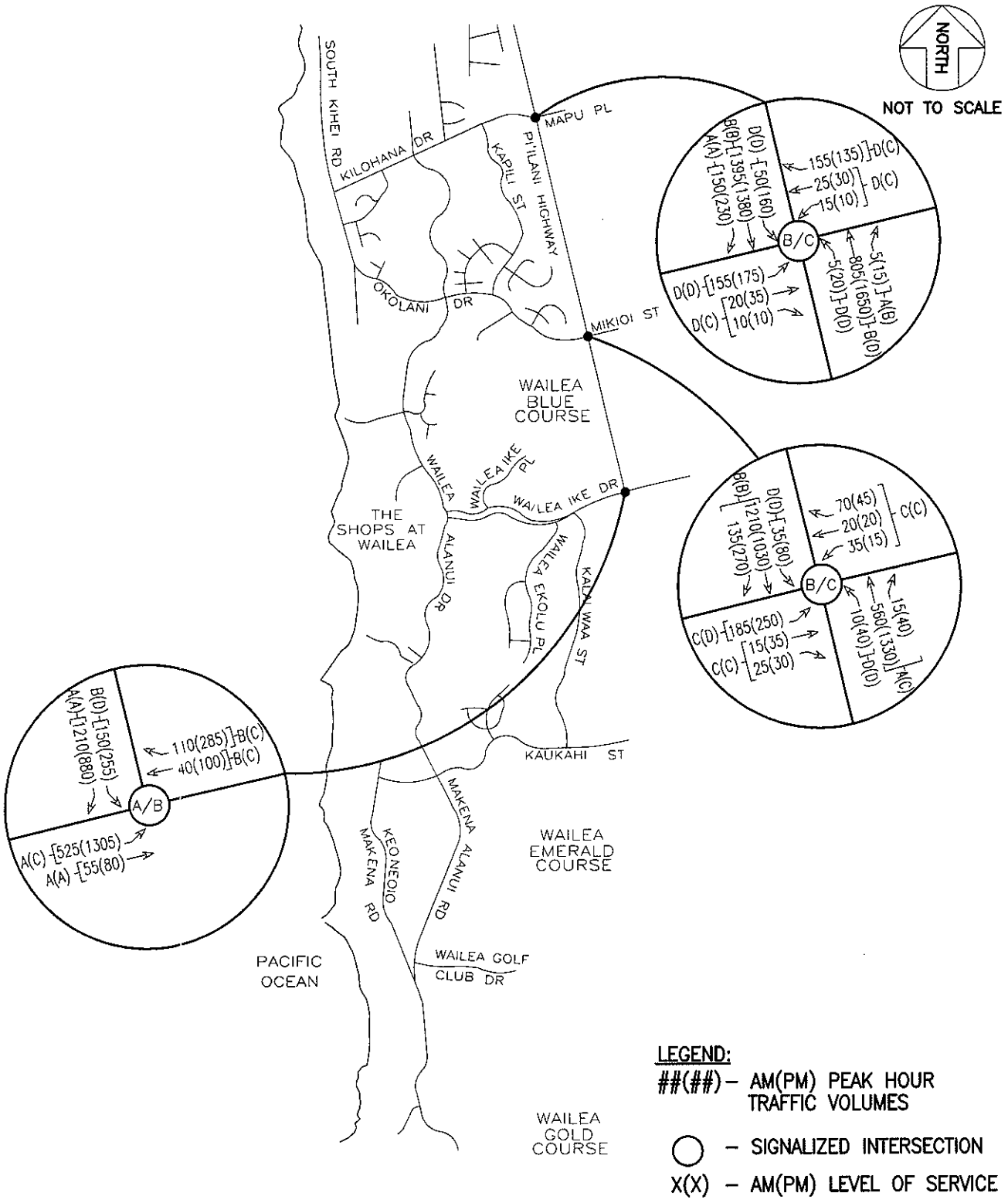
Piilani Highway/Wailea Ike Drive

- Southbound approach: Provide an exclusive left-turn lane and an exclusive right-turn lane. Allow the Piilani Highway southbound right-turn to be a free turning movement by providing an exclusive westbound receiving lane on Wailea Ike Drive.
- Eastbound approach: Provide two exclusive left-turn lanes (with a protected left-turn signal phase) and an exclusive through lane. Also, provide an acceleration lane on the north leg to accommodate two eastbound left-turn lanes.
- Westbound Approach: Provide an exclusive through lane, and an exclusive right-turn lane.

With the Project and the recommended lane configurations at the study intersections, the intersections of Piilani Highway/Kilohana Drive/Mapu Place, Piilani Highway/Okolani Drive/Mikioi Place and Piilani Highway/Wailea Ike Drive will operate at LOS D or better during both the AM and PM peak hours of traffic.

Figure 5 shows the Year 2016 With Project Traffic Volumes and LOS at the study intersections.

Appendix D shows the level-of-service summary table at the study intersections.



PI'ILANI HIGHWAY WIDENING

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FIGURE 5

FUTURE YEAR 2016 WITH PI'ILANI WIDENING TRAFFIC VOLUMES AND LEVELS OF SERVICE

C. Year 2022 WITH Project Traffic and Analysis

With the build-out of known developments in the vicinity of the Project, traffic volumes were estimated for Year 2022. Table 6 shows the Additional Known Developments Land Uses and Trip Generation for Year 2022. The following are conditions of the study intersections in Year 2022 WITH the Project:

Piilani Highway/Kilohana Drive/Mikioi Place

The eastbound left-turn and southbound left-turn movements at the Piilani Highway/Kilohana Drive/Mapu Place intersection will operate at LOS E during the PM peak hour of traffic.

Providing additional capacity for the eastbound left-turn movement (double eastbound left-turn lanes) requires improvements to provide an exclusive westbound left-turn lane and a protected left-turn signal phase (8-phase signal cycle) for the eastbound and westbound left-turn movements. However, by introducing an additional signal phase, the eastbound approach will continue to operate at LOS E conditions. Providing a split phase (6-signal phase) for the eastbound and westbound approaches will continue to operate at LOS E conditions.

The Piilani Highway/Kilohana Drive/Mapu Place intersection serves as the northern access point to the Maui Meadows subdivision which is comprised of single-family homes. As mentioned above, during the PM peak hour of traffic, the southbound left-turn movement will operate at LOS E conditions. By providing double southbound left-turn lanes, all movements will operate at LOS D or better during the PM peak hour of traffic. However, the Highway Capacity Manual (HCM) recommends that double left-turn lanes be provided where the left-turn volume exceeds 300 vehicles during the peak hour, in which, approximately 50 vehicles and 160 vehicles will utilize the southbound left-turn movement during the AM and PM peak hour of traffic, respectively. Additionally, some vehicles may opt to utilize the southbound left-turn at Piilani Highway/Okolani Drive/Mikioi Place intersection, rather than Piilani Highway/Kilohana Drive/Mapu Place, since it will be signalized. Therefore, additional improvements are not recommended at the Piilani Highway/Kilohana Drive/Mapu Place intersection.

Table 6
Additional Known Development's Land Uses and Trip Generation in Year 2022

	AM PEAK HOUR			PM PEAK HOUR		
	IN	OUT	TOTAL	IN	OUT	TOTAL
YEAR 2022 WAILEA RESORT *						
Business I	9	43	52	41	20	61
Business 2	165	23	188	27	131	158
SUBTOTAL	**174**	**66**	**240**	**68**	**151**	**219**
YEAR 2022 MAKENA RESORT **						
M-5	2	3	5	3	5	8
M-6	7	9	16	11	14	25
M-8	2	1	3	2	3	5
M-9	2	1	3	2	3	5
S-2	5	3	8	4	4	8
S-4	7	4	11	6	5	11
S-7	2	0	2	1	1	2
M-1	3	2	5	3	2	5
M-10	3	4	7	5	6	11
M-11	2	3	5	3	4	7
S-1	25	17	42	21	21	42
S-3	8	5	13	7	6	13
U-1	31	21	52	26	26	52
SUBTOTAL	**99**	**73**	**172**	**94**	**100**	**194**
YEAR 2022 HONUA'ULA ***						
SF Detached Housing	74	52	126	64	62	126
MF Market Rate Villas	5	5	10	9	7	16
MF Townhouse	8	33	41	32	14	46
MF Affordable Housing	32	153	185	147	70	217
SUBTOTAL	**119**	**243**	**362**	**252**	**153**	**405**
YEAR 2022 TOTAL	**392**	**382**	**774**	**414**	**404**	**818**

DU = Dwelling Units
SF = Single-Family
MF = Multi-Family
VMX = Village Mixed Use

* Trips generated by these developments were estimated by applying appropriate rates contained in the Institute of Transportation Engineers, Trip Generation, 8th Edition.
** Makena Resort Trips generated by these developments were estimated by applying Parsons Brinckerhoff's 2006 single-family and multi-family resort residential trip rates.
*** Both ITE Trip Generation Rates and PB rates were used to generate trips

Piilani Highway/Okolani Drive/Mikioi Place

The Piilani Highway/Okolani Drive/Mikioi Place will continue to operate at LOS D or better conditions during the AM and PM peak hours of traffic.

Piilani Highway/Wailea Ike Drive

Phase II of Honuaula proposes to form the south leg of the Piilani Highway/Wailea Ike Drive intersection, forming a cross intersection. As a part of the Honuaula Project, Piilani Highway will be extended to intersect with an extension of Kaukahi Street. The following lane configuration is recommended at the Piilani Highway/Wailea Ike Drive with the construction of the south leg:

- Northbound Approach: Provide an exclusive left-turn lane (with a protected left-turn signal phase), two exclusive through lanes, and an exclusive right-turn lane.
- Southbound Approaches: Provide two exclusive left-turn lanes (with a protected left-turn signal phase), an exclusive through lane, and an exclusive right-turn lane. Also, it is recommended that the Piilani Highway southbound right-turn to be a free turning movement by providing an exclusive westbound receiving lane on Wailea Ike Drive. It is projected that a higher volume will be utilizing the southbound left-turn movement (175 vehicles and 290 vehicles during the AM and PM peak hours of traffic, respectively) as opposed to the southbound through movement (70 vehicles and 130 vehicles during the AM and PM peak hours of traffic, respectively) during the AM and PM peak hours of traffic due to the layout of the Honuaula Project. Additionally, the HCM recommends that double left-turn lanes be provided where the left-turn volume exceeds 300 vehicles during the peak hour
- Eastbound Approach: Provide two exclusive left-turn lanes (with a protected left-turn signal phase) and a shared through/right-turn lane.
- Westbound Approach: Provide an exclusive left-turn lane (with a protected left-turn signal phase), an exclusive through lane, and an exclusive right-turn lane.

Appendix D shows the level-of-service table summary at all the study intersections.

Figure 6 shows the Year 2022 With Project Traffic Volumes and LOS at the study intersections.

D. Modern Roundabouts

Due to zoning conditions and Special Management Area conditions, the Piilani Highway/Kilohana Drive/Mapu Place, Piilani Highway/Okolani Drive/Mikioi Place, Piilani Highway/Wailea Ike Drive intersections are conditioned to be signalized intersections. Therefore, the option of modern roundabouts is not studied.

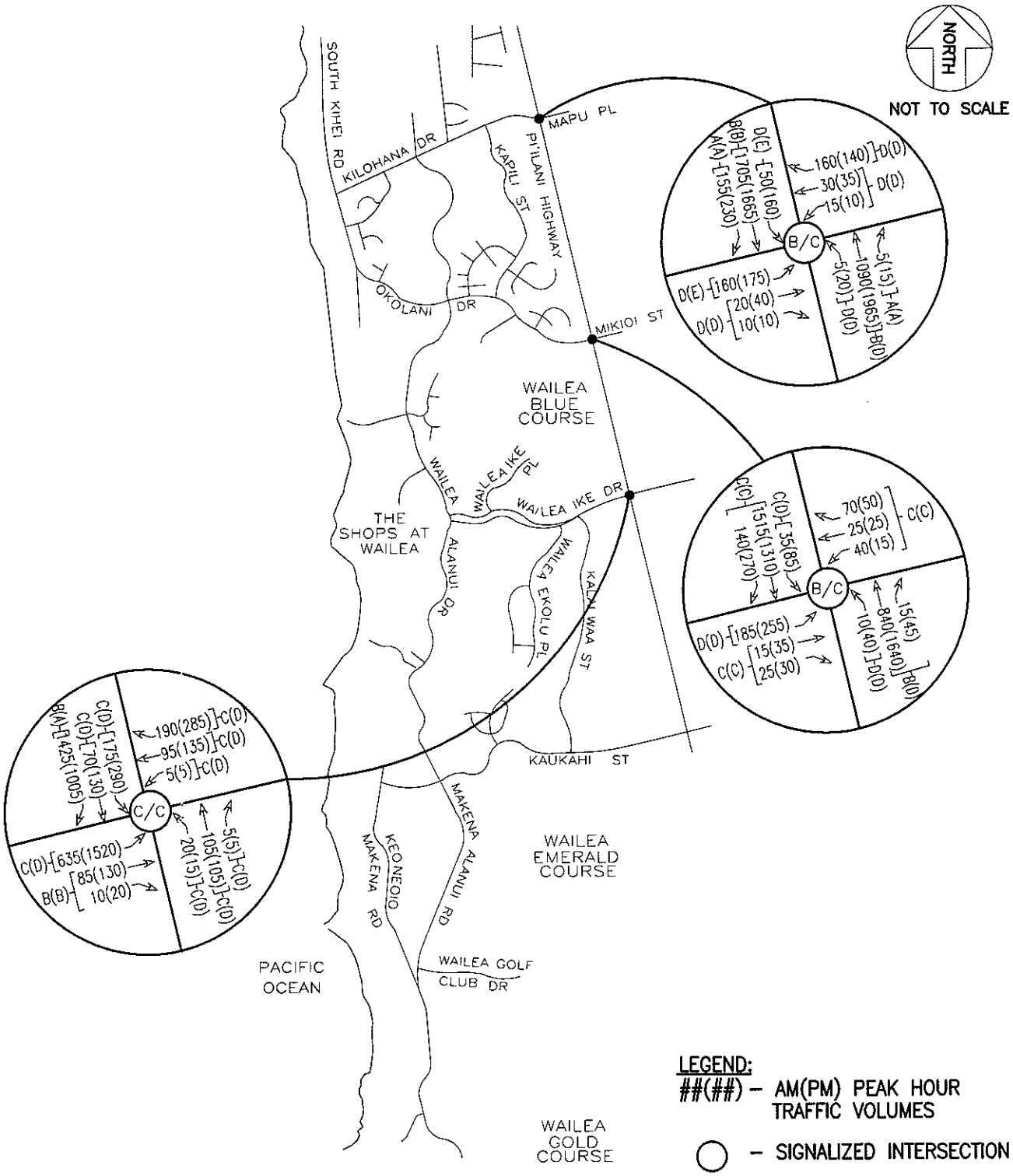
V. Summary and Recommendations

A. Summary

Honuaula, Wailea Resort, and Makena Resort reached an agreement with SDOT to widen Piilani Highway between Kilohana Drive and Wailea Ike Drive from two-lanes to four-lanes.

Existing Conditions

Field observations show that at the signalized intersection of Piilani Highway/Kilohana Drive/Mapu Place, vehicles would queue, however clear the intersection within one signal cycle length. At the unsignalized Piilani Highway/Okolani Drive/Mikioi Place intersection, approximately one to three vehicles queued on the stop-controlled approach. However, improvements to the Piilani Highway/Okolani Drive/Mikioi Place intersection is a condition for the development of the Kai Malu Project (MF-8) within the Wailea Resort. Improvements to the intersection include installation of a traffic signal system and providing the eastbound approach with an exclusive left-turn lane and a shared through/right-turn lane.



PI'ILANI HIGHWAY WIDENING

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FIGURE 6

FUTURE YEAR 2022 WITH PI'ILANI WIDENING TRAFFIC VOLUMES AND LEVELS OF SERVICE

Year 2016 WITHOUT the Project

Traffic volume projections for Year 2016 utilizes a vehicular de facto growth rate of 0.5 percent per year and traffic generated by known developments which include Honuaula, Wailea Resort and Makena Resort projects. The improvements to Piilani Highway/Okolani Drive/Mikioi Place intersection, as a result of the Kai Malu Project (MF-8), are assumed to be completed by Year 2016.

Analysis of Year 2016 traffic conditions without the project indicates that some individual movements at the Piilani Highway/Kilohana Drive/Mapu Place, Piilani Highway/Okolani Drive/Mikioi Place, and Piilani Highway/Wailea Ike Drive signalized intersections will operate at LOS F during the AM and PM peak hours of traffic. Phase I of Honuaula proposes to construct the east leg of the Piilani Highway/Wailea Ike Drive intersection, forming a tee-intersection.

Future Years with Project

Full-build out of known developments in the vicinity of the Project is anticipated by Year 2022. Analyses show that with the recommendations of this report implemented, the Piilani Highway/Kilohana Drive/Mapu Place intersection eastbound left-turn and southbound left-turn movements will operate at LOS E during the PM peak hour of traffic. However, increasing capacity on the eastbound approach will require additional traffic signal phases or split phasing on the eastbound and westbound approach which results in LOS E conditions. The Piilani Highway/Kilohana Drive/Mapu Place intersection serves as the northern access point to the Maui Meadows subdivision which is comprised of single-family homes. As mentioned above, during the PM peak hour of traffic, the southbound left-turn movement will operate at LOS E conditions. By providing double southbound left-turn lanes, all movements will operate at LOS D or better during the PM peak hour of traffic. However, the Highway Capacity Manual (HCM) recommends that double left-turn lanes be provided where the left-turn volume exceeds 300 vehicles during the peak hour, in which, approximately 50 vehicles and 160 vehicles will utilize the southbound left-turn movement during the AM and PM peak hour of traffic, respectively. Additionally, some vehicles may opt to utilize the southbound left-turn at Piilani

Highway/Okolani Drive/Mikioi Place intersection, rather than Piilani Highway/Kilohana Drive/Mapu Place, since it will be signalized.

Phase II of Honuaula proposes extend Piilani Highway to intersect with the extension of Kaukahi Street forming the south leg of the Piilani Highway/Wailea Ike Drive intersection. All other study intersections will operate at LOS D or better during the AM and PM peak hours of traffic.

B. Recommendations

The following are the recommended lane configuration and with the widening of Piilani Highway:

Piilani Highway/Kilohana Drive/Mapu Place

- Northbound and Southbound Approaches: Provide an exclusive left-turn lane (with a protected left-turn signal phase), two exclusive through lanes, and an exclusive right-turn lane.
- Eastbound Approach: Remain as an exclusive left-turn lane and a shared through/right-turn lane (with a permissive signal phase).
- Westbound Approach: Provide a shared left-turn/through lane and an exclusive right-turn lane.

Piilani Highway/Okolani Drive/Mikioi Place

- Northbound and Southbound Approaches: Provide an exclusive left-turn lane (with a protected left-turn signal phase), an exclusive through lane, and a shared through/right-turn lane.
- Eastbound Approach: Provide an exclusive left-turn lane and a shared through/right-turn lane (with a permissive signal phase).
- Westbound Approach: Remain as a shared left-turn/through/right-turn lane (with a permissive signal phase).

Piilani Highway/Wailea Ike Drive

- Without Honuaula, intersection control will not be required and the following lane configuration is recommended:
  - Southbound approach: Provide an exclusive free right-turn lane.
  - Eastbound approach: Provide an exclusive free left-turn lane.
- By Year 2016 or when access to Phase I of Honuaula is constructed:
  - With projected traffic volumes, the intersection will warrant a traffic signal, in accordance with the HCM, therefore, it is recommended to signalize the intersection.
  - Southbound approach: Provide an exclusive left-turn lane and an exclusive right-turn lane. Allow the Piilani Highway southbound right-turn to be a free turning movement by providing an exclusive westbound receiving lane on Wailea Ike Drive.
  - Eastbound approach: Provide two exclusive left-turn lanes (with a protected left-turn signal phase) and an exclusive through lane.
  - Westbound Approach: Provide an exclusive through lane, and an exclusive right-turn lane
- By Year 2022 or when Piilani Highway is extended:
  - Northbound Approach: Provide an exclusive left-turn lane (with a protected left-turn signal phase), two exclusive through lanes, and an exclusive right-turn lane.
  - Southbound Approaches: Provide two exclusive left-turn lanes (with a protected left-turn signal phase), an exclusive through lane, and an exclusive right-turn lane. Also, it is recommended that the Piilani Highway southbound right-turn

be a free turning movement by providing an exclusive westbound receiving lane on Wailea Ike Drive.

- Eastbound Approach: Provide two exclusive left-turn lanes (with a protected left-turn signal phase) and a shared through/right-turn lane.
- Westbound Approach: Provide an exclusive left-turn lane (with a protected left-turn signal phase), an exclusive through lane, and an exclusive right-turn lane.

REFERENCES

1. Institute of Transportation Engineers, Trip Generation, 8th Edition
2. Institute of Transportation Engineers, Trip Generation Handbook, and ITE Recommended Practice, 2001
3. Phillip Rowell and Associates, Traffic Impact Analysis Report for Wailea Gateway, March 6, 2006.
4. Phillip Rowell and Associates, Traffic Impact Analysis Report for Wailea MF-8, May 13, 2004.
5. Transportation Research Board, Highway Capacity Manual, 2000.
6. Wilson Okamoto Corporation, Traffic Impact Report for 1 Resort & Residences, Wailea, March 2009.
7. Wilson Okamoto Corporation, Traffic Impact Report for the Grand Wailea Resort Renovation, January 2009.

APPENDICES

APPENDIX A

TRAFFIC COUNT DATA

Austin, Tsutsumi and Associates
501 Sumner Street, Suite 521
Honolulu, Hawaii 96817
Ph: 533-3646 Fax: 526-1267

File Name : Piilani - Kilohana AM
Site Code : 00000000
Start Date : 6/25/2008
Page No : 1

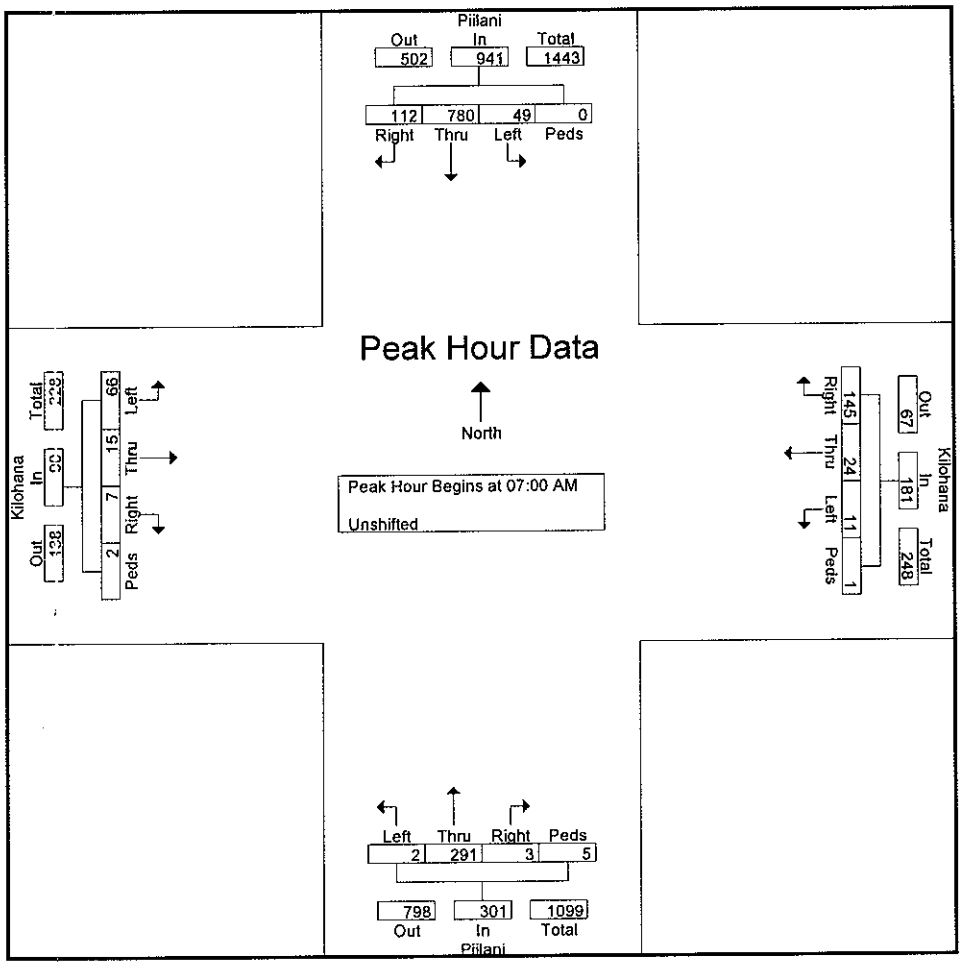
Groups Printed- Unshifted

	Piilani From North				Kilohana From East				Piilani From South				Kilohana From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:30 AM	18	155	4	0	28	2	0	0	0	73	1	4	0	1	11	2	299
06:45 AM	17	169	11	0	29	3	2	0	0	53	0	2	2	5	15	1	309
Total	35	324	15	0	57	5	2	0	0	126	1	6	2	6	26	3	608
07:00 AM	30	166	6	0	39	8	3	0	2	71	1	3	2	1	9	1	342
07:15 AM	30	198	10	0	35	7	1	0	0	76	1	0	2	5	19	0	384
07:30 AM	21	208	11	0	35	5	3	1	0	67	0	2	1	3	23	1	381
07:45 AM	31	208	22	0	36	4	4	0	1	77	0	0	2	6	15	0	406
Total	112	780	49	0	145	24	11	1	3	291	2	5	7	15	66	2	1513
08:00 AM	23	153	9	0	38	1	1	1	0	67	1	1	1	4	18	0	318
08:15 AM	13	135	23	0	39	7	3	0	3	68	0	1	3	12	21	0	328
Grand Total	183	1392	96	0	279	37	17	2	6	552	4	13	13	37	131	5	2767
Apprch %	11	83.3	5.7	0	83.3	11	5.1	0.6	1	96	0.7	2.3	7	19.9	70.4	2.7	
Total %	6.6	50.3	3.5	0	10.1	1.3	0.6	0.1	0.2	19.9	0.1	0.5	0.5	1.3	4.7	0.2	

Austin, Tsutsumi and Associates
501 Sumner Street, Suite 521
Honolulu, Hawaii 96817
Ph: 533-3646 Fax: 526-1267

File Name : Piilani - Kilohana AM
Site Code : 00000000
Start Date : 6/25/2008
Page No : 2

	Piilani From North					Kilohana From East					Piilani From South					Kilohana From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	30	166	6	0	202	39	8	3	0	50	2	71	1	3	77	2	1	9	1	13	342
07:15 AM	30	198	10	0	238	35	7	1	0	43	0	76	1	0	77	2	5	19	0	26	384
07:30 AM	21	208	11	0	240	35	5	3	1	44	0	67	0	2	69	1	3	23	1	28	381
07:45 AM	31	208	12	0	261	36	4	4	0	44	1	77	0	0	78	2	6	15	0	23	406
Total Volume	112	780	49	0	941	145	24	11	1	181	3	291	2	5	301	7	15	66	2	90	1513
% App. Total	11.9	82.9	5.2	0		80.1	13.3	6.1	0.6		1	96.7	0.7	1.7		7.8	16.7	73.3	2.2		
PHF	.903	.938	.557	.000	.901	.929	.750	.688	.250	.905	.375	.945	.500	.417	.965	.875	.625	.717	.500	.804	.932



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File Name : Piilani - Okolani AM
Site Code : 00000000
Start Date : 6/25/2008
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Groups Printed- Unshifted

	Piilani From North				Okolani From East				Piilani From South				Okolani From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:30 AM	10	147	5	0	23	1	1	0	2	46	0	1	1	2	11	0	250
06:45 AM	10	162	4	0	18	1	10	0	1	33	0	0	1	2	5	0	247
Total	20	309	9	0	41	2	11	0	3	79	0	1	2	4	16	0	497
07:00 AM	16	148	4	0	20	4	11	0	2	44	0	0	0	1	6	0	256
07:15 AM	12	155	10	0	16	6	4	0	2	50	2	0	4	0	6	0	267
07:30 AM	14	192	9	0	16	5	5	0	5	49	0	0	3	1	8	0	307
07:45 AM	13	180	6	0	12	3	13	0	4	55	1	1	8	2	7	0	305
Total	55	675	29	0	64	18	33	0	13	198	3	1	15	4	27	0	1135
08:00 AM	13	136	8	0	9	9	11	0	1	52	2	0	2	3	8	0	254
Grand Total	88	1120	46	0	114	29	55	0	17	329	5	2	19	11	51	0	1886
Apprch %	7	89 3	3.7	0	57.6	14.6	27.8	0	4.8	93.2	1.4	0.6	23.5	13.6	63	0	
Total %	4.7	59 4	2.4	0	6	1.5	2.9	0	0.9	17.4	0.3	0.1	1	0.6	2.7	0	

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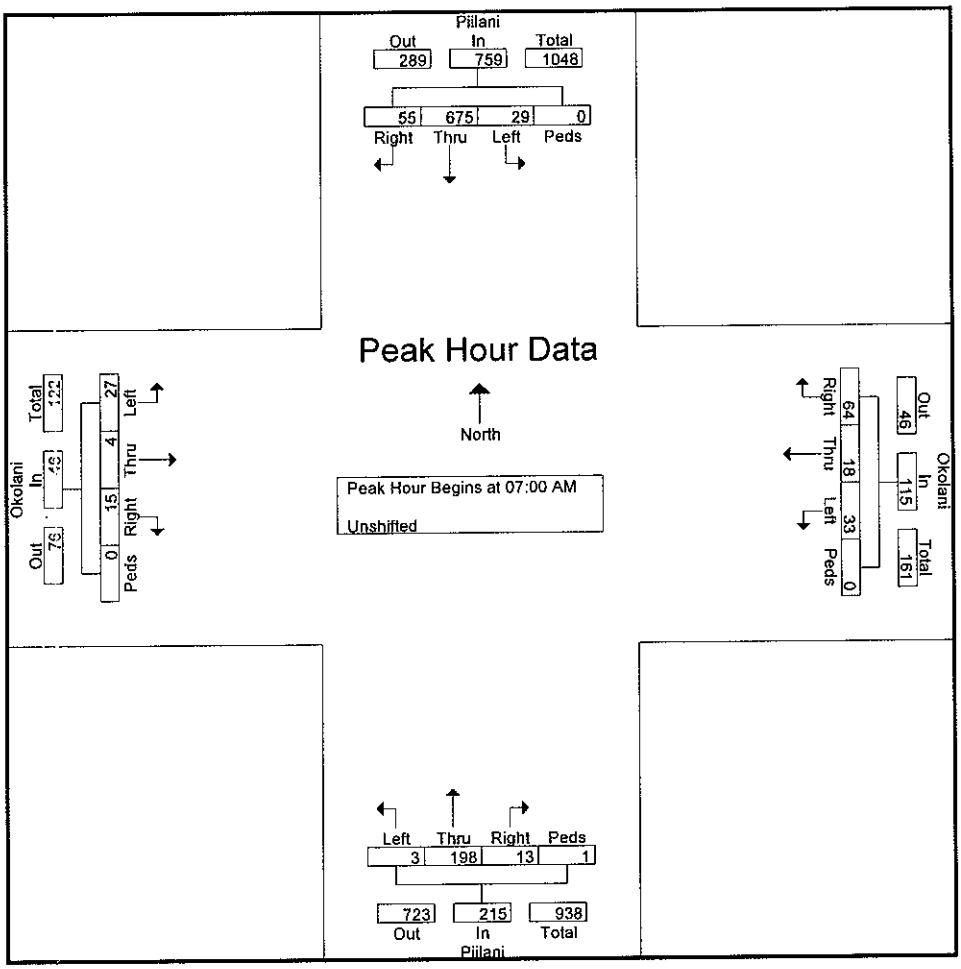
	Piilani From North					Okolani From East					Piilani From South					Okolani From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:00 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	**16**	148	4	0	168	**20**	4	11	0	**35**	2	44	0	0	46	0	1	6	0	7	256
07:15 AM	12	155	**10**	0	177	16	**6**	4	0	26	2	50	**2**	0	54	4	0	6	0	10	267
07:30 AM	14	**192**	9	0	**215**	16	5	5	0	26	**5**	49	0	0	54	3	1	**8**	0	12	**307**
07:45 AM	13	180	6	0	199	12	3	**13**	0	28	4	**55**	1	**1**	**61**	**8**	**2**	7	0	**17**	305
Total Volume	55	675	29	0	759	64	18	33	0	115	13	198	3	1	215	15	4	27	0	46	1135
% App. Total	7.2	88.9	3.8	0		55.7	15.7	28.7	0		6	92.1	1.4	0.5		32.6	8.7	58.7	0		
PHF	.859	.879	.725	.000	.883	.800	.750	.635	.000	.821	.650	.900	.375	.250	.881	.469	.500	.844	.000	.676	.924



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File Name : Piilani - Kilohana PM merged
Site Code : 00000000
Start Date : 6/24/2008
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Groups Printed- Unshifted

	Piilani From North				Kilohana From East				Piilani From South				Kilohana From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:15 PM	28	152	23	0	21	3	2	0	3	154	0	0	1	6	26	0	419
03:30 PM	26	111	21	1	22	3	1	0	4	178	5	0	3	11	30	0	416
03:45 PM	17	140	19	0	16	3	4	0	27	107	8	0	2	9	29	0	381
Total	71	403	63	1	59	9	7	0	34	439	13	0	6	26	85	0	1216
04:00 PM	19	145	38	0	27	6	3	0	2	229	2	0	4	9	31	0	515
04:15 PM	36	126	43	0	31	7	1	0	1	220	5	1	1	12	28	1	513
04:30 PM	28	117	36	1	39	8	2	0	5	190	0	0	2	5	36	0	469
04:45 PM	43	104	39	0	32	7	3	0	2	163	2	1	1	7	17	0	421
Total	126	492	156	1	129	28	9	0	10	802	9	2	8	33	112	1	1918
05:00 PM	24	104	44	0	36	9	2	0	1	190	3	0	0	9	17	0	439
05:15 PM	32	101	27	0	38	8	0	0	0	158	3	0	5	10	21	0	403
Grand Total	253	1100	290	2	262	54	18	0	45	1589	28	2	19	78	235	1	3976
Apprch %	15.4	66 9	17.6	0.1	78.4	16.2	5.4	0	2.7	95.5	1.7	0.1	5.7	23.4	70.6	0.3	
Total %	6.4	27 7	7.3	0.1	6.6	1.4	0.5	0	1.1	40	0.7	0.1	0.5	2	5.9	0	

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Start Date : 6/24/2008
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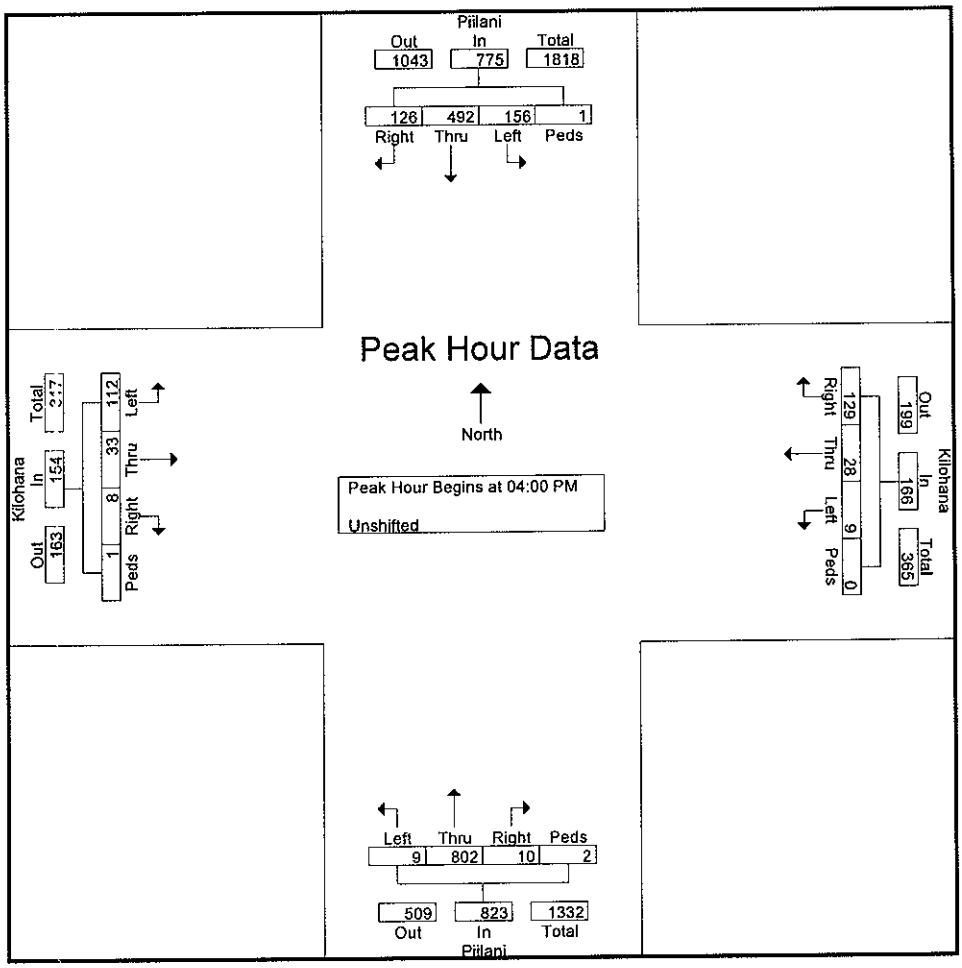
	Piilani From North					Kilohana From East					Piilani From South					Kilohana From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 04:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	19	145	38	0	202	27	6	3	0	36	2	229	2	0	233	4	9	31	0	44	515
04:15 PM	36	126	43	0	205	31	7	1	0	39	1	220	5	1	227	1	12	28	1	42	513
04:30 PM	28	117	36	1	182	39	8	2	0	49	5	190	0	0	195	2	5	36	0	43	469
04:45 PM	43	104	39	0	186	32	7	3	0	42	2	163	2	1	168	1	7	17	0	25	421
Total Volume	126	492	156	1	775	129	28	9	0	166	10	802	9	2	823	8	33	112	1	154	1918
% App. Total	16.3	63.5	20.1	0.1		77.7	16.9	5.4	0		1.2	97.4	1.1	0.2		5.2	21.4	72.7	0.6		
PHF	.733	.848	.907	.250	.945	.827	.875	.750	.000	.847	.500	.876	.450	.500	.883	.500	.688	.778	.250	.875	.931



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	Piilani From North				Okolani From East				Piilani From South				Okolani From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:30 PM	8	103	13	0	12	3	3	0	11	174	2	0	1	2	7	0	339
03:45 PM	15	123	13	0	10	1	4	0	8	152	0	0	4	4	18	0	352
Total	23	226	26	0	22	4	7	0	19	326	2	0	5	6	25	0	691
04:00 PM	13	104	25	0	13	1	1	0	17	206	2	1	3	5	16	0	407
04:15 PM	6	93	25	0	12	1	6	0	3	172	3	0	6	6	15	0	348
04:30 PM	10	97	12	1	10	8	2	0	13	167	2	0	3	6	18	0	349
04:45 PM	10	77	14	0	8	4	4	0	5	121	0	0	2	9	12	0	266
Total	39	371	76	1	43	14	13	0	38	666	7	1	14	26	61	0	1370
05:00 PM	13	69	16	0	15	4	4	0	12	172	1	0	1	3	9	0	319
05:15 PM	5	70	20	0	15	3	3	0	7	130	3	0	2	3	10	0	271
Grand Total	80	736	138	1	95	25	27	0	76	1294	13	1	22	38	105	0	2651
Apprch %	8.4	77.1	14.5	0.1	64.6	17	18.4	0	5.5	93.5	0.9	0.1	13.3	23	63.6	0	
Total %	3	27.8	5.2	0	3.6	0.9	1	0	2.9	48.8	0.5	0	0.8	1.4	4	0	

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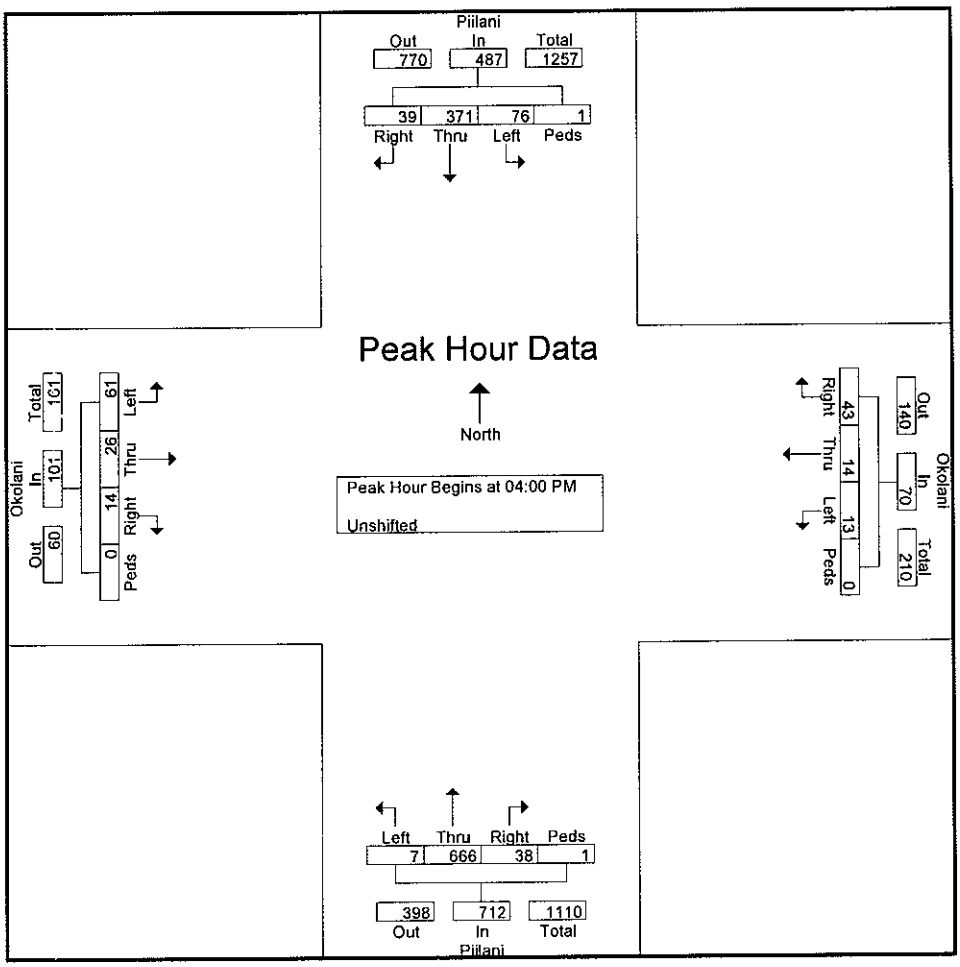
	Piilani From North					Okolani From East					Piilani From South					Okolani From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 04:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	**13**	**104**	**25**	0	**142**	**13**	1	1	0	15	**17**	**206**	2	**1**	**226**	3	5	16	0	24	**407**
04:15 PM	6	93	25	0	124	12	1	**6**	0	19	3	172	**3**	0	178	**6**	6	15	0	**27**	348
04:30 PM	10	97	12	1	120	10	**8**	2	0	**20**	13	167	2	0	182	3	6	**18**	0	27	349
04:45 PM	10	77	14	0	101	8	4	4	0	16	5	121	0	0	126	2	**9**	12	0	23	266
Total Volume	39	371	76	1	487	43	14	13	0	70	38	666	7	1	712	14	26	61	0	101	1370
% App. Total	8	76.2	15.6	0.2		61.4	20	18.6	0		5.3	93.5	1	0.1		13.9	25.7	60.4	0		
PHF	.750	.892	.760	.250	.857	.827	.438	.542	.000	.875	.559	.808	.583	.250	.788	.583	.722	.847	.000	.935	.842



APPENDIX B

LEVEL OF SERVICE CRITERIA

APPENDIX B – LEVEL OF SERVICE (LOS) CRITERIA

LEVEL OF SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS (HCM 2000)

The level of service criteria for unsignalized intersections is defined as the average total delay, in seconds per vehicle. As used here, total delay is defined as the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line; this time includes the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position. While the criteria for level of service for TWSC and AWSC intersections are the same, procedures to calculate the average total delay may differ.

Level of Service Criteria for Two-Way Stop-Controlled Intersections

Level of Service	Average Total Delay (sec/veh)
A	≤ 10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	> 50

LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS (HCM 2000)

Level of service for signalized intersections is directly related to delay values and is assigned on that basis. Level of Service is a measure of the acceptability of delay values to motorists at a given intersection. The criteria are given in table below.

Level-of Service Criteria for Signalized Intersections

Level of Service	Control Delay per Vehicle (sec./veh.)
A	< 10.0
B	>10.0 and ≤ 20.0
C	>20.0 and ≤ 35.0
D	>35.0 and ≤ 55.0
E	>55.0 and ≤ 80.0
F	> 80.0

Delay is a complex measure, and is dependent on a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group or approach in question.

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Existing Conditions

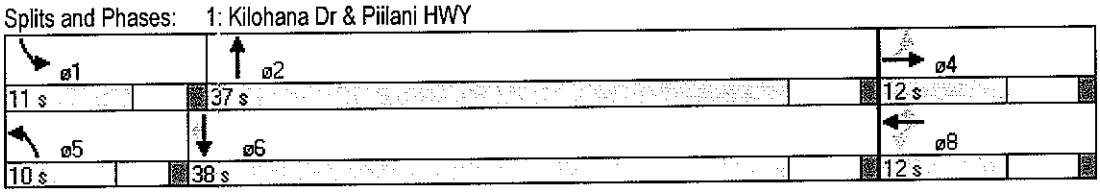
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	66	15	11	24	145	2	291	49	780	112
Turn Type	Perm		Perm		Perm	Prot		Prot		Perm
Protected Phases		4		8		5	2	1	6	
Permitted Phases	4		8		8					6
Detector Phase	4	4	8	8	8	5	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	10.0	24.0	24.0
Total Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	37.0	11.0	38.0	38.0
Total Split (%)	20.0%	20.0%	20.0%	20.0%	20.0%	16.7%	61.7%	18.3%	63.3%	63.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	Max	None	Max	Max
Act Effct Green (s)	6.7	6.7		6.7	6.7	5.7	37.3	6.5	41.6	41.6
Actuated g/C Ratio	0.12	0.12		0.12	0.12	0.10	0.66	0.11	0.73	0.73
v/c Ratio	0.45	0.11		0.20	0.49	0.01	0.26	0.26	0.62	0.10
Control Delay	34.1	20.7		26.5	10.8	24.5	7.4	27.5	9.8	1.6
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.1	20.7		26.5	10.8	24.5	7.4	27.5	9.8	1.6
LOS	C	C		C	B	C	A	C	A	A
Approach Delay		30.7		13.9			7.5		9.8	
Approach LOS		C		B			A		A	

Intersection Summary

Cycle Length: 60
Actuated Cycle Length: 56.9
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.62
Intersection Signal Delay: 11.0
Intersection Capacity Utilization 59.7%
Analysis Period (min) 15

Intersection LOS: B
ICU Level of Service B

Splits and Phases: 1: Kilohana Dr & Piilani HWY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	66	15	7	11	24	145	2	291	3	49	780	112
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.95			1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.98	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1770			1834	1583	1770	1860		1770	1863	1583
Flt Permitted	0.73	1.00			0.89	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1364	1770			1649	1583	1770	1860		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	72	16	8	12	26	158	2	316	3	53	848	122
RTOR Reduction (vph)	0	7	0	0	0	144	0	0	0	0	0	41
Lane Group Flow (vph)	72	17	0	0	38	14	2	319	0	53	848	81
Turn Type	Perm			Perm		Perm	Prot			Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8						6
Actuated Green, G (s)	5.5	5.5			5.5	5.5	1.1	37.6		4.0	40.5	40.5
Effective Green, g (s)	5.5	5.5			5.5	5.5	1.1	37.6		4.0	40.5	40.5
Actuated g/C Ratio	0.09	0.09			0.09	0.09	0.02	0.62		0.07	0.66	0.66
Clearance Time (s)	5.0	5.0			5.0	5.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	123	159			148	142	32	1145		116	1235	1049
v/s Ratio Prot		0.01					0.00	0.17		c0.03	c0.46	
v/s Ratio Perm	c0.05				0.02	0.01						0.05
v/c Ratio	0.59	0.11			0.26	0.10	0.06	0.28		0.46	0.69	0.08
Uniform Delay, d1	26.7	25.5			25.9	25.5	29.5	5.5		27.5	6.4	3.7
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.9	0.3			0.9	0.3	0.8	0.6		2.8	3.1	0.1
Delay (s)	33.6	25.8			26.8	25.8	30.3	6.1		30.3	9.5	3.8
Level of Service	C	C			C	C	C	A		C	A	A
Approach Delay (s)		31.7			26.0			6.2			9.9	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	12.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	61.1	Sum of lost time (s)	14.0
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	27	4	15	33	18	65	3	198	13	29	675	55
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	29	4	16	36	20	71	3	215	14	32	734	60
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2			2						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1028	1018	734	1021	1018	215	734			215		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1028	1018	734	1021	1018	215	734			215		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	83	98	96	82	92	91	100			98		
cM capacity (veh/h)	178	231	420	199	231	825	871			1355		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	50	126	3	215	14	32	734	60
Volume Left	29	36	3	0	0	32	0	0
Volume Right	16	71	0	0	14	0	0	60
cSH	274	479	871	1700	1700	1355	1700	1700
Volume to Capacity	0.18	0.26	0.00	0.13	0.01	0.02	0.43	0.04
Queue Length 95th (ft)	16	26	0	0	0	2	0	0
Control Delay (s)	23.9	17.8	9.1	0.0	0.0	7.7	0.0	0.0
Lane LOS	C	C	A			A		
Approach Delay (s)	23.9	17.8	0.1			0.3		
Approach LOS	C	C						

Intersection Summary				
Average Delay	3.0			
Intersection Capacity Utilization	52.2%	ICU Level of Service	A	
Analysis Period (min)	15			

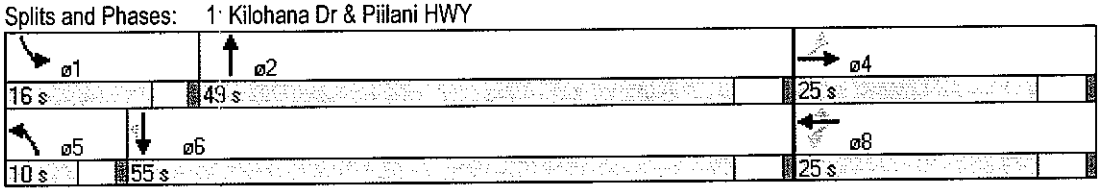
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	112	33	9	28	129	9	802	156	555	126
Turn Type	Perm		Perm		Perm	Prot		Prot		Perm
Protected Phases		4		8		5	2	1	6	
Permitted Phases	4		8		8					6
Detector Phase	4	4	8	8	8	5	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	10.0	24.0	24.0
Total Split (s)	25.0	25.0	25.0	25.0	25.0	10.0	49.0	16.0	55.0	55.0
Total Split (%)	27.8%	27.8%	27.8%	27.8%	27.8%	11.1%	54.4%	17.8%	61.1%	61.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Min	Max	Min	Max	Max
Act Effct Green (s)	12.6	12.6		12.6	12.6	5.8	44.7	11.2	50.2	50.2
Actuated g/C Ratio	0.15	0.15		0.15	0.15	0.07	0.54	0.14	0.61	0.61
v/c Ratio	0.59	0.16		0.15	0.39	0.08	0.88	0.71	0.53	0.13
Control Delay	44.1	26.2		30.9	9.0	39.4	30.0	52.4	12.4	2.0
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.1	26.2		30.9	9.0	39.4	30.0	52.4	12.4	2.0
LOS	D	C		C	A	D	C	D	B	A
Approach Delay		39.3		13.9			30.1		18.3	
Approach LOS		D		B			C		B	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 82.6
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 24.5
Intersection Capacity Utilization 76.0%
Analysis Period (min) 15

Intersection LOS: C
ICU Level of Service D

Splits and Phases: 1: Kilohana Dr & Piilani HWY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	112	33	8	9	28	129	9	802	10	156	555	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.97			1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1807			1840	1583	1770	1859		1770	1863	1583
Flt Permitted	0.73	1.00			0.93	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1362	1807			1735	1583	1770	1859		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	122	36	9	10	30	140	10	872	11	170	603	137
RTOR Reduction (vph)	0	8	0	0	0	119	0	0	0	0	0	54
Lane Group Flow (vph)	122	37	0	0	40	21	10	883	0	170	603	83
Turn Type	Perm			Perm		Perm	Prot			Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8						6
Actuated Green, G (s)	12.6	12.6			12.6	12.6	5.8	44.7		11.2	50.1	50.1
Effective Green, g (s)	12.6	12.6			12.6	12.6	5.8	44.7		11.2	50.1	50.1
Actuated g/C Ratio	0.15	0.15			0.15	0.15	0.07	0.54		0.14	0.61	0.61
Clearance Time (s)	5.0	5.0			5.0	5.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	208	276			265	242	124	1007		240	1131	961
v/s Ratio Prot		0.02					0.01	c0.47		c0.10	0.32	
v/s Ratio Perm	c0.09				0.02	0.01						0.05
v/c Ratio	0.59	0.14			0.15	0.09	0.08	0.88		0.71	0.53	0.09
Uniform Delay, d1	32.5	30.2			30.3	30.0	35.9	16.5		34.1	9.4	6.7
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.2	0.2			0.3	0.2	0.3	10.6		9.2	1.8	0.2
Delay (s)	36.7	30.5			30.6	30.2	36.1	27.1		43.3	11.2	6.9
Level of Service	D	C			C	C	D	C		D	B	A
Approach Delay (s)		35.0			30.3			27.2			16.6	
Approach LOS		D			C			C			B	

Intersection Summary			
HCM Average Control Delay	23.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	82.5	Sum of lost time (s)	14.0
Intersection Capacity Utilization	76.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	61	26	14	13	14	43	7	666	38	76	434	39
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	66	28	15	14	15	47	8	724	41	83	472	42
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			2			2						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1384	1376	472	1390	1376	724	472			724		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1384	1376	472	1390	1376	724	472			724		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	27	78	97	84	88	89	99			91		
cM capacity (veh/h)	91	131	592	90	131	426	1090			879		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	110	76	8	724	41	83	472	42
Volume Left	66	14	8	0	0	83	0	0
Volume Right	15	47	0	0	41	0	0	42
cSH	115	288	1090	1700	1700	879	1700	1700
Volume to Capacity	0.95	0.26	0.01	0.43	0.02	0.09	0.28	0.02
Queue Length 95th (ft)	152	26	1	0	0	8	0	0
Control Delay (s)	141.7	27.7	8.3	0.0	0.0	9.5	0.0	0.0
Lane LOS	F	D	A			A		
Approach Delay (s)	141.7	27.7	0.1			1.3		
Approach LOS	F	D						

Intersection Summary				
Average Delay	11.9			
Intersection Capacity Utilization	60.7%	ICU Level of Service	B	
Analysis Period (min)	15			

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2016 Traffic Operation without Project

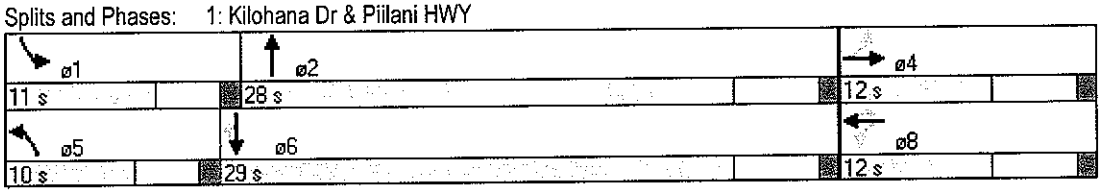
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	155	20	15	25	155	5	805	50	1395	150
Turn Type	Perm		Perm		Perm	Prot		Prot		Perm
Protected Phases		4		8		5	2	1	6	
Permitted Phases	4		8		8					6
Detector Phase	4	4	8	8	8	5	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	10.0	24.0	24.0
Total Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	28.0	11.0	29.0	29.0
Total Split (%)	23.5%	23.5%	23.5%	23.5%	23.5%	19.6%	54.9%	21.6%	56.9%	56.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	Max	None	Max	Max
Act Effct Green (s)	7.1	7.1		7.1	7.1	5.8	26.6	6.5	28.8	28.8
Actuated g/C Ratio	0.15	0.15		0.15	0.15	0.12	0.55	0.14	0.60	0.60
v/c Ratio	0.84	0.12		0.18	0.44	0.02	0.85	0.22	1.35	0.16
Control Delay	59.0	16.1		20.6	8.6	19.8	24.3	21.1	182.6	2.0
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	59.0	16.1		20.6	8.6	19.8	24.3	21.1	182.6	2.0
LOS	E	B		C	A	B	C	C	F	A
Approach Delay		51.9		11.0			24.3		160.6	
Approach LOS		D		B			C		F	

Intersection Summary

Cycle Length: 51
Actuated Cycle Length: 48
Natural Cycle: 150
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.35
Intersection Signal Delay: 103.1
Intersection Capacity Utilization 97.0%
Analysis Period (min) 15

Intersection LOS: F
ICU Level of Service F

Splits and Phases: 1: Kilohana Dr & Piilani HWY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	20	10	15	25	155	5	805	5	50	1395	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.95			1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.98	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1770			1829	1583	1770	1861		1770	1863	1583
Flt Permitted	0.73	1.00			0.86	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1358	1770			1611	1583	1770	1861		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	168	22	11	16	27	168	5	875	5	54	1516	163
RTOR Reduction (vph)	0	9	0	0	0	145	0	0	0	0	0	69
Lane Group Flow (vph)	168	24	0	0	43	23	5	880	0	54	1516	94
Turn Type	Perm			Perm		Perm	Prot			Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8						6
Actuated Green, G (s)	7.1	7.1			7.1	7.1	1.1	27.3		2.6	28.8	28.8
Effective Green, g (s)	7.1	7.1			7.1	7.1	1.1	27.3		2.6	28.8	28.8
Actuated g/C Ratio	0.14	0.14			0.14	0.14	0.02	0.54		0.05	0.56	0.56
Clearance Time (s)	5.0	5.0			5.0	5.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	189	246			224	220	38	996		90	1052	894
v/s Ratio Prot		0.01					0.00	0.47		c0.03	c0.81	
v/s Ratio Perm	c0.12				0.03	0.01						0.06
v/c Ratio	0.89	0.10			0.19	0.11	0.13	0.88		0.60	1.44	0.11
Uniform Delay, d1	21.6	19.1			19.4	19.2	24.5	10.4		23.7	11.1	5.1
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	35.9	0.2			0.4	0.2	1.6	11.2		10.8	203.9	0.2
Delay (s)	57.4	19.3			19.8	19.4	26.1	21.7		34.4	215.0	5.4
Level of Service	E	B			B	B	C	C		C	F	A
Approach Delay (s)		51.2			19.5			21.7			189.7	
Approach LOS		D			B			C			F	

Intersection Summary			
HCM Average Control Delay	119.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	51.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	97.0%	ICU Level of Service	F
Analysis Period (min)	15		

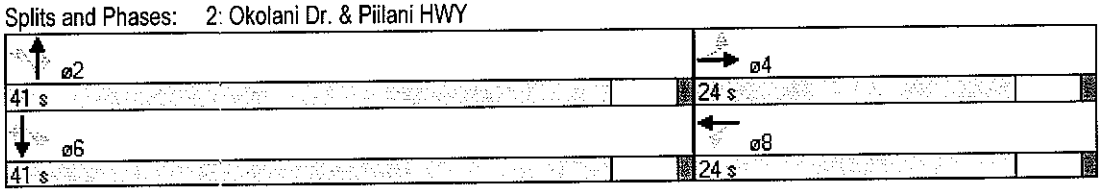
c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	185	15	35	20	10	560	15	35	1210	135
Turn Type	Perm		Perm		Perm		Perm	Perm		Perm
Protected Phases		4		8		2			6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	2	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Total Split (s)	24.0	24.0	24.0	24.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (%)	36.9%	36.9%	36.9%	36.9%	63.1%	63.1%	63.1%	63.1%	63.1%	63.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	Min	Min	Min	Min	Min	Min
Act Effct Green (s)	14.2	14.2		14.2	38.9	38.9	38.9	38.9	38.9	38.9
Actuated g/C Ratio	0.23	0.23		0.23	0.62	0.62	0.62	0.62	0.62	0.62
v/c Ratio	0.68	0.11		0.33	0.09	0.53	0.02	0.09	1.15	0.14
Control Delay	33.6	10.6		11.5	8.9	10.0	3.4	7.1	94.0	1.8
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.6	10.6		11.5	8.9	10.0	3.4	7.1	94.0	1.8
LOS	C	B		B	A	A	A	A	F	A
Approach Delay		29.6		11.5		9.8			82.8	
Approach LOS		C		B		A			F	

Intersection Summary

Cycle Length: 65
Actuated Cycle Length: 63.1
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.15
Intersection Signal Delay: 55.3
Intersection LOS: E
Intersection Capacity Utilization 88.9%
ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 2: Okolani Dr. & Piilani HWY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	185	15	25	35	20	70	10	560	15	35	1210	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.91			0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1687			1698		1770	1863	1583	1770	1863	1583
Flt Permitted	0.71	1.00			0.91		0.10	1.00	1.00	0.35	1.00	1.00
Satd. Flow (perm)	1314	1687			1564		192	1863	1583	655	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	201	16	27	38	22	76	11	609	16	38	1315	147
RTOR Reduction (vph)	0	21	0	0	59	0	0	0	6	0	0	56
Lane Group Flow (vph)	201	22	0	0	77	0	11	609	10	38	1315	91
Turn Type	Perm			Perm			Perm		Perm	Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	14.2	14.2			14.2		38.9	38.9	38.9	38.9	38.9	38.9
Effective Green, g (s)	14.2	14.2			14.2		38.9	38.9	38.9	38.9	38.9	38.9
Actuated g/C Ratio	0.23	0.23			0.23		0.62	0.62	0.62	0.62	0.62	0.62
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	296	380			352		118	1149	976	404	1149	976
v/s Ratio Prot		0.01						0.33			c0.71	
v/s Ratio Perm	c0.15				0.05		0.06		0.01	0.06		0.06
v/c Ratio	0.68	0.06			0.22		0.09	0.53	0.01	0.09	1.14	0.09
Uniform Delay, d1	22.4	19.2			19.9		4.9	6.9	4.7	4.9	12.1	4.9
Progression Factor	1.00	1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.1	0.1			0.3		0.3	0.5	0.0	0.1	75.7	0.0
Delay (s)	28.4	19.3			20.2		5.3	7.4	4.7	5.0	87.8	5.0
Level of Service	C	B			C		A	A	A	A	F	A
Approach Delay (s)		26.8			20.2			7.3			77.6	
Approach LOS		C			C			A			E	

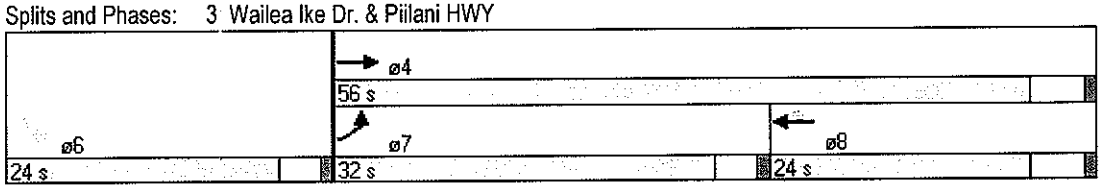
Intersection Summary			
HCM Average Control Delay	51.8	HCM Level of Service	D
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	63.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	88.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

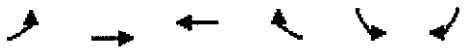
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	525	55	40	110	150	1210
Turn Type	Prot			Perm		Free
Protected Phases	7	4	8			
Permitted Phases				8	6	Free
Detector Phase	7	4	8	8	6	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	
Minimum Split (s)	10.0	24.0	24.0	24.0	24.0	
Total Split (s)	32.0	56.0	24.0	24.0	24.0	0.0
Total Split (%)	40.0%	70.0%	30.0%	30.0%	30.0%	0.0%
Yellow Time (s)	3.0	4.0	4.0	4.0	3.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	5.0	5.0	4.0	4.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?	Yes		Yes	Yes		
Recall Mode	None	None	None	None	None	
Act Effct Green (s)	25.4	32.8	7.3	7.3	10.7	50.6
Actuated g/C Ratio	0.50	0.65	0.14	0.14	0.20	1.00
v/c Ratio	0.64	0.05	0.17	0.37	0.45	0.83
Control Delay	17.4	4.2	25.5	9.7	25.5	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.4	4.2	25.5	9.7	25.5	5.9
LOS	B	A	C	A	C	A
Approach Delay		16.1	13.9		8.1	
Approach LOS		B	B		A	

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 50.6
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 10.7 Intersection LOS: B
Intersection Capacity Utilization 51.6% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3 Wailea Ike Dr. & Piilani HWY





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	525	55	40	110	150	1210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	5.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	571	60	43	120	163	1315
RTOR Reduction (vph)	0	0	0	108	0	0
Lane Group Flow (vph)	571	60	43	12	163	1315
Turn Type	Prot			Perm		Free
Protected Phases	7	4	8			
Permitted Phases				8	6	Free
Actuated Green, G (s)	25.4	34.6	5.2	5.2	8.1	51.7
Effective Green, g (s)	25.4	34.6	5.2	5.2	8.1	51.7
Actuated g/C Ratio	0.49	0.67	0.10	0.10	0.16	1.00
Clearance Time (s)	4.0	5.0	5.0	5.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	870	1247	187	159	277	1583
v/s Ratio Prot	0.32	0.03	0.02			
v/s Ratio Perm				0.01	0.09	c0.83
v/c Ratio	0.66	0.05	0.23	0.08	0.59	0.83
Uniform Delay, d1	9.9	2.9	21.4	21.1	20.3	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.8	0.0	0.6	0.2	3.2	5.2
Delay (s)	11.7	2.9	22.0	21.3	23.4	5.2
Level of Service	B	A	C	C	C	A
Approach Delay (s)		10.8	21.5		7.2	
Approach LOS		B	C		A	

Intersection Summary			
HCM Average Control Delay	9.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	51.7	Sum of lost time (s)	0.0
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

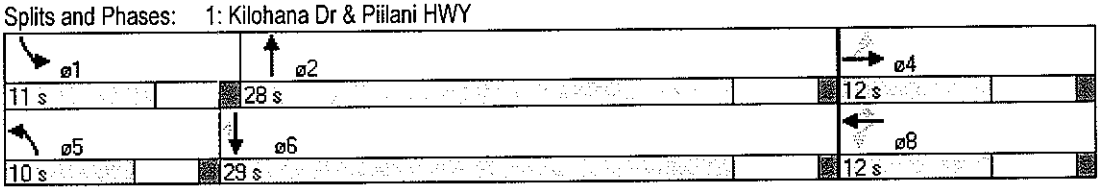
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	175	35	10	30	135	20	1650	160	1380	230
Turn Type	Perm		Perm		Perm	Prot		Prot		Perm
Protected Phases		4		8		5	2	1	6	
Permitted Phases	4		8		8					6
Detector Phase	4	4	8	8	8	5	2	1	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	10.0	24.0	24.0
Total Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	28.0	11.0	29.0	29.0
Total Split (%)	23.5%	23.5%	23.5%	23.5%	23.5%	19.6%	54.9%	21.6%	56.9%	56.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	Max	None	Max	Max
Act Effct Green (s)	7.0	7.0		7.0	7.0	5.8	24.6	7.0	33.6	33.6
Actuated g/C Ratio	0.13	0.13		0.13	0.13	0.11	0.47	0.13	0.64	0.64
v/c Ratio	1.05	0.20		0.20	0.43	0.11	2.08	0.74	1.26	0.23
Control Delay	110.2	18.4		21.9	9.1	21.6	508.8	43.3	142.3	1.8
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	110.2	18.4		21.9	9.1	21.6	508.8	43.3	142.3	1.8
LOS	F	B		C	A	C	F	D	F	A
Approach Delay		91.4		12.0			502.9		115.1	
Approach LOS		F		B			F		F	

Intersection Summary

Cycle Length: 51
Actuated Cycle Length: 52.7
Natural Cycle: 150
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 2.08
Intersection Signal Delay: 278.7
Intersection Capacity Utilization 124.6%
Analysis Period (min) 15

Intersection LOS: F
ICU Level of Service H

Splits and Phases: 1: Kilohana Dr & Piilani HWY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	175	35	10	10	30	135	20	1650	15	160	1380	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0	4.0	5.0		4.0	5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.97			1.00	0.85	1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1800			1840	1583	1770	1860		1770	1863	1583
Flt Permitted	0.73	1.00			0.90	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1357	1800			1682	1583	1770	1860		1770	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	190	38	11	11	33	147	22	1793	16	174	1500	250
RTOR Reduction (vph)	0	10	0	0	0	129	0	1	0	0	0	97
Lane Group Flow (vph)	190	39	0	0	44	18	22	1808	0	174	1500	153
Turn Type	Perm			Perm		Perm	Prot			Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8						6
Actuated Green, G (s)	7.0	7.0			7.0	7.0	1.2	27.8		7.0	33.6	33.6
Effective Green, g (s)	7.0	7.0			7.0	7.0	1.2	27.8		7.0	33.6	33.6
Actuated g/C Ratio	0.13	0.13			0.13	0.13	0.02	0.50		0.13	0.60	0.60
Clearance Time (s)	5.0	5.0			5.0	5.0	4.0	5.0		4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	170	226			211	199	38	927		222	1122	953
v/s Ratio Prot		0.02					0.01	c0.97		c0.10	c0.81	
v/s Ratio Perm	c0.14				0.03	0.01						0.10
v/c Ratio	1.12	0.17			0.21	0.09	0.58	1.95		0.78	1.34	0.16
Uniform Delay, d1	24.4	21.8			21.9	21.6	27.0	14.0		23.7	11.1	4.9
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	104.1	0.4			0.5	0.2	19.6	431.9		16.4	157.7	0.4
Delay (s)	128.5	22.2			22.4	21.8	46.6	445.9		40.1	168.8	5.2
Level of Service	F	C			C	C	D	F		D	F	A
Approach Delay (s)		106.7			21.9			441.1			135.9	
Approach LOS		F			C			F			F	

Intersection Summary			
HCM Average Control Delay	262.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.86		
Actuated Cycle Length (s)	55.8	Sum of lost time (s)	19.0
Intersection Capacity Utilization	124.6%	ICU Level of Service	H
Analysis Period (min)	15		

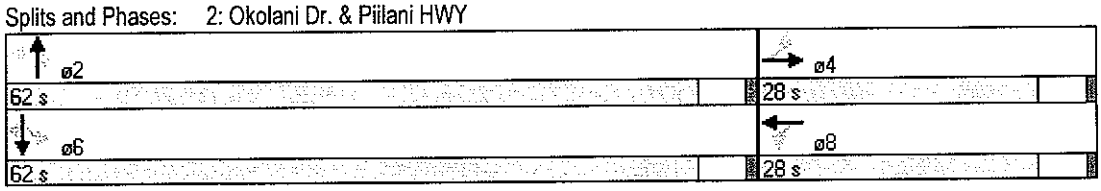
c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	250	35	15	20	40	1330	40	80	1030	270
Turn Type	Perm		Perm		Perm		Perm	Perm		Perm
Protected Phases		4		8		2			6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	2	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	33.0	33.0	33.0
Total Split (s)	28.0	28.0	28.0	28.0	62.0	62.0	62.0	62.0	62.0	62.0
Total Split (%)	31.1%	31.1%	31.1%	31.1%	68.9%	68.9%	68.9%	68.9%	68.9%	68.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	Min	Min	Min	Min	Min	Min
Act Effct Green (s)	20.7	20.7		20.7	58.4	58.4	58.4	58.4	58.4	58.4
Actuated g/C Ratio	0.23	0.23		0.23	0.66	0.66	0.66	0.66	0.66	0.66
v/c Ratio	0.85	0.17		0.21	0.52	1.18	0.04	1.05	0.92	0.26
Control Delay	57.6	17.1		14.9	37.2	110.6	2.1	139.2	28.0	1.4
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.6	17.1		14.9	37.2	110.6	2.1	139.2	28.0	1.4
LOS	E	B		B	D	F	A	F	C	A
Approach Delay		49.2		14.9		105.5			29.2	
Approach LOS		D		B		F			C	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 89.1
Natural Cycle: 110
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.18
Intersection Signal Delay: 64.6 — Intersection LOS: E
Intersection Capacity Utilization 98.9% — ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 2: Okolani Dr. & Piilani HWY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	35	30	15	20	45	40	1330	40	80	1030	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.93			0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1733			1705		1770	1863	1583	1770	1863	1583
Flt Permitted	0.74	1.00			0.95		0.07	1.00	1.00	0.07	1.00	1.00
Satd. Flow (perm)	1375	1733			1634		128	1863	1583	128	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	272	38	33	16	22	49	43	1446	43	87	1120	293
RTOR Reduction (vph)	0	25	0	0	38	0	0	0	15	0	0	101
Lane Group Flow (vph)	272	46	0	0	49	0	43	1446	28	87	1120	192
Turn Type	Perm			Perm			Perm		Perm	Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Actuated Green, G (s)	20.7	20.7			20.7		58.4	58.4	58.4	58.4	58.4	58.4
Effective Green, g (s)	20.7	20.7			20.7		58.4	58.4	58.4	58.4	58.4	58.4
Actuated g/C Ratio	0.23	0.23			0.23		0.66	0.66	0.66	0.66	0.66	0.66
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	319	403			380		84	1221	1038	84	1221	1038
v/s Ratio Prot		0.03						c0.78			0.60	
v/s Ratio Perm	c0.20				0.03		0.34		0.02	0.68		0.12
v/c Ratio	0.85	0.11			0.13		0.51	1.18	0.03	1.04	0.92	0.19
Uniform Delay, d1	32.7	27.0			27.1		8.0	15.3	5.4	15.3	13.3	6.0
Progression Factor	1.00	1.00			1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	19.2	0.1			0.2		5.2	91.5	0.0	108.3	10.8	0.1
Delay (s)	52.0	27.1			27.2		13.1	106.9	5.4	123.6	24.1	6.1
Level of Service	D	C			C		B	F	A	F	C	A
Approach Delay (s)		46.8			27.2			101.4			26.4	
Approach LOS		D			C			F			C	

Intersection Summary			
HCM Average Control Delay	61.6	HCM Level of Service	E
HCM Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	89.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	98.9%	ICU Level of Service	F
Analysis Period (min)	15		

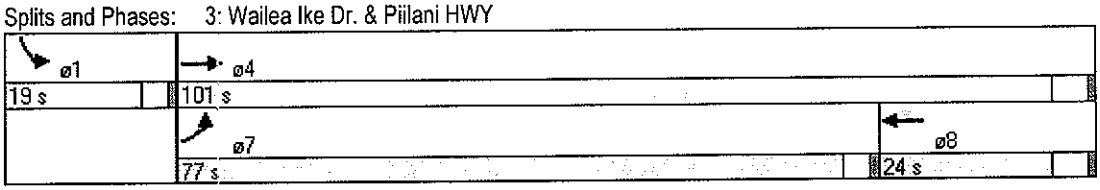
c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	1305	80	100	285	255	880
Turn Type	Prot			Perm		Free
Protected Phases	7	4	8		1	
Permitted Phases				8		Free
Detector Phase	7	4	8	8	1	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	3.0	
Minimum Split (s)	24.0	24.0	24.0	24.0	7.0	
Total Split (s)	77.0	101.0	24.0	24.0	19.0	0.0
Total Split (%)	64.2%	84.2%	20.0%	20.0%	15.8%	0.0%
Yellow Time (s)	3.0	4.0	4.0	4.0	3.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	5.0	5.0	4.0	4.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	None	
Act Effct Green (s)	73.1	90.1	13.0	13.0	15.0	114.1
Actuated g/C Ratio	0.64	0.79	0.11	0.11	0.13	1.00
v/c Ratio	1.25	0.06	0.51	0.81	1.19	0.60
Control Delay	143.0	2.7	55.9	31.7	163.4	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	143.0	2.7	55.9	31.7	163.4	1.7
LOS	F	A	E	C	F	A
Approach Delay		134.9	38.0		38.0	
Approach LOS		F	D		D	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 114.1
Natural Cycle: 150
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.25
Intersection Signal Delay: 84.2 Intersection LOS: F
Intersection Capacity Utilization 100.6% ICU Level of Service G
Analysis Period (min) 15

Splits and Phases: 3: Wailea Ike Dr. & Piilani HWY



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	1305	80	100	285	255	880
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	5.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1863	1863	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1418	87	109	310	277	957
RTOR Reduction (vph)	0	0	0	200	0	0
Lane Group Flow (vph)	1418	87	109	110	277	957
Turn Type	Prot			Perm		Free
Protected Phases	7	4	8		1	
Permitted Phases				8		Free
Actuated Green, G (s)	73.1	90.1	13.0	13.0	15.0	114.1
Effective Green, g (s)	73.1	90.1	13.0	13.0	15.0	114.1
Actuated g/C Ratio	0.64	0.79	0.11	0.11	0.13	1.00
Clearance Time (s)	4.0	5.0	5.0	5.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	1134	1471	212	180	233	1583
v/s Ratio Prot	c0.80	0.05	0.06		c0.16	
v/s Ratio Perm				0.07		c0.60
v/c Ratio	1.25	0.06	0.51	0.61	1.19	0.60
Uniform Delay, d1	20.5	2.6	47.6	48.1	49.5	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	120.1	0.0	2.1	5.7	119.5	1.7
Delay (s)	140.6	2.7	49.7	53.9	169.1	1.7
Level of Service	F	A	D	D	F	A
Approach Delay (s)		132.7	52.8		39.3	
Approach LOS		F	D		D	

Intersection Summary			
HCM Average Control Delay	85.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	114.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	100.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Year 2016 Traffic Operations with Project

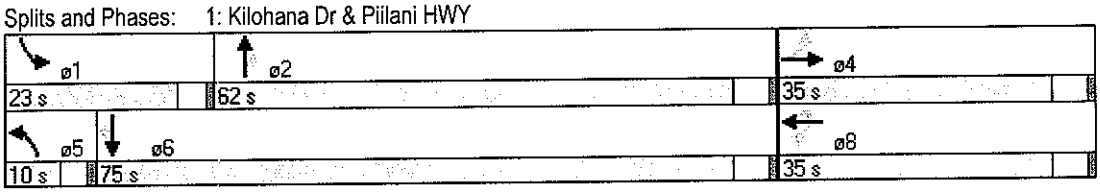
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	155	20	15	25	155	5	805	5	50	1395	150
Turn Type	Perm		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4		8		5	2		1	6	
Permitted Phases	4		8		8			2			6
Detector Phase	4	4	8	8	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	24.0	10.0	24.0	24.0
Total Split (s)	35.0	35.0	35.0	35.0	35.0	10.0	62.0	62.0	23.0	75.0	75.0
Total Split (%)	29.2%	29.2%	29.2%	29.2%	29.2%	8.3%	51.7%	51.7%	19.2%	62.5%	62.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Min	Max	Max	Min	Max	Max
Act Effct Green (s)	18.5	18.5		18.5	18.5	5.7	67.2	67.2	8.7	70.2	70.2
Actuated g/C Ratio	0.17	0.17		0.17	0.17	0.05	0.62	0.62	0.08	0.65	0.65
v/c Ratio	0.72	0.11		0.15	0.41	0.05	0.40	0.01	0.38	0.66	0.15
Control Delay	60.3	27.9		38.4	8.8	52.8	12.2	7.0	56.0	14.5	1.9
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.3	27.9		38.4	8.8	52.8	12.2	7.0	56.0	14.5	1.9
LOS	E	C		D	A	D	B	A	E	B	A
Approach Delay		55.0		14.9			12.4			14.6	
Approach LOS		D		B			B			B	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 108.5
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.72
Intersection Signal Delay: 16.7
Intersection Capacity Utilization 65.1%
Analysis Period (min) 15

Intersection LOS: B
ICU Level of Service C

Splits and Phases: 1: Kilohana Dr & Piilani HWY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	20	10	15	25	155	5	805	5	50	1395	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.95			1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00			0.98	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1770			1829	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.73	1.00			0.91	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1358	1770			1688	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	168	22	11	16	27	168	5	875	5	54	1516	163
RTOR Reduction (vph)	0	9	0	0	0	139	0	0	2	0	0	57
Lane Group Flow (vph)	168	24	0	0	43	29	5	875	3	54	1516	106
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	18.5	18.5			18.5	18.5	5.7	67.2	67.2	8.7	70.2	70.2
Effective Green, g (s)	18.5	18.5			18.5	18.5	5.7	67.2	67.2	8.7	70.2	70.2
Actuated g/C Ratio	0.17	0.17			0.17	0.17	0.05	0.62	0.62	0.08	0.65	0.65
Clearance Time (s)	5.0	5.0			5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	232	302			288	270	93	2194	981	142	2292	1025
v/s Ratio Prot		0.01					0.00	0.25		c0.03	c0.43	
v/s Ratio Perm	c0.12				0.03	0.02			0.00			0.07
v/c Ratio	0.72	0.08			0.15	0.11	0.05	0.40	0.00	0.38	0.66	0.10
Uniform Delay, d1	42.5	37.8			38.3	38.0	48.8	10.4	7.8	47.3	11.8	7.2
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.7	0.1			0.2	0.2	0.2	0.5	0.0	1.7	1.5	0.2
Delay (s)	53.2	37.9			38.5	38.1	49.0	10.9	7.9	49.0	13.3	7.4
Level of Service	D	D			D	D	D	B	A	D	B	A
Approach Delay (s)		50.7			38.2			11.1			13.9	
Approach LOS		D			D			B			B	

Intersection Summary			
HCM Average Control Delay	17.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	108.4	Sum of lost time (s)	14.0
Intersection Capacity Utilization	65.1%	ICU Level of Service	C
Analysis Period (min)	15		

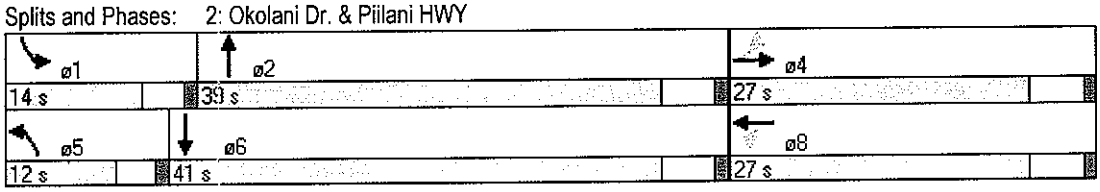
c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	185	15	35	20	10	560	35	1210
Turn Type	Perm		Perm		Prot		Prot	
Protected Phases		4		8	5	2	1	6
Permitted Phases	4		8					
Detector Phase	4	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	10.0	24.0
Total Split (s)	27.0	27.0	27.0	27.0	12.0	39.0	14.0	41.0
Total Split (%)	33.8%	33.8%	33.8%	33.8%	15.0%	48.8%	17.5%	51.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	None	Max
Act Effct Green (s)	15.7	15.7		15.7	6.1	37.7	7.1	40.2
Actuated g/C Ratio	0.23	0.23		0.23	0.09	0.55	0.10	0.59
v/c Ratio	0.69	0.10		0.32	0.07	0.32	0.21	0.71
Control Delay	36.9	12.4		13.0	32.8	11.0	32.7	14.5
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	36.9	12.4		13.0	32.8	11.0	32.7	14.5
LOS	D	B		B	C	B	C	B
Approach Delay		32.6		13.0		11.4		14.9
Approach LOS		C		B		B		B

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 68
Natural Cycle: 70
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.71
Intersection Signal Delay: 15.6
Intersection LOS: B
Intersection Capacity Utilization 63.0%
ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 2: Okolani Dr. & Piilani HWY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	185	15	25	35	20	70	10	560	15	35	1210	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.91			0.92		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1687			1698		1770	3526		1770	3486	
Flt Permitted	0.68	1.00			0.91		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1263	1687			1566		1770	3526		1770	3486	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	201	16	27	38	22	76	11	609	16	38	1315	147
RTOR Reduction (vph)	0	21	0	0	59	0	0	2	0	0	8	0
Lane Group Flow (vph)	201	22	0	0	77	0	11	623	0	38	1454	0
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	15.7	15.7			15.7		1.2	38.4		3.0	40.2	
Effective Green, g (s)	15.7	15.7			15.7		1.2	38.4		3.0	40.2	
Actuated g/C Ratio	0.22	0.22			0.22		0.02	0.54		0.04	0.57	
Clearance Time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	279	373			346		30	1904		75	1971	
v/s Ratio Prot		0.01					0.01	0.18		c0.02	c0.42	
v/s Ratio Perm	c0.16				0.05							
v/c Ratio	0.72	0.06			0.22		0.37	0.33		0.51	0.74	
Uniform Delay, d1	25.7	21.9			22.7		34.6	9.1		33.3	11.5	
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.8	0.1			0.3		7.4	0.5		5.3	2.5	
Delay (s)	34.5	21.9			23.0		42.0	9.6		38.6	14.0	
Level of Service	C	C			C		D	A		D	B	
Approach Delay (s)		32.3			23.0			10.2			14.7	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	15.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	71.1	Sum of lost time (s)	9.0
Intersection Capacity Utilization	63.0%	ICU Level of Service	B
Analysis Period (min)	15		

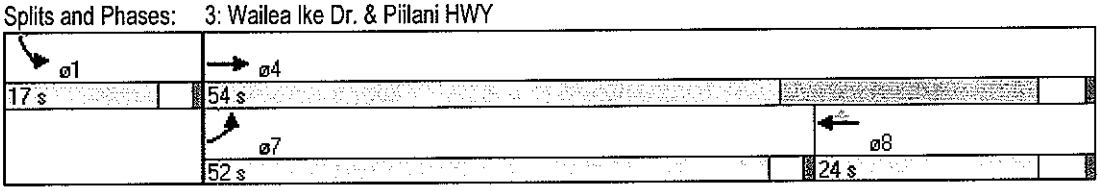
c Critical Lane Group

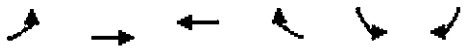
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	525	55	40	110	150	1210
Turn Type	Prot			Perm		Free
Protected Phases	7	4	8		1	
Permitted Phases				8		Free
Detector Phase	7	4	8	8	1	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	3.0	
Minimum Split (s)	24.0	24.0	24.0	24.0	7.0	
Total Split (s)	52.0	54.0	24.0	24.0	17.0	0.0
Total Split (%)	55.9%	58.1%	25.8%	25.8%	18.3%	0.0%
Yellow Time (s)	3.0	4.0	4.0	4.0	3.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	5.0	5.0	4.0	4.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	None	
Act Effct Green (s)	14.2	21.4	7.7	7.7	10.8	38.4
Actuated g/C Ratio	0.37	0.56	0.20	0.20	0.28	1.00
v/c Ratio	0.45	0.06	0.11	0.29	0.33	0.83
Control Delay	13.2	4.8	18.2	7.1	16.9	6.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.2	4.8	18.2	7.1	16.9	6.3
LOS	B	A	B	A	B	A
Approach Delay		12.4	10.0		7.5	
Approach LOS		B	B		A	

Intersection Summary

Cycle Length: 93
Actuated Cycle Length: 38.4
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 9.0 — Intersection LOS: A
Intersection Capacity Utilization 37.5% — ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: Wailea Ike Dr. & Piilani HWY





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	525	55	40	110	150	1210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	5.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1863	1863	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	571	60	43	120	163	1315
RTOR Reduction (vph)	0	0	0	105	0	0
Lane Group Flow (vph)	571	60	43	15	163	1315
Turn Type	Prot			Perm		Free
Protected Phases	7	4	8		1	
Permitted Phases				8		Free
Actuated Green, G (s)	14.2	23.0	4.8	4.8	7.2	39.2
Effective Green, g (s)	14.2	23.0	4.8	4.8	7.2	39.2
Actuated g/C Ratio	0.36	0.59	0.12	0.12	0.18	1.00
Clearance Time (s)	4.0	5.0	5.0	5.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	1244	1093	228	194	325	1583
v/s Ratio Prot	0.17	0.03	0.02		0.09	
v/s Ratio Perm				0.01		c0.83
v/c Ratio	0.46	0.05	0.19	0.08	0.50	0.83
Uniform Delay, d1	9.6	3.5	15.5	15.2	14.4	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.3	0.0	0.4	0.2	1.2	5.2
Delay (s)	9.8	3.5	15.9	15.4	15.6	5.2
Level of Service	A	A	B	B	B	A
Approach Delay (s)		9.2	15.5		6.4	
Approach LOS		A	B		A	

Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	39.2	Sum of lost time (s)	0.0
Intersection Capacity Utilization	37.5%	ICU Level of Service	A
Analysis Period (min)	15		

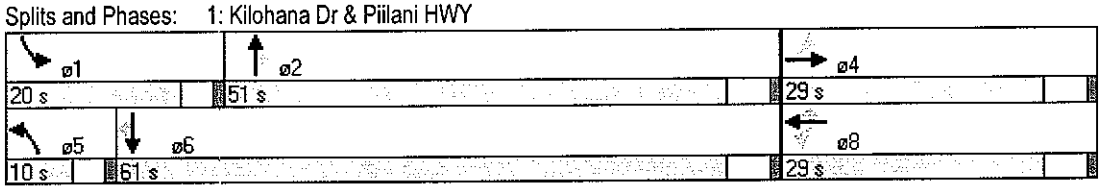
c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	175	35	10	30	135	20	1650	15	160	1380	230
Turn Type	Perm		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4		8		5	2		1	6	
Permitted Phases	4		8		8			2			6
Detector Phase	4	4	8	8	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	24.0	10.0	24.0	24.0
Total Split (s)	29.0	29.0	29.0	29.0	29.0	10.0	51.0	51.0	20.0	61.0	61.0
Total Split (%)	29.0%	29.0%	29.0%	29.0%	29.0%	10.0%	51.0%	51.0%	20.0%	61.0%	61.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Min	Max	Max	Min	Max	Max
Act Effct Green (s)	17.7	17.7		17.7	17.7	5.9	48.7	48.7	13.4	56.2	56.2
Actuated g/C Ratio	0.19	0.19		0.19	0.19	0.06	0.52	0.52	0.14	0.60	0.60
v/c Ratio	0.74	0.14		0.13	0.35	0.20	0.98	0.02	0.69	0.71	0.24
Control Delay	53.6	26.2		31.7	7.9	48.1	40.5	8.5	53.4	16.3	2.0
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.6	26.2		31.7	7.9	48.1	40.5	8.5	53.4	16.3	2.0
LOS	D	C		C	A	D	D	A	D	B	A
Approach Delay		48.0		13.4			40.3			17.8	
Approach LOS		D		B			D			B	

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 93.8
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.98
Intersection Signal Delay: 29.2
Intersection LOS: C
Intersection Capacity Utilization 82.5%
ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 1: Kilohana Dr & Piilani HWY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	175	35	10	10	30	135	20	1650	15	160	1380	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.97			1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1800			1840	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.73	1.00			0.94	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1357	1800			1749	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	190	38	11	11	33	147	22	1793	16	174	1500	250
RTOR Reduction (vph)	0	9	0	0	0	119	0	0	6	0	0	100
Lane Group Flow (vph)	190	40	0	0	44	28	22	1793	10	174	1500	150
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	17.7	17.7			17.7	17.7	5.9	48.7	48.7	13.4	56.2	56.2
Effective Green, g (s)	17.7	17.7			17.7	17.7	5.9	48.7	48.7	13.4	56.2	56.2
Actuated g/C Ratio	0.19	0.19			0.19	0.19	0.06	0.52	0.52	0.14	0.60	0.60
Clearance Time (s)	5.0	5.0			5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	256	340			330	299	111	1837	822	253	2120	948
v/s Ratio Prot		0.02					0.01	c0.51		c0.10	0.42	
v/s Ratio Perm	c0.14				0.03	0.02			0.01			0.09
v/c Ratio	0.74	0.12			0.13	0.09	0.20	0.98	0.01	0.69	0.71	0.16
Uniform Delay, d1	35.9	31.6			31.7	31.4	41.7	22.0	10.9	38.2	13.1	8.3
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.0	0.2			0.2	0.1	0.9	16.0	0.0	7.6	2.0	0.4
Delay (s)	46.9	31.7			31.9	31.6	42.6	38.0	10.9	45.8	15.1	8.7
Level of Service	D	C			C	C	D	D	B	D	B	A
Approach Delay (s)		43.8			31.6			37.8			17.0	
Approach LOS		D			C			D			B	

Intersection Summary			
HCM Average Control Delay	28.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	93.8	Sum of lost time (s)	14.0
Intersection Capacity Utilization	82.5%	ICU Level of Service	E
Analysis Period (min)	15		

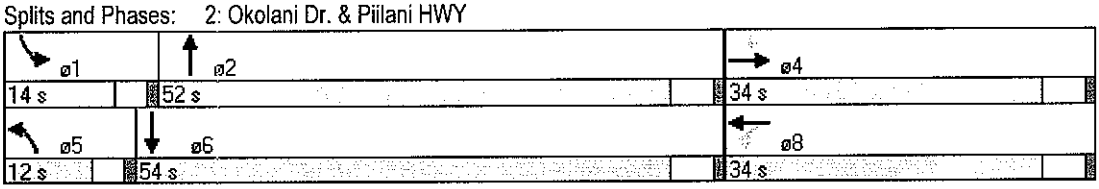
c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	250	35	15	20	40	1330	80	1030
Turn Type	Perm		Perm		Prot		Prot	
Protected Phases		4		8	5	2	1	6
Permitted Phases	4		8					
Detector Phase	4	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	10.0	24.0
Total Split (s)	34.0	34.0	34.0	34.0	12.0	52.0	14.0	54.0
Total Split (%)	34.0%	34.0%	34.0%	34.0%	12.0%	52.0%	14.0%	54.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	None	Max
Act Effct Green (s)	22.5	22.5		22.5	7.1	48.5	8.8	52.2
Actuated g/C Ratio	0.25	0.25		0.25	0.08	0.53	0.10	0.57
v/c Ratio	0.81	0.16		0.20	0.31	0.80	0.51	0.71
Control Delay	52.0	17.3		15.2	49.0	24.1	52.7	18.9
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	52.0	17.3		15.2	49.0	24.1	52.7	18.9
LOS	D	B		B	D	C	D	B
Approach Delay		44.8		15.2		24.8		20.8
Approach LOS		D		B		C		C

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 91.5
Natural Cycle: 70
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 24.8 — Intersection LOS: C
Intersection Capacity Utilization 74.7% — ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 2: Okolani Dr. & Piilani HWY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	35	30	15	20	45	40	1330	40	80	1030	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.93			0.92		1.00	1.00		1.00	0.97	
Flt Protected	0.95	1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1733			1705		1770	3524		1770	3429	
Flt Permitted	0.73	1.00			0.95		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1363	1733			1635		1770	3524		1770	3429	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	272	38	33	16	22	49	43	1446	43	87	1120	293
RTOR Reduction (vph)	0	25	0	0	37	0	0	2	0	0	20	0
Lane Group Flow (vph)	272	46	0	0	50	0	43	1487	0	87	1393	0
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	22.5	22.5			22.5		4.4	49.3		7.3	52.2	
Effective Green, g (s)	22.5	22.5			22.5		4.4	49.3		7.3	52.2	
Actuated g/C Ratio	0.24	0.24			0.24		0.05	0.53		0.08	0.56	
Clearance Time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	329	419			395		84	1866		139	1923	
v/s Ratio Prot		0.03					0.02	c0.42		c0.05	c0.41	
v/s Ratio Perm	c0.20				0.03							
v/c Ratio	0.83	0.11			0.13		0.51	0.80		0.63	0.72	
Uniform Delay, d1	33.5	27.5			27.6		43.3	17.8		41.6	15.1	
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	15.5	0.1			0.1		5.2	3.6		8.5	2.4	
Delay (s)	49.0	27.6			27.8		48.5	21.5		50.1	17.5	
Level of Service	D	C			C		D	C		D	B	
Approach Delay (s)		44.5			27.8			22.2			19.4	
Approach LOS		D			C			C			B	

Intersection Summary			
HCM Average Control Delay	23.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	93.1	Sum of lost time (s)	19.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		

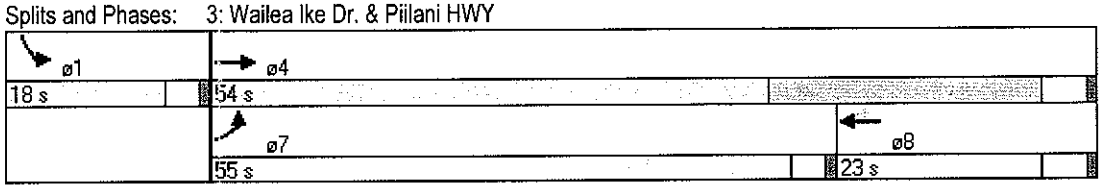
c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	1305	80	100	285	255	880
Turn Type	Prot			Perm		Free
Protected Phases	7	4	8		1	
Permitted Phases				8		Free
Detector Phase	7	4	8	8	1	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	3.0	
Minimum Split (s)	24.0	24.0	24.0	24.0	7.0	
Total Split (s)	55.0	54.0	23.0	23.0	18.0	0.0
Total Split (%)	57.3%	56.3%	24.0%	24.0%	18.8%	0.0%
Yellow Time (s)	3.0	4.0	4.0	4.0	3.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	5.0	5.0	4.0	4.0
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?						
Recall Mode	None	None	None	None	None	
Act Effct Green (s)	37.2	51.9	10.6	10.6	14.4	75.6
Actuated g/C Ratio	0.49	0.69	0.14	0.14	0.19	1.00
v/c Ratio	0.84	0.07	0.42	0.70	0.82	0.60
Control Delay	22.1	3.5	36.8	16.9	54.6	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.1	3.5	36.8	16.9	54.6	1.7
LOS	C	A	D	B	D	A
Approach Delay		21.0	22.1		13.6	
Approach LOS		C	C		B	

Intersection Summary

Cycle Length: 96
Actuated Cycle Length: 75.6
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 18.3 — Intersection LOS: B
Intersection Capacity Utilization 65.5% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 3: Wailea Ike Dr. & Piilani HWY



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	1305	80	100	285	255	880
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	5.0	4.0	4.0
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1863	1863	1583	1770	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1863	1863	1583	1770	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1418	87	109	310	277	957
RTOR Reduction (vph)	0	0	0	221	0	0
Lane Group Flow (vph)	1418	87	109	89	277	957
Turn Type	Prot			Perm		Free
Protected Phases	7	4	8		1	
Permitted Phases				8		Free
Actuated Green, G (s)	37.1	51.9	10.8	10.8	14.4	75.3
Effective Green, g (s)	37.1	51.9	10.8	10.8	14.4	75.3
Actuated g/C Ratio	0.49	0.69	0.14	0.14	0.19	1.00
Clearance Time (s)	4.0	5.0	5.0	5.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	1691	1284	267	227	338	1583
v/s Ratio Prot	c0.41	0.05	0.06		c0.16	
v/s Ratio Perm				0.06		c0.60
v/c Ratio	0.84	0.07	0.41	0.39	0.82	0.60
Uniform Delay, d1	16.5	3.8	29.3	29.3	29.2	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.8	0.0	1.0	1.1	14.3	1.7
Delay (s)	20.3	3.8	30.4	30.4	43.5	1.7
Level of Service	C	A	C	C	D	A
Approach Delay (s)		19.4	30.4		11.1	
Approach LOS		B	C		B	

Intersection Summary			
HCM Average Control Delay	17.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	75.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

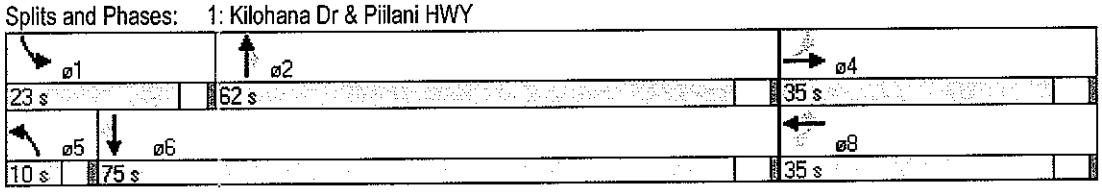
- Year 2022 Traffic Operations with Project

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	160	20	15	30	160	5	1090	5	50	1705	155
Turn Type	Perm		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4		8		5	2		1	6	
Permitted Phases	4		8		8			2			6
Detector Phase	4	4	8	8	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	24.0	10.0	24.0	24.0
Total Split (s)	35.0	35.0	35.0	35.0	35.0	10.0	62.0	62.0	23.0	75.0	75.0
Total Split (%)	29.2%	29.2%	29.2%	29.2%	29.2%	8.3%	51.7%	51.7%	19.2%	62.5%	62.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Min	Max	Max	Min	Max	Max
Act Effct Green (s)	19.2	19.2		19.2	19.2	5.7	67.2	67.2	8.7	70.2	70.2
Actuated g/C Ratio	0.18	0.18		0.18	0.18	0.05	0.62	0.62	0.08	0.64	0.64
v/c Ratio	0.73	0.10		0.16	0.41	0.05	0.54	0.01	0.38	0.81	0.16
Control Delay	60.6	27.6		38.4	8.6	53.4	14.6	7.2	56.5	19.6	2.9
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.6	27.6		38.4	8.6	53.4	14.6	7.2	56.5	19.6	2.9
LOS	E	C		D	A	D	B	A	E	B	A
Approach Delay		55.4		15.2			14.7			19.2	
Approach LOS		E		B			B			B	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 109.2
Natural Cycle: 75
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 19.5 — Intersection LOS: B
Intersection Capacity Utilization 71.0% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 1: Kilohana Dr & Piilani HWY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	160	20	10	15	30	160	5	1090	5	50	1705	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.95			1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00			0.98	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1770			1833	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.73	1.00			0.92	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1351	1770			1708	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	22	11	16	33	174	5	1185	5	54	1853	168
RTOR Reduction (vph)	0	9	0	0	0	143	0	0	2	0	0	48
Lane Group Flow (vph)	174	24	0	0	49	31	5	1185	3	54	1853	120
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	19.2	19.2			19.2	19.2	5.7	67.2	67.2	8.7	70.2	70.2
Effective Green, g (s)	19.2	19.2			19.2	19.2	5.7	67.2	67.2	8.7	70.2	70.2
Actuated g/C Ratio	0.18	0.18			0.18	0.18	0.05	0.62	0.62	0.08	0.64	0.64
Clearance Time (s)	5.0	5.0			5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	238	311			301	279	92	2180	975	141	2277	1019
v/s Ratio Prot		0.01					0.00	0.33		c0.03	c0.52	
v/s Ratio Perm	c0.13				0.03	0.02			0.00			0.08
v/c Ratio	0.73	0.08			0.16	0.11	0.05	0.54	0.00	0.38	0.81	0.12
Uniform Delay, d1	42.5	37.5			38.1	37.8	49.1	12.1	8.1	47.7	14.6	7.5
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.0	0.1			0.3	0.2	0.2	1.0	0.0	1.7	3.3	0.2
Delay (s)	53.5	37.7			38.4	37.9	49.4	13.1	8.1	49.4	17.9	7.7
Level of Service	D	D			D	D	D	B	A	D	B	A
Approach Delay (s)		51.0			38.0			13.2			17.9	
Approach LOS		D			D			B			B	

Intersection Summary			
HCM Average Control Delay	19.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	109.1	Sum of lost time (s)	14.0
Intersection Capacity Utilization	71.0%	ICU Level of Service	C
Analysis Period (min)	15		

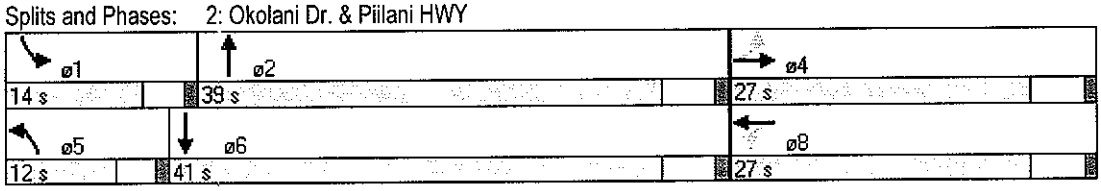
c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	185	15	40	25	10	840	35	1515
Turn Type	Perm		Perm		Prot		Prot	
Protected Phases		4		8	5	2	1	6
Permitted Phases	4		8					
Detector Phase	4	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	10.0	24.0
Total Split (s)	27.0	27.0	27.0	27.0	12.0	39.0	14.0	41.0
Total Split (%)	33.8%	33.8%	33.8%	33.8%	15.0%	48.8%	17.5%	51.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	None	Max
Act Effct Green (s)	15.9	15.9		15.9	6.1	37.1	7.1	41.8
Actuated g/C Ratio	0.23	0.23		0.23	0.09	0.53	0.10	0.60
v/c Ratio	0.73	0.11		0.36	0.07	0.49	0.21	0.86
Control Delay	41.0	12.8		15.6	33.6	13.9	33.9	19.6
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	41.0	12.8		15.6	33.6	13.9	33.9	19.6
LOS	D	B		B	C	B	C	B
Approach Delay		36.0		15.6		14.1		19.9
Approach LOS		D		B		B		B

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 69.8
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.86
Intersection Signal Delay: 19.2
Intersection LOS: B
Intersection Capacity Utilization 71.6%
ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 2: Okolani Dr. & Piilani HWY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	185	15	25	40	25	70	10	840	15	35	1515	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.91			0.93		1.00	1.00		1.00	0.99	
Flt Protected	0.95	1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1687			1707		1770	3530		1770	3494	
Flt Permitted	0.65	1.00			0.90		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1217	1687			1561		1770	3530		1770	3494	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	201	16	27	43	27	76	11	913	16	38	1647	152
RTOR Reduction (vph)	0	21	0	0	52	0	0	1	0	0	7	0
Lane Group Flow (vph)	201	22	0	0	94	0	11	928	0	38	1792	0
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	15.9	15.9			15.9		1.3	38.6		4.5	41.8	
Effective Green, g (s)	15.9	15.9			15.9		1.3	38.6		4.5	41.8	
Actuated g/C Ratio	0.22	0.22			0.22		0.02	0.53		0.06	0.57	
Clearance Time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	265	367			340		32	1867		109	2001	
v/s Ratio Prot		0.01					0.01	0.26		c0.02	c0.51	
v/s Ratio Perm	c0.17				0.06							
v/c Ratio	0.76	0.06			0.28		0.34	0.50		0.35	0.90	
Uniform Delay, d1	26.8	22.6			23.8		35.4	11.0		32.8	13.7	
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	11.7	0.1			0.4		6.3	0.9		1.9	6.7	
Delay (s)	38.5	22.7			24.2		41.8	11.9		34.8	20.4	
Level of Service	D	C			C		D	B		C	C	
Approach Delay (s)		35.7			24.2			12.3			20.7	
Approach LOS		D			C			B			C	

Intersection Summary			
HCM Average Control Delay	19.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	73.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	71.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

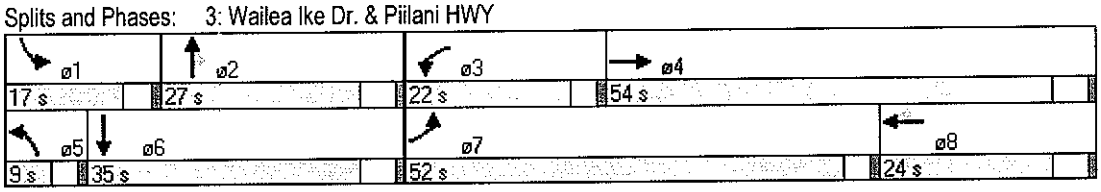
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	635	85	5	95	190	20	105	5	175	70	1425
Turn Type	Prot		Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4	3	8		5	2		1	6	
Permitted Phases					8			2			Free
Detector Phase	7	4	3	8	8	5	2	2	1	6	
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	7.0	27.0	27.0	7.0	27.0	
Total Split (s)	52.0	54.0	22.0	24.0	24.0	9.0	27.0	27.0	17.0	35.0	0.0
Total Split (%)	43.3%	45.0%	18.3%	20.0%	20.0%	7.5%	22.5%	22.5%	14.2%	29.2%	0.0%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?											
Recall Mode	None	None	Min	None	None	Min	Min	Min	None	Min	
Act Effct Green (s)	19.2	20.8	10.7	9.5	9.5	5.1	7.9	7.9	9.5	12.2	64.5
Actuated g/C Ratio	0.30	0.32	0.17	0.15	0.15	0.08	0.12	0.12	0.15	0.19	1.00
v/c Ratio	0.68	0.17	0.02	0.38	0.51	0.16	0.26	0.03	0.38	0.22	0.98
Control Delay	24.1	14.4	32.4	31.6	9.7	35.6	30.3	19.8	29.2	25.6	21.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.1	14.4	32.4	31.6	9.7	35.6	30.3	19.8	29.2	25.6	21.3
LOS	C	B	C	C	A	D	C	B	C	C	C
Approach Delay		22.8		17.2			30.7			22.3	
Approach LOS		C		B			C			C	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 64.5
Natural Cycle: 85
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.98
Intersection Signal Delay: 22.3
Intersection Capacity Utilization 44.9%
Analysis Period (min) 15

Intersection LOS: C
ICU Level of Service A

Splits and Phases: 3: Wailea Ike Dr. & Piilani HWY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	635	85	10	5	95	190	20	105	5	175	70	1425
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	4.0
Lane Util. Factor	0.97	1.00		1.00	1.00	1.00	1.00	0.95	1.00	0.97	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	1833		1770	1863	1583	1770	3539	1583	3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	1833		1770	1863	1583	1770	3539	1583	3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	690	92	11	5	103	207	22	114	5	190	76	1549
RTOR Reduction (vph)	0	4	0	0	0	173	0	0	4	0	0	0
Lane Group Flow (vph)	690	99	0	5	103	34	22	114	1	190	76	1549
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			Free
Actuated Green, G (s)	19.2	19.2		10.7	10.7	10.7	5.1	7.9	7.9	9.5	12.3	65.3
Effective Green, g (s)	19.2	19.2		10.7	10.7	10.7	5.1	7.9	7.9	9.5	12.3	65.3
Actuated g/C Ratio	0.29	0.29		0.16	0.16	0.16	0.08	0.12	0.12	0.15	0.19	1.00
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	1009	539		290	305	259	138	428	192	499	351	1583
v/s Ratio Prot	0.20	0.05		0.00	0.06		0.01	0.03		0.06	0.04	
v/s Ratio Perm						0.02			0.00			c0.98
v/c Ratio	0.68	0.18		0.02	0.34	0.13	0.16	0.27	0.00	0.38	0.22	0.98
Uniform Delay, d1	20.4	17.2		22.9	24.2	23.3	28.1	26.1	25.2	25.2	22.4	0.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	0.2		0.0	0.7	0.2	0.5	0.3	0.0	0.5	0.3	18.1
Delay (s)	22.3	17.4		22.9	24.8	23.6	28.6	26.4	25.2	25.7	22.7	18.1
Level of Service	C	B		C	C	C	C	C	C	C	C	B
Approach Delay (s)		21.7			24.0			26.7			19.1	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM Average Control Delay	20.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	65.3	Sum of lost time (s)	0.0
Intersection Capacity Utilization	44.9%	ICU Level of Service	A
Analysis Period (min)	15		

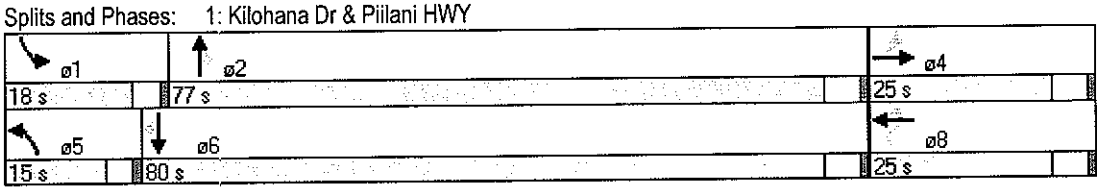
c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	175	40	10	35	140	20	1965	15	160	1665	230
Turn Type	Perm		Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4		8		5	2		1	6	
Permitted Phases	4		8		8			2			6
Detector Phase	4	4	8	8	8	5	2	2	1	6	6
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0	12.0	10.0	24.0	24.0	10.0	24.0	24.0
Total Split (s)	25.0	25.0	25.0	25.0	25.0	15.0	77.0	77.0	18.0	80.0	80.0
Total Split (%)	20.8%	20.8%	20.8%	20.8%	20.8%	12.5%	64.2%	64.2%	15.0%	66.7%	66.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lead/Lag						Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Min	Max	Max	Min	Max	Max
Act Effct Green (s)	19.0	19.0		19.0	19.0	7.0	72.0	72.0	13.6	78.6	78.6
Actuated g/C Ratio	0.16	0.16		0.16	0.16	0.06	0.61	0.61	0.11	0.66	0.66
v/c Ratio	0.88	0.18		0.17	0.40	0.21	0.99	0.02	0.86	0.77	0.22
Control Delay	86.0	38.8		44.8	10.2	57.8	41.8	5.5	86.9	17.2	1.8
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	86.0	38.8		44.8	10.2	57.8	41.8	5.5	86.9	17.2	1.8
LOS	F	D		D	B	E	D	A	F	B	A
Approach Delay		75.6		18.6			41.7			20.9	
Approach LOS		E		B			D			C	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 118.6
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.99
Intersection Signal Delay: 32.9
Intersection LOS: C
Intersection Capacity Utilization 91.2%
ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 1: Kilohana Dr & Piilani HWY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	175	40	10	10	35	140	20	1965	15	160	1665	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Lane Util. Factor	1.00	1.00			1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	0.97			1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1806			1842	1583	1770	3539	1583	1770	3539	1583
Flt Permitted	0.73	1.00			0.94	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1351	1806			1754	1583	1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	190	43	11	11	38	152	22	2136	16	174	1810	250
RTOR Reduction (vph)	0	8	0	0	0	128	0	0	5	0	0	78
Lane Group Flow (vph)	190	46	0	0	49	24	22	2136	11	174	1810	172
Turn Type	Perm			Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8		8			2			6
Actuated Green, G (s)	19.0	19.0			19.0	19.0	7.0	72.0	72.0	13.6	78.6	78.6
Effective Green, g (s)	19.0	19.0			19.0	19.0	7.0	72.0	72.0	13.6	78.6	78.6
Actuated g/C Ratio	0.16	0.16			0.16	0.16	0.06	0.61	0.61	0.11	0.66	0.66
Clearance Time (s)	5.0	5.0			5.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	216	289			281	254	104	2148	961	203	2345	1049
v/s Ratio Prot		0.03					0.01	c0.60		c0.10	0.51	
v/s Ratio Perm	c0.14				0.03	0.02			0.01			0.11
v/c Ratio	0.88	0.16			0.17	0.10	0.21	0.99	0.01	0.86	0.77	0.16
Uniform Delay, d1	48.7	42.9			43.0	42.5	53.2	23.1	9.2	51.5	13.8	7.6
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	30.8	0.3			0.3	0.2	1.0	18.1	0.0	28.1	2.5	0.3
Delay (s)	79.4	43.2			43.3	42.6	54.2	41.2	9.2	79.7	16.3	7.9
Level of Service	E	D			D	D	D	D	A	E	B	A
Approach Delay (s)		71.4			42.8			41.1			20.3	
Approach LOS		E			D			D			C	

Intersection Summary			
HCM Average Control Delay	33.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	118.6	Sum of lost time (s)	14.0
Intersection Capacity Utilization	91.2%	ICU Level of Service	F
Analysis Period (min)	15		

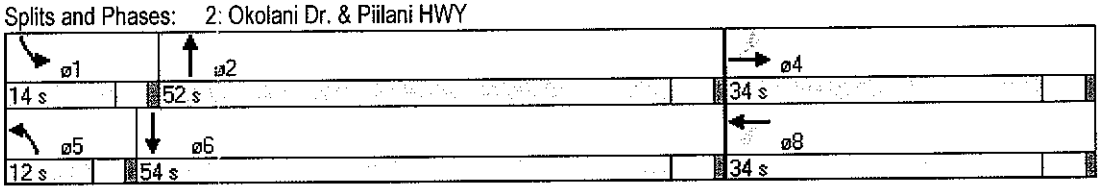
c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	255	35	15	25	40	1640	85	1310
Turn Type	Perm		Perm		Prot		Prot	
Protected Phases		4		8	5	2	1	6
Permitted Phases	4		8					
Detector Phase	4	4	8	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	24.0	24.0	10.0	24.0	10.0	24.0
Total Split (s)	34.0	34.0	34.0	34.0	12.0	52.0	14.0	54.0
Total Split (%)	34.0%	34.0%	34.0%	34.0%	12.0%	52.0%	14.0%	54.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	4.0	5.0	4.0	5.0
Lead/Lag					Lead	Lag	Lead	Lag
Lead-Lag Optimize?					Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Max	None	Max
Act Effct Green (s)	23.2	23.2		23.2	7.1	48.3	8.9	52.1
Actuated g/C Ratio	0.25	0.25		0.25	0.08	0.52	0.10	0.57
v/c Ratio	0.83	0.15		0.21	0.31	0.99	0.54	0.87
Control Delay	54.1	17.2		15.1	49.3	43.6	54.2	26.3
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	54.1	17.2		15.1	49.3	43.6	54.2	26.3
LOS	D	B		B	D	D	D	C
Approach Delay		46.6		15.1		43.8		27.7
Approach LOS		D		B		D		C

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 92.1
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.99
Intersection Signal Delay: 36.3
Intersection LOS: D
Intersection Capacity Utilization 83.9%
ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 2: Okolani Dr. & Piilani HWY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	255	35	30	15	25	50	40	1640	45	85	1310	270
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.93			0.92		1.00	1.00		1.00	0.97	
Flt Protected	0.95	1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1733			1709		1770	3525		1770	3449	
Flt Permitted	0.71	1.00			0.96		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1323	1733			1646		1770	3525		1770	3449	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	277	38	33	16	27	54	43	1783	49	92	1424	293
RTOR Reduction (vph)	0	25	0	0	41	0	0	2	0	0	15	0
Lane Group Flow (vph)	277	46	0	0	56	0	43	1830	0	92	1702	0
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	23.2	23.2			23.2		4.4	49.2		7.3	52.1	
Effective Green, g (s)	23.2	23.2			23.2		4.4	49.2		7.3	52.1	
Actuated g/C Ratio	0.25	0.25			0.25		0.05	0.53		0.08	0.56	
Clearance Time (s)	5.0	5.0			5.0		4.0	5.0		4.0	5.0	
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	328	429			408		83	1851		138	1918	
v/s Ratio Prot		0.03					0.02	c0.52		c0.05	c0.49	
v/s Ratio Perm	c0.21				0.03							
v/c Ratio	0.84	0.11			0.14		0.52	0.99		0.67	0.89	
Uniform Delay, d1	33.5	27.2			27.5		43.6	22.0		42.0	18.2	
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	17.7	0.1			0.2		5.4	18.4		11.5	6.5	
Delay (s)	51.2	27.4			27.6		49.0	40.4		53.5	24.8	
Level of Service	D	C			C		D	D		D	C	
Approach Delay (s)		46.4			27.6			40.6			26.2	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM Average Control Delay	34.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	93.7	Sum of lost time (s)	19.0
Intersection Capacity Utilization	83.9%	ICU Level of Service	E
Analysis Period (min)	15		

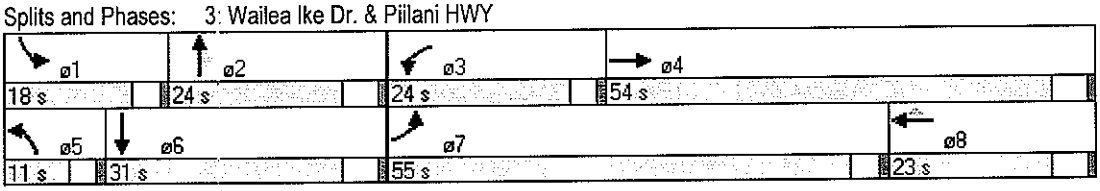
c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	1520	130	5	135	285	15	105	5	290	130	1005
Turn Type	Prot		Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4	3	8		5	2		1	6	
Permitted Phases					8			2			Free
Detector Phase	7	4	3	8	8	5	2	2	1	6	
Switch Phase											
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
Minimum Split (s)	24.0	24.0	24.0	24.0	24.0	7.0	27.0	27.0	7.0	27.0	
Total Split (s)	55.0	54.0	24.0	23.0	23.0	11.0	24.0	24.0	18.0	31.0	0.0
Total Split (%)	45.8%	45.0%	20.0%	19.2%	19.2%	9.2%	20.0%	20.0%	15.0%	25.8%	0.0%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	3.0	4.0	4.0	3.0	4.0	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	4.0
Lead/Lag	Lead	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?											
Recall Mode	None	None	Min	None	None	Min	Min	Min	None	Min	
Act Effct Green (s)	51.2	58.6	5.9	13.3	13.3	6.3	8.8	8.8	13.2	15.8	104.6
Actuated g/C Ratio	0.49	0.56	0.06	0.13	0.13	0.06	0.08	0.08	0.13	0.15	1.00
v/c Ratio	0.98	0.16	0.05	0.62	0.73	0.15	0.38	0.04	0.72	0.50	0.69
Control Delay	46.2	11.5	50.4	55.4	20.9	52.1	50.0	28.0	55.2	48.3	2.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.2	11.5	50.4	55.4	20.9	52.1	50.0	28.0	55.2	48.3	2.5
LOS	D	B	D	E	C	D	D	C	E	D	A
Approach Delay		43.1		32.2			49.4			17.4	
Approach LOS		D		C			D			B	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 104.6
Natural Cycle: 135
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.98
Intersection Signal Delay: 32.0
Intersection LOS: C
Intersection Capacity Utilization 77.1%
ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 3: Wailea Ike Dr. & Piilani HWY



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	1520	130	20	5	135	285	15	105	5	290	130	1005
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	4.0
Lane Util. Factor	0.97	1.00		1.00	1.00	1.00	1.00	0.95	1.00	0.97	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	1825		1770	1863	1583	1770	3539	1583	3433	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	1825		1770	1863	1583	1770	3539	1583	3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1652	141	22	5	147	310	16	114	5	315	141	1092
RTOR Reduction (vph)	0	4	0	0	0	222	0	0	5	0	0	0
Lane Group Flow (vph)	1652	159	0	5	147	88	16	114	0	315	141	1092
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			Free
Actuated Green, G (s)	51.2	58.6		5.9	13.3	13.3	6.3	8.9	8.9	13.2	15.8	104.6
Effective Green, g (s)	51.2	58.6		5.9	13.3	13.3	6.3	8.9	8.9	13.2	15.8	104.6
Actuated g/C Ratio	0.49	0.56		0.06	0.13	0.13	0.06	0.09	0.09	0.13	0.15	1.00
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	1680	1022		100	237	201	107	301	135	433	281	1583
v/s Ratio Prot	c0.48	0.09		0.00	0.08		0.01	0.03		0.09	0.08	
v/s Ratio Perm						0.06			0.00			c0.69
v/c Ratio	0.98	0.16		0.05	0.62	0.44	0.15	0.38	0.00	0.73	0.50	0.69
Uniform Delay, d1	26.3	11.1		46.7	43.3	42.2	46.6	45.2	43.8	44.0	40.8	0.0
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	18.0	0.1		0.2	5.0	1.5	0.6	0.8	0.0	6.0	1.4	2.5
Delay (s)	44.3	11.2		46.9	48.2	43.7	47.3	46.0	43.8	50.0	42.2	2.5
Level of Service	D	B		D	D	D	D	D	D	D	D	A
Approach Delay (s)		41.3			45.2			46.1			15.8	
Approach LOS		D			D			D			B	

Intersection Summary			
HCM Average Control Delay	31.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	104.6	Sum of lost time (s)	4.0
Intersection Capacity Utilization	77.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX D

LEVEL-OF-SERVICE SUMMARY TABLE

Table D-1

LOS INTERSECTION ANALYSIS

Intersection	Existing 2008						Base Year 2016 WITHOUT Piilani Widening WITH Honua'ula Access						Future Year 2016 WITH Piilani Widening						Future Year 2022					
	AM			PM			AM			PM			AM			PM			AM			PM		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
1: Piilani Highway & Kilohana Drive																								
EB LT	33.6	0.59	C	36.7	0.59	D	57.4	0.89	E	128.5	1.12	F	53.2	0.72	D	46.9	0.74	D	53.5	0.73	D	79.4	0.88	E
EB TH/RT	25.8	0.11	C	30.5	0.14	C	19.3	0.1	B	22.2	0.17	C	37.9	0.08	D	31.7	0.12	C	37.7	0.08	D	43.2	0.16	D
WB LT/TH	26.8	0.26	C	30.6	0.15	C	19.8	0.19	B	22.4	0.21	C	38.5	0.15	D	31.9	0.13	C	38.4	0.16	D	43.3	0.17	D
WB RT	25.8	0.1	C	30.2	0.09	C	19.4	0.11	B	21.8	0.09	C	38.1	0.11	D	31.6	0.09	C	37.9	0.11	D	42.6	0.1	D
NB LT	30.3	0.06	C	36.1	0.08	D	26.1	0.13	C	46.6	0.58	D	49	0.05	D	42.6	0.2	D	49.4	0.05	D	54.2	0.21	D
NB TH	-	-	-	-	-	-	-	-	-	-	-	-	10.9	0.4	B	38	0.98	D	13.1	0.54	B	41.2	0.99	D
NB TH/RT	6.1	0.28	A	27.1	0.88	C	21.7	0.88	C	445.9	1.95	F	-	-	-	-	-	-	-	-	-	-	-	-
NB RT	-	-	-	-	-	-	-	-	-	-	-	-	7.9	0	A	10.9	0.01	B	8.1	0	A	9.2	0.01	A
SB LT	30.3	0.46	C	43.3	0.71	D	34.4	0.6	C	40.1	0.78	D	49	0.38	D	45.8	0.69	D	49.4	0.38	D	79.7	0.86	E
SB TH	9.5	0.69	A	11.2	0.53	B	215	1.44	F	168.8	1.34	F	13.3	0.66	B	15.1	0.71	B	17.9	0.81	B	16.3	0.77	B
SB RT	3.8	0.08	A	6.9	0.09	A	5.4	0.11	A	5.2	0.16	A	7.4	0.1	A	8.7	0.16	A	7.7	0.12	A	7.9	0.16	A
Overall	12.4	0.68	B	23.6	0.8	C	119.6	1.18	F	262.6	1.86	F	17.2	0.66	B	28.3	0.88	C	19.4	0.78	B	33.2	0.96	C
2: Piilani Highway & Okolani Drive																								
EB LT	-	-	-	-	-	-	28.4	0.68	C	52	0.85	D	34.5	0.72	C	49	0.83	D	38.5	0.76	D	51.2	0.84	D
EB LT/TH	23.9	-	C	141.7	-	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB TH/RT	-	-	-	-	-	-	19.3	0.06	B	27.1	0.11	C	21.9	0.06	C	27.6	0.11	C	22.7	0.06	C	27.4	0.11	C
EB RT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WB LT/TH	17.8	-	C	27.7	-	D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WB LT/TH/RT	-	-	-	-	-	-	20.2	0.22	C	27.2	0.13	C	23	0.22	C	27.8	0.13	C	24.2	0.28	C	27.6	0.14	C
WB RT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NB LT	9.1	-	A	8.3	-	A	5.3	0.09	A	13.1	0.51	B	42	0.37	D	48.5	0.51	D	41.8	0.34	D	49	0.52	D
NB TH	-	-	-	-	-	-	7.4	0.53	A	106.9	1.18	F	-	-	-	-	-	-	-	-	-	-	-	-
NB TH/RT	-	-	-	-	-	-	-	-	-	-	-	-	9.6	0.33	A	21.5	0.8	C	11.9	0.5	B	40.4	0.99	D
NB RT	-	-	-	-	-	-	4.7	0.01	A	5.4	0.03	A	-	-	-	-	-	-	-	-	-	-	-	-
SB LT	7.7	-	A	9.5	-	A	5	0.09	A	123.6	1.04	F	38.6	0.51	D	50.1	0.63	D	34.8	0.35	C	53.5	0.67	D
SB TH	-	-	-	-	-	-	87.8	1.14	F	24.1	0.92	C	-	-	-	-	-	-	-	-	-	-	-	-
SB TH/RT	-	-	-	-	-	-	-	-	-	-	-	-	14	0.74	B	17.5	0.72	B	20.4	0.9	C	24.8	0.89	C
SB RT	-	-	-	-	-	-	5	0.09	A	6.1	0.19	A	-	-	-	-	-	-	-	-	-	-	-	-
Overall	3	-	A	11.9	-	B	51.8	1.02	D	61.6	1.1	E	15.7	0.68	B	23.4	0.83	C	19.5	0.86	B	34.5	0.97	C
3: Piilani Highway & Waiea Ike Drive																								
EB LT							11.7	0.66	B	140.6	1.25	F	9.8	0.46	A	20.3	0.84	C	22.3	0.68	C	44.3	0.98	D
EB TH							2.9	0.05	A	2.7	0.06	A	3.5	0.05	A	3.8	0.07	A	-	-	-	-	-	-
EB TH/RT							-	-	-	-	-	-	-	-	-	-	-	-	17.4	0.18	B	11.2	0.16	B
WB LT							-	-	-	-	-	-	-	-	-	-	-	-	22.9	0.02	C	46.9	0.05	D
WB TH							22	0.23	C	49.7	0.51	D	15.9	0.19	B	30.4	0.41	C	24.8	0.34	C	48.2	0.62	D
WB RT							21.3	0.08	C	53.9	0.61	D	15.4	0.08	B	30.4	0.39	C	23.6	0.13	C	43.7	0.44	D
NB LT							-	-	-	-	-	-	-	-	-	-	-	-	28.6	0.16	C	47.3	0.15	D
NB TH							-	-	-	-	-	-	-	-	-	-	-	-	26.4	0.27	C	46	0.38	D
NB RT							-	-	-	-	-	-	-	-	-	-	-	-	25.2	0	C	43.8	0	D
SB LT							23.4	0.59	C	169.1	1.19	F	15.6	0.5	B	43.5	0.82	D	25.7	0.38	C	50	0.73	D
SB TH							-	-	-	-	-	-	-	-	-	-	-	-	22.7	0.22	C	42.2	0.5	D
SB RT							5.2	0.83	A	1.7	0.6	A	5.2	0.83	A	1.7	0.6	A	18.1	0.98	B	2.5	0.69	A
Overall							9.3	0.83	A	85.6	1.13	F	7.8	0.83	A	17.6	0.78	B	20.6	0.98	C	31.9	0.84	C

APPENDIX I-1.

Preliminary Basis of Design for Pi`ilani Highway Widening

AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

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July 10, 2009

PRELIMINARY BASIS OF DESIGN
FOR
PI'ILANI HIGHWAY WIDENING
(KILOHANA STREET TO WAILEA IKE DRIVE)
WAILEA, MAUI, HAWAII

I. INTRODUCTION

This basis of design evaluates the existing roadway conditions and defines design guidelines and assumptions for the roadway widening of Piilani Highway (Highway 31) from Kilohana Street to Wailea Ike Drive.

II. PROPOSED PROJECT

A. Location

Piilani Highway is a north-south State arterial providing access to the Kihei-Wailea-Makena areas from areas north of Wailea-Makena. The proposed Piilani Highway Widening project consists of widening of approximately 1.44 miles of highway from Kilohana Drive/Mapu Street to Wailea Ike Drive. Intersection improvements proposed within the project area are Kilohana Drive/Mapu Street, Okolani Drive/Mikioi Place and Wailea Ike Drive/proposed Honua'ula project access road. The project area is bounded by the Maui Meadows Subdivision and the proposed Honua'ula Partners LLC development (currently vacant land) to the east and Wailea Kanani, Wailea Puanani Estates, Kai Malu at Wailea, Wailea Gateway Shopping Center, and the Bluffs at Wailea to the west. Refer to Exhibit 1 for Location and Vicinity Map.

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B. Project Description

Widening of Piilani Highway from Kilohana Drive/Mapu Place to the terminus is required as a condition in the change in zoning approval for the Honua'ula Development, Makena Resort Development, and Wailea A&B Properties Development. The proposed project will widen Piilani Highway from a two-lane highway to a four-lane highway south of its intersection with Kilohana Drive/Mapu Place until its terminus at Wailea Ike Drive, including reconstructing Piilani Highway/Wailea Ike intersection to include a southbound extension of Piilani Highway and eastbound entry roadway into the Honua'ula project area. Proposed improvements include excavation and embankment, widening of the road with asphalt concrete pavement, construction of concrete curb, gutters, sidewalks, asphalt concrete swales, drainage systems, storm water retention systems, storm water filtration systems, retaining walls, sound attenuation walls, roadway re-striping, relocation of overhead electrical transmission lines, telephone lines and cable television lines to new utility poles, installation of new utility boxes, street light standards, traffic sign posts, guard rails, and adjustments to existing utilities as may be necessary for installation of proposed improvements. Reconstruction of the existing traffic signal at Kilohana Drive/Mapu Street and installation of new traffic signals at Okolani Drive/Mikioi Place and at Wailea Ike Drive/proposed Honua'ula project access road are also proposed. Refer to Exhibit 2 for General Site Plan.

III. EXISTING ROADWAY CONDITIONS

Piilani Highway - is generally a four-lane, undivided, north/south State arterial highway providing access to Kihei and Wailea from areas north of Kihei. Piilani Highway narrows to a two-lane highway at its intersection with Kilohana Drive/Mapu Place until its terminus at Wailea Ike Drive. Piilani Highway begins at its intersection with South/North Kihei Road and ends at its intersection with Wailea Ike Drive, with provisions to extend the highway further south. Left-turn storage lanes are provided at major intersections on Piilani Highway. The posted speed limit on Piilani Highway is 40 miles per hour (mph) for a majority of the highway. The speed limit on Piilani Highway within the project limits

is 45 mph in the northbound direction from Wailea Ike Drive to Kilohana Drive; the southbound speed limit on this segment decreases from 45 mph to 25 mph as it approaches Wailea Ike Drive.

Piilani Highway is currently classified as an Urban Principal Arterial. The segment of highway under this project scope is currently an existing two-lane asphalt concrete paved roadway with one (1) lane of traffic in each direction. A highway functional classification evaluation study prepared by Austin Tsutsumi & Associates, Inc., dated March 6, 2009 for the project highway section was submitted to HDOT (currently waiting for formal approval). This classification evaluation concludes that this segment of highway merits consideration to revise the functional classification to Urban Minor Arterial.

Kilohana Drive - is a two-lane, undivided, east/west roadway that connects South Kihei Road with Piilani Highway, intersecting Piilani Highway across Mapu Place, which provides the north access to Maui Meadows residential subdivision. Kilohana Drive is a State roadway from approximately Piilani Highway to Kapili Street. The posted speed limit on Kilohana Drive is 25 mph.

Mapu Place – is a two-lane, undivided, east/west roadway that provides one of two access points from Pi'ilani Highway to Maui Meadows residential subdivision. The posted speed limit on Mapu Place is 25 mph.

Okolani Drive - is a four-lane, divided, east/west private collector roadway between South Kihei Road and Wailea Alanui Drive. Okolani Drive narrows to a two-lane undivided County roadway east of Wailea Alanui Drive to its intersection with Piilani Highway directly across of Mikioi Place. The posted speed limit on Okolani Drive is 30 mph.

Mikioi Place – is a two-lane, undivided, east/west roadway that provides one of two access points from Pi'ilani Highway, across Okolani Drive, to Maui Meadows residential subdivision. The posted speed limit on Mikioi Place is 25 mph.

Wailea Ike Drive - is a four-lane, divided, east/west County collector roadway that narrows to a two-lane roadway just before its connection to Piilani Highway. Wailea Ike Drive is the main entrance to the Wailea Resort and connects Piilani Highway with Wailea Alanui Drive. Its vertical alignment is a relatively steep grade with a posted

speed limit of 30 mph. Wailea Ike Drive, from its intersection with Wailea Ekolu Place to Wailea Alanui Drive, has a major drainage channel in its median area.

IV. PROPOSED ROADWAY BASIS OF DESIGN

A. Roadway Functional Classification

Piilani Highway is currently classified as an Urban Principal Arterial. Thus, roadway design is based on an Urban Principal Arterial roadway.

B. Posted and Design Speed

The existing posted speed limit on Piilani Highway is 40 miles per hour (mph) for a majority of the highway. The speed limit on Piilani Highway within the project limits is 45 mph in the northbound direction from Wailea Ike Drive to Kilohana Drive; the southbound speed limit on this segment decreases from 45 mph to 25 mph as it approaches Wailea Ike Drive. Based on a speed study of this segment of highway by Austin, Tsutsumi & Associates, Inc. in April 2009, the 85th percentile speed was determined to be 37.7 mph. Thus, under the proposed design, the posted speed limit will be 35 mph and the design speed will be 45 mph for the section of highway under the project scope.

Design Speed	45 mph
Posted Speed	35 mph

C. Horizontal Alignment

The existing horizontal roadway alignment is maintained throughout the highway segment except for a 1,500 feet section from Station 136+00 to 151+00 where a 20' horizontal shift mauka (including transitional taper) occurs. This 20' shift allows for the makai side of the highway in this vicinity to remain as is for the most part and minimizes the amount of retaining walls and renovations to existing infrastructure. A normal cross slope of 2% is used for the entire stretch of highway. Below is a table showing storage lengths used for left-turn auxiliary lanes:

Table of Left-Turn Storage Lengths	
	Storage Length (ft)
Piilani Hwy onto Mapu Pl.	100
Piilani Hwy onto Kilohana Dr.	50
Piilani Hwy onto Mikioi St.	75
Piilani Hwy onto Okolani Dr.	50
Piilani Hwy onto Honua'ula access rd.	150

Storage length values are based on traffic volume calculations taken from the Traffic Impact Assessment Report (TIAR) by Austin, Tsutsumi & Associates, Inc dated July 21, 2009. Deceleration lengths of 350' for right-turn lanes and 400' for left-turn lanes are used, in accordance with AASHTO (Green Book, 2004 edition) guidelines. 15:1 tapers are included in the auxiliary lane deceleration length. Taper lengths for travel-way lanes are based on AASHTO and Manual on Uniform Traffic Control Devices (MUTCD, 2003 edition) guidelines, for the posted speed of 35 mph.

D. Vertical Alignment

No changes in longitudinal grades are proposed. The project will require excavation and embankment in order to widen the existing highway while maintaining the existing longitudinal grade of the highway. The site will be graded to maintain the existing highway grades and drainage patterns. Retaining walls, ranging from an exposed face of approximately 2-feet to 26-feet, will be required in order to attain the proposed roadway grades. Preliminary geotechnical consultation recommendations dated March 30, 2009 state that gradients of 2H:1V or flatter should be used for permanent cut slopes exposing the surface soil, as well as fill slopes. Gradients of 1H:1V or flatter should be used for permanent cut slopes into the basalt. Sound attenuation walls will also be incorporated into the construction to aid in reduction in noise levels due to traffic noise impacts, as recommended by the acoustical engineer. HDOT criteria will be used to determine feasibility of sound wall construction.

E. Cross Section Elements

The proposed road improvements will widen Piilani Highway from a 24-feet travel-way to a 48-feet travel-way by adding a 12-feet wide travel lane in each direction of traffic flow. All cross sectional elements conform to AASHTO guidelines, and include 11-feet wide left-turn auxiliary lanes and 12' wide right-turn lanes. In addition, a 4-feet wide bike lane, 2-feet wide concrete curb and gutter and 6-feet wide sidewalk are proposed for both sides of the highway. An 8-feet wide striped median is also proposed for the segment of highway. Currently, there is no existing median provided for this segment of highway.

F. Intersection Improvements

The proposed intersection improvements are as follows:

Kilohana Drive/Mapu Place

- Modification of the existing traffic signal system
- Northbound Approach and Southbound Approaches: Provide an exclusive left-turn lane, two (2) exclusive through lanes, and an exclusive right-turn lane.
- Eastbound Approach: Remain as an exclusive left-turn lane and a shared through/right-turn lane.
- Westbound Approach: Provide an exclusive left-turn lane, exclusive through lane and an exclusive right-turn lane.

Okolani Drive/Mikioi Place

- Install a traffic signal system.
- Northbound and Southbound Approaches: Provide an exclusive left-turn lane, an exclusive through lane, and a shared through/right-turn lane.
- Eastbound Approach: Provide an exclusive left-turn lane and a shared through/right-turn lane.

- Eastbound Approach: Provide an exclusive left-turn lane and a shared through/right-turn lane.
- Westbound Approach: Remain as a shared left-turn/through/right-turn lane.

The Piilani Highway/Wailea Ike Drive intersection will be completed in 3 phases. The Year 2016 was selected to reflect the completion year of Phase I of Honua'ula which includes the creation of a tee-intersection at the Piilani Highway/Wailea Ike Drive intersection. Year 2022 was selected to reflect the full build-out of Honua'ula, Wailea Resort and Makena Resort.

Phase I of the Piilani Highway/Wailea Ike Drive intersection is expected to occur prior to the construction of Honua'ula. The Piilani Highway/Wailea Ike Drive intersection will not require any intersection control and will have the following lane configuration:

Wailea Ike Drive – Phase 1

- Southbound Approaches: Provide an exclusive free right-turn lane.
- Eastbound Approach: Provide an exclusive free left-turn lane.

Phase II of the Piilani Highway/Wailea Ike Drive intersection is expected to occur upon completion of Phase I of Honua'ula (Year 2016). The east leg of the Piilani Highway/Wailea Ike Drive intersection will be striped forming a tee-intersection, with Piilani Highway being the stem of the tee. Due to a high southbound right-turn and eastbound left-turn, the intersection will warrant a traffic signal, in accordance with the HCM. With the Piilani Highway/Wailea Ike Drive intersection re-striped to a tee-intersection, the following are the recommended lane configuration:

Wailea Ike Drive/ Project Road – Phase 2

- Install a traffic signal system.
- Southbound Approaches: Provide an exclusive left-turn lane, and an exclusive right-turn lane. Also, it is recommended that the Piilani Highway southbound right-turn be a free turning movement

by providing an exclusive westbound receiving lane on Wailea Ike Drive.

- Eastbound Approach: Provide two (2) exclusive left-turn lanes and a through lane.
- Westbound Approach: Provide an exclusive through lane and an exclusive right-turn lane.

Phase III of the Piilani Highway/Wailea Ike Drive intersection is expected to occur during Phase II of Honua'ula where an extension of Piilani Highway to intersection with an extension of Kaukahi Street forming the south leg of the Piilani Highway/Wailea Ike Drive intersection is proposed. The following lane configuration is recommended:

Wailea Ike Drive/ Project Road/Future Piilani Highway Extension South – Phase 3

- Install a traffic signal system.
- Northbound Approach: Provide an exclusive left-turn lane, two (2) exclusive through lanes, and an exclusive right-turn lane.
- Southbound Approaches: Provide two (2) exclusive left-turn lanes, an exclusive through lane, and an exclusive right-turn lane. Piilani Highway southbound right-turn will be a free turning movement by providing an exclusive westbound receiving lane on Wailea Ike Drive.
- Eastbound Approach: Provide two (2) exclusive left-turn lanes and a shared through/right-turn lane.
- Westbound Approach: Provide an exclusive left-turn lane, an exclusive through lane, and an exclusive right-turn lane.

Intersection curve geometrics are based on turning path requirements for WB-50 design vehicles. Where appropriate, ADA curb ramps will be designed and constructed.

G. Signage and Pavement Markings

The signage and pavement markings will be designed and constructed based on the Federal Highway Administration "Manual on Uniform Traffic Control Devices" (MUTCD).

H. Roadside Design

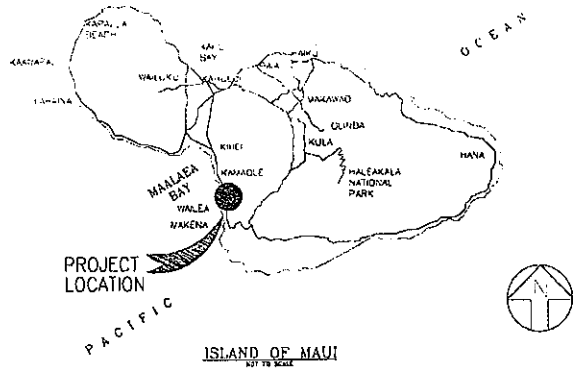
Guard rails will be installed in accordance with the AASHTO Roadside Design Guide.

V. CONCLUSION

Based on the foregoing it is our professional opinion that the proposed improvements for this project will be designed in accordance with the applicable rules and regulations of the State of Hawaii and the County of Maui as applicable. Highway elements were based on HDOT, County of Maui and AASHTO guidelines.

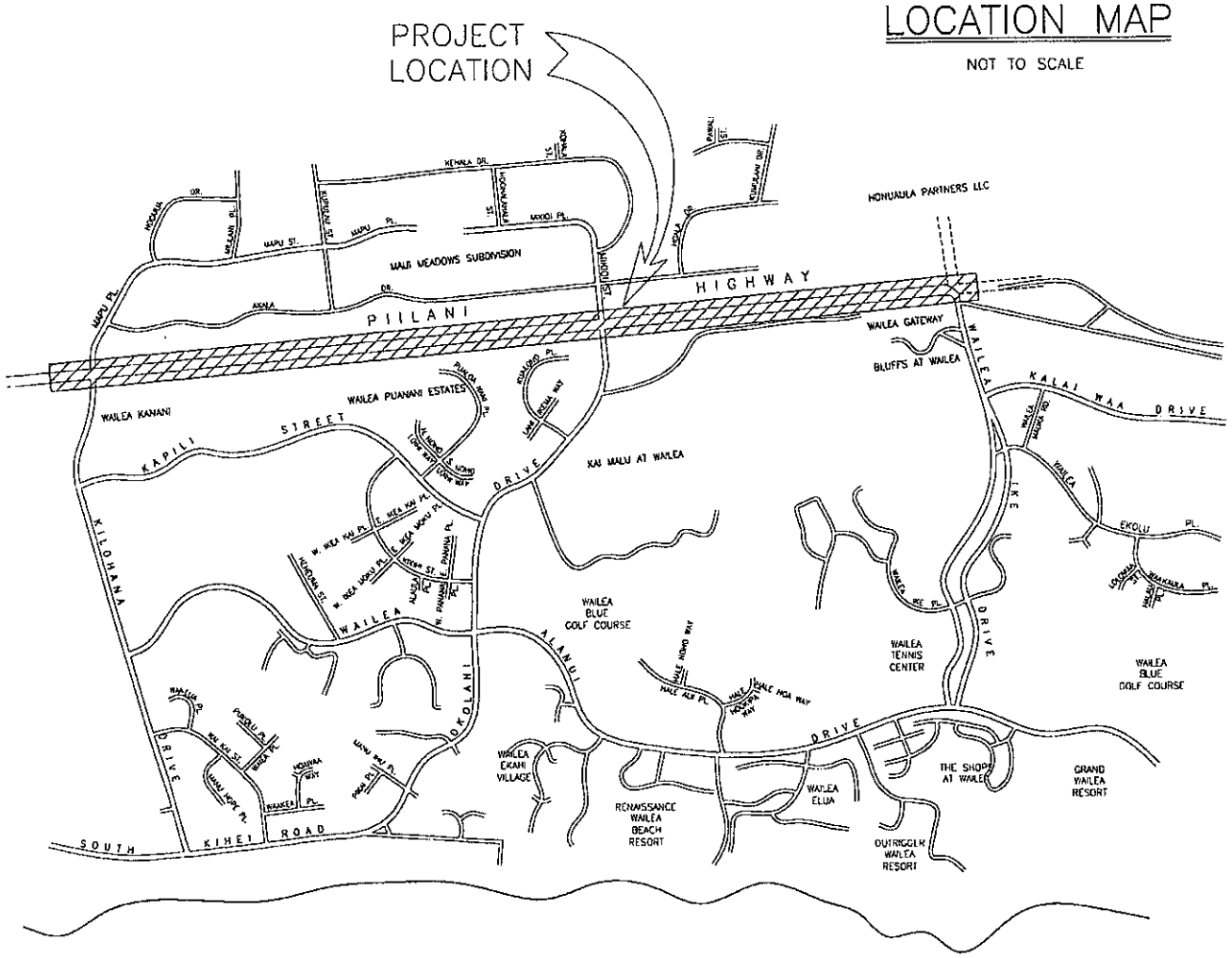
VI. DESIGN REFERENCES

1. AASHTO. (2004 Edition). *A Policy on Geometric Design for Highways and Streets.*
2. AASHTO. (2002). *Roadside Design Guide.*
3. Department of Public Works and Waste Management, County of Maui. (November, 1995). *Rules for the Design of Storm Drainage Facilities in the County of Maui.*
4. Federal Emergency Management Agency. (June 1, 1981). *Flood and Insurance Rate Map, Maui County, Hawaii.* Map Number 150003-0330-B.
5. HDOT. (April 15, 2008). *Design Criteria for Bridges and Structures.*
6. HDOT. (May 15, 2006). *Design Criteria for Highway Drainage.*
7. HDOT. (2005). *Hawaii Standard Specifications for Road, Bridge, and Public Works Construction.*
8. HDOT. *Permanent Best Management Practices (BMP) Manual.*
9. HDOT. (2008). *Standard Plans.*
10. USDOT FHWA. (2003). *Manual on Uniform Traffic Control Devices.*



LOCATION MAP

NOT TO SCALE



VICINITY MAP

NOT TO SCALE

PRELIMINARY BASIS OF DESIGN

PIILANI HIGHWAY WIDENING
KILOHANA STREET TO WAILEA IKE DRIVE

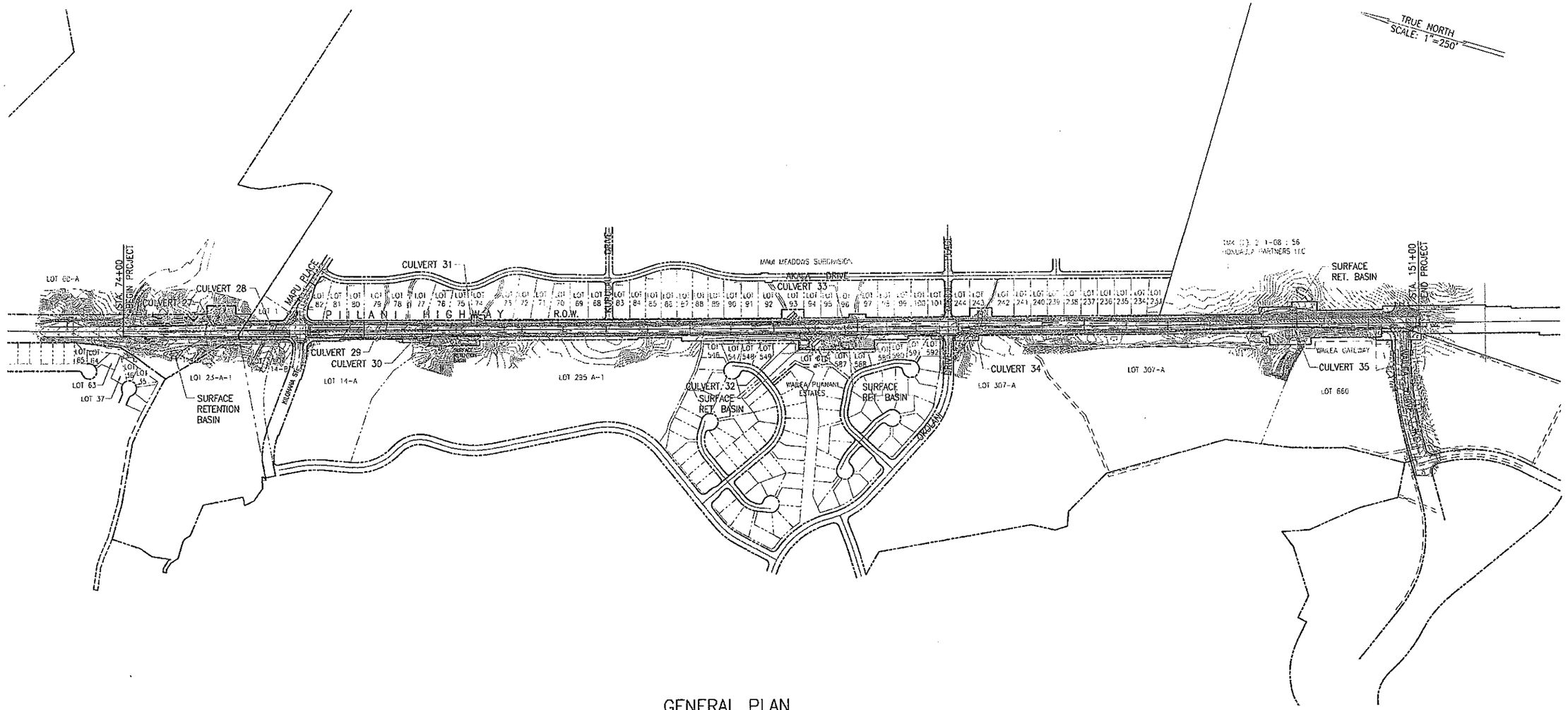
WAILEA, MAUI, HAWAII

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII

PROJECT LOCATION & VICINITY MAP

EXHIBIT 1

JULY 2009



GENERAL PLAN
SCALE: 1"=300'

SCALE IN FEET

80' 0 80' 160'

16' 0 16' 32'

PRELIMINARY BASIS OF DESIGN
PIILANI HIGHWAY WIDENING
KILOHANA STREET TO WAILEA IKE DRIVE
WAILEA, MAUI, HAWAII

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII

GENERAL SITE PLAN

EXHIBIT
2

JULY 2009

FN X:\2008\08-516\BASIS OF DESIGN\

APPENDIX J.

Preliminary Engineering Report

PRELIMINARY ENGINEERING REPORT
PIILANI HIGHWAY WIDENING - KILOHANA DRIVE TO WAILEA IKE DRIVE
WAILEA, MAUI, HAWAII

FINAL

July 23, 2010

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PRELIMINARY ENGINEERING REPORT
FOR
PIILANI HIGHWAY WIDENING
KILOHANA DRIVE TO WAILEA IKE DRIVE

WAILEA, MAUI, HAWAII

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July 23, 2010

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A PRELIMINARY HYDROLOGY CALCULATIONS

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PRELIMINARY ENGINEERING REPORT
FOR
PIILANI HIGHWAY WIDENING
(KILOHANA DRIVE TO WAILEA IKE DRIVE)
WAILEA, MAUI, HAWAII

I. INTRODUCTION

The purpose of this report is to provide an overview of the preliminary engineering design of the Piilani Highway Widening – Kilohana Drive to Wailea Ike Drive project in Wailea, Maui. This report evaluates the existing site conditions and defines requirements for grading, drainage, electrical and water utilities, and intersection improvements with traffic signalization, along with other miscellaneous improvements for the widening of Piilani Highway from Kilohana Drive to Wailea Ike Drive.

II. PROPOSED PROJECT

A. Location

Piilani Highway (Route 31) is a four (4) lane principal arterial roadway from South Kihei Road to Kilohana Drive in Wailea. The highway reduces to two (2) lanes from its intersection with Kilohana Drive to its existing terminus at Wailea Ike Drive. This north-south State arterial provides access to the Kihei-

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Wailea-Makena areas from areas north of Wailea-Makena. The proposed Piilani Highway Widening project consists of widening of approximately 1.44 miles of highway from Kilohana Drive/Mapu Street to Wailea Ike Drive. Intersection improvements proposed within the project area are Kilohana Drive/Mapu Street, Okolani Drive/Mikioi Place and Wailea Ike Drive/proposed Honua'ula project access road. The project area is bounded by the Maui Meadows Subdivision and the proposed Honua'ula Partners LLC development (currently vacant land) to the east and Wailea Kanani, Wailea Puanani Estates, Kai Malu at Wailea, Wailea Gateway Shopping Center, and the Bluffs at Wailea to the west. Refer to Exhibit 1 for Location and Vicinity Map.

B. Project Description

Honua'ula Partners LLC, A&B Wailea LLC, and Honua LLC in coordination with the State of Hawaii, Department of Transportation, Highways Division proposes to implement the project. The proposed project will widen Piilani Highway from a two-lane highway to a four-lane highway beginning at approximately 1,000 feet north of its intersection with Kilohana Drive/Mapu Place to its terminus at Wailea Ike Drive, including reconstructing Piilani Highway/Wailea Ike intersection to include a southbound extension of Piilani Highway and eastbound entry roadway into the Honua'ula project area. Proposed improvements include excavation and embankment, widening of the road with asphalt concrete pavement, construction of concrete curb, gutters, sidewalks, drainage systems, storm water retention and filtration systems, retaining walls, sound attenuation walls, roadway re-striping, relocation of overhead electrical transmission lines, telephone lines and cable television lines to new utility poles, installation of new utility boxes, street light standards, traffic sign posts, guard rails, and adjustments to existing utilities as may be necessary for installation of proposed improvements. Reconstruction of the existing traffic signal at Kilohana Drive/Mapu Street and installation of new traffic signals at Okolani Drive/Mikioi Street and at Wailea Ike Drive/proposed Honua'ula project access road are also proposed. (Refer to Exhibits 2 to 9 for Typical Road Sections and Preliminary Plans.)

III. EXISTING CONDITIONS

A. Topography and Soil Conditions

The project site within the existing highway right-of-way is currently developed with the construction of the existing roadway and utility improvements. The longitudinal slope of the highway slopes in a south to north direction from Wailea Ike Drive (Station 150+00 at approximate elevation of 323 feet) to the beginning of the project limits just north of Kilohana Drive/Mapu Place intersection (Station 74+00 at approximately elevation of 197 feet). The existing ground cross sections generally slope in the mauka to makai direction with elevations ranging from 329 ft to 197-feet mean sea level (MSL).

Soil on the site is mainly Makena loam and stony complex (MXC). MXC soil is typically found on 3 to 15 percent slopes, on the lower leeward slopes of Haleakala in the Makena and Kamaole region. This complex is a mixture of Makena loam and stony land. Stony land occurs on low ridges and makes up 30 to 60 percent of the complex. Makena loam is dark brown to dark yellowish brown soil. Type MXC soil is part of the Makena soil series and characterized as well drained, having moderately rapid permeability, and slow to medium runoff with a slight erosion hazard and a low shrink-swell potential. Classifications are based on the USDA Soil Conservation Service's publication, "Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai and Lanai", State of Hawaii, dated August 1972 and soil classification information is confirmed with the geotechnical consultation letter prepared by Hirata & Associates, Inc. dated March 30, 2009.

B. Existing Infrastructure

1. Water

The Kihei-Makena region is served by the Central Maui Water System. The Central Maui Water System is served by the Iao Aquifer which includes the Mokuhau wells located in Wailuku.

Two (2) segments of waterlines are located within the project area. The first segment is an existing 12-inch cast iron waterline which

crosses Piilani Highway north of Kilohana Drive/Mapu Place intersection at approximately Station 83+50 from the Maui Meadows Subdivision into Lot 1-A (TMK: (2) 2-1-008:046) owned by the County of Maui. The second 12" waterline crosses Piilani Highway south of Okolani Drive/Mikioi Place at approximately Station 123+00 and branches off in the southerly direction from Station 123+00 to 126+40 then continues offsite within Easement 136 located within Lot 307-A (TMK: (2) 2-1-008:130) owned by A&B Wailea LLC.

2. Sewer

The wastewater service area for the County's Kihei Wastewater Reclamation System extends from North Kihei to Wailea. The system consists of pump stations and force mains which convey wastewater through the County's sewer lines. The combined flows are transported to the Kihei Wastewater Reclamation Facility, which is located adjacent to the Elleair Golf Course. The existing design capacity of the Kihei Wastewater Reclamation Facility is 8.0 million gallons per day (MGD).

The proposed improvements are not expected to adversely impact the wastewater collection system and associated infrastructure. There are no existing sewer systems within the project limits.

3. Electrical

An existing overhead Maui Electric Company (MECo) transmission line runs along the makai side of the highway, then crosses the existing highway to the mauka side from Station 141+60 and continues in the southerly direction beyond the project limits. Overhead service lines cross the highway at various locations and provide service to the adjacent subdivisions. Power to existing street lights are provided via service drops from overhead lines and underground conduits.

Hawaiian Telephone Company (HTCo) overhead telecommunication lines situated on the makai side of Piilani Highway are located on joint poles shared with MECo with crossings at various locations to provide service to adjacent subdivisions.

Sandwich Isle Communication (SIC) underground fiber optic telecommunications lines are situated on the mauka side of the existing highway and provide service to Department of Hawaiian Home Land (DHHL) lessees.

4. Drainage

There are nine (9) existing culvert crossings spanning the section of Piilani Highway within the project vicinity. The culverts were designed based on a 50 year – 1 hour storm recurrence interval. Existing culvert capacity and drainage calculations are based on a drainage report titled "Hydrology Report for Piilani Highway" dated March 1977, prepared by Trans-Meridian Engineers & Surveyors, Inc. for the HDOT Highways Division. The table below summarizes the existing culvert information within the project site limits:

Culvert Designation	Culvert Size	Culvert Capacity (cfs)
27	2- 60"	302
28	3- 48"	217
29	2- 42"	115
30	1- 30"	27
31	1- 84"	398
32	4- 120"	2522
33	1- 120"	1005
34	3- 48"	295
35	2- 120"	1925

The culvert designation and culvert capacity information was obtained from the Trans-Meridian Drainage Report. The culvert size information was obtained from field measurements by Austin, Tsutsumi & Associates, Inc. completed on July 24, 2008.

Currently, roadway drainage systems consist of concrete swales, curb/gutter, catch basins/grated drain inlets and 24-inch diameter drain pipes at certain segments of the highway, primarily in the vicinity of the

three intersections. These systems drain to the existing culverts and then to the gulches. No retention systems currently exist within the existing state right-of-way. Offsite flows are currently intercepted by a concrete drainage ditch located along the eastern boundary of the project area and are conveyed to the existing culverts.

Existing flows within the project limits were calculated to be approximately 65.2 cfs based on a 25 year-1 hour storm recurrence interval in accordance with HDOT Design Criteria for Highway Drainage dated May 15, 2006. As mentioned above, existing offsite and culvert flows were taken from the drainage report prepared by Trans-Meridian Engineers & Surveyors, Inc. Refer to Appendix A for Preliminary Hydrology Computations.

5. Roadway System

Piilani Highway - is generally a four-lane, undivided, north/south State arterial highway providing access to Kihei and Wailea from areas north of Kihei. Piilani Highway narrows to a two-lane highway at its intersection with Kilohana Drive/Mapu Place until its terminus at Wailea Ike Drive. Piilani Highway begins at its intersection with South/North Kihei Road and ends at its intersection with Wailea Ike Drive, with provisions to extend the highway further south. Left-turn storage lanes are provided at major intersections on Piilani Highway. The posted speed limit on Piilani Highway is 40 miles per hour (mph) for a majority of the highway. The speed limit on Piilani Highway is 45 mph in the northbound direction from Wailea Ike Drive to Kilohana Drive; the southbound speed limit on this segment decreases from 45 mph to 25 mph as it approaches Wailea Ike Drive.

Piilani Highway is currently classified as an Urban Principal Arterial. The segment of highway under this project scope is currently an existing two-lane asphalt concrete paved roadway with one (1) lane of traffic in each direction.

Kilohana Drive - is a two-lane, undivided, east/west roadway that connects South Kihei Road with Piilani Highway, intersecting Piilani Highway across Mapu Place, which provides the north access to Maui Meadows residential subdivision. Kilohana Drive is currently a private roadway from South Kihei Road to approximately Kapili Street and a State roadway from approximately Kapili Street to Piilani Highway. The posted speed limit on Kilohana Drive is 25 mph.

Mapu Place – is a two-lane, undivided, east/west roadway that provides one of two access points from Pi'ilani Highway to Maui Meadows residential subdivision. The posted speed limit on Mapu Place is 25 mph.

Okolani Drive - is a four-lane, divided, east/west private collector roadway between South Kihei Road and Wailea Alanui Drive. Okolani Drive narrows to a two-lane undivided roadway east of Wailea Alanui Drive to its intersection with Piilani Highway directly across of Mikioi Street. The posted speed limit on Okolani Drive is 30 mph.

Mikioi Place – is a two-lane, undivided, east/west roadway that provides one of two access points from Pi'ilani Highway, across Okolani Drive, to Maui Meadows residential subdivision. The posted speed limit on Mikioi Place is 25 mph.

Wailea Ike Drive - is a four-lane, divided, east/west County collector roadway that narrows to a two-lane roadway just before its connection to Piilani Highway. Wailea Ike Drive is the main entrance to the Wailea Resort and connects Piilani Highway with Wailea Alanui Drive. Its vertical alignment is a relatively steep grade with a posted speed limit of 30 mph. Wailea Ike Drive, from its intersection with Wailea Ekolu Place to Wailea Alanui Drive, has a major drainage channel in its median area.

C. Flood Zone

The project site sits in a designated flood zone "X", with areas of minimal flooding. Flood zone information is obtained from the Federal Emergency

Management Agency, Flood Insurance Rate Map (FIRM), Panel No. 150003 0676E, dated September 25, 2009.

IV. PROPOSED INFRASTRUCTURE IMPROVEMENTS

A. Grading and Drainage Plan

The project will require excavation and embankment in order to widen the existing highway while maintaining the existing longitudinal grade of the highway. The site will be graded to maintain the existing highway grades and south to north drainage pattern. Retaining walls, ranging from an exposed face of 2-feet to 26-feet, will be required in order to attain the proposed roadway grades. Based on the geotechnical consultation letter dated March 30, 2009 by Hirata & Associates, gradients of 2H:1V or flatter should be used for permanent cut slopes exposing the surface soil, as well as fill slopes. Gradients of 1H:1V or flatter should be used for permanent cut slopes into the basalt. (Refer to Exhibit 2 - Typical Road Sections).

The Rational Method is used to determine the storm water runoff quantities for drainage area less than 200 acres. Hydrology calculations are based on a 25 year – 1 hour storm recurrence interval in accordance with HDOT Design Criteria for Highway Drainage dated May 15, 2006. Refer to Appendix A for preliminary computations for onsite runoff.

Offsite runoff mauka of the project site will be intercepted by concrete trapezoidal ditches located makai of the eastern right-of-way boundary. The runoff will be conveyed to existing culverts following the existing drainage routing. Offsite runoff calculations were taken from the drainage report prepared by Trans-Meridian Engineers & Surveyors, Inc. Flows were assumed unchanged, since any mauka developments that occurred subsequent to the Trans-Meridian report would be required to retain their respective increases in storm water flows in accordance with Maui County drainage standards.

Piilani Highway will be widened from a 24-feet travelway to a 48-feet travelway by adding one (1) additional lane in each direction of traffic flow. In addition, an 8-feet wide median is proposed along with 4-feet wide bike lane, 2-

feet wide curb/gutter and 6-feet wide concrete sidewalk on both sides of the road. Refer to Exhibit 2 for Typical Road Sections. The proposed widening improvements will increase the impervious surfaces by approximately 5.8 acres, thus increasing the developed runoff from approximately 65.2 cfs (existing) to approximately 76.8 cfs (proposed), an increase of 11.6 cfs.

An analysis was conducted to determine the impact of discharging the increase in flow generated from the project site to each culvert. Based on the percentage increase in flow through the culvert and the normal depth increase through the culvert, the flow increase was considered to be negligible. The table below summarizes the existing culvert flow and the increase in flow generated from the project site to each culvert (if no retention provided):

Culvert Designation	Culvert Size	Exist. Culvert Flow (cfs)	Increase in Flow (cfs)	% Increase in Flow
27	2- 60"	302	0.56	0.2
28	3- 48"	217	1.22	0.6
29	2- 42"	115	0.31	0.3
30	1- 30"	27	~0	~0
31	1- 84"	398	2.86	0.7
32	4- 120"	2522	1.27	0.05
33	1- 120"	1005	0.84	0.08
34	3- 48"	295	2.74	0.9
35	2- 120"	1925	1.61	0.08

Based on discussion with Maui County Dept. of Public Works – Engineering Division, there are no known flooding issues downstream of the project area. Thus, potential impact to downstream areas is negligible. Permanent BMPs including surface retention basins and mechanical filtration systems are proposed for this project that will retain the increase in flow generated by the 25 yr-1 hr design storm event and meet HDOT water quality standards.

The proposed drainage system improvements will include grated drain inlets, manholes, drain lines, surface retention basins and mechanical filtration systems, and extension of existing culverts and construction of new inlet and outlet structures to accommodate the widened road section. The 11.6 cfs

increase in runoff will be retained via the surface retention basins in accordance with HDOT Storm Water Permanent Best Management Practices Manual dated March 2007. Refer to Exhibits 3 to 9 for the proposed drainage system schematic layout. Coordination with the Army Corp of Engineers, Department of Health and Department of Land and Natural Resources will be undertaken during the design process to address applicable, additional permitting requirements for the culvert modifications.

In addition to reducing peak flow rates, the proposed stormwater system will provide water quality treatment via mechanical filtration systems and reduce the discharge of pollutants to the maximum extent practicable in accordance with the HDOT Storm Water Permanent Best Management Practices Manual dated March 2007.

B. Water System

A segment of the existing 12-inch cast iron waterline which crosses Piilani Highway north of Kilohana Drive/Mapu Place intersection will need to be relocated and lowered to allow for the proposed drainage improvements. A segment of the 12" waterline that runs along Piilani Highway south of Okolani Drive/Mikioi Place will also need to be relocated to allow for the proposed drainage improvements. Refer to Exhibits 4 and 7 for schematic of waterline relocation.

C. Sewer System

No existing sewer lines will be affected by the proposed road improvements.

D. Electrical System

The existing MECo overhead electrical transmission lines and HTCo overhead telecommunication lines will need to be relocated to new joint utility poles along the length of the project section to accommodate the proposed roadway widening. Existing electrical boxes, underground conduits and street lights will also be relocated to accommodate the proposed roadway widening. Relocation of the SIC lines are not anticipated. The contractor must ensure that the existing SIC line remain intact and uncut during construction.

E. Roadway Improvements

Widening of Piilani Highway from Kilohana Drive/Mapu Place to the terminus is required as a condition in the change in zoning approval for the Honua'ula Development, Makena Resort Development, and Wailea A&B Properties Development. The proposed road improvements will widen Piilani Highway from a 24-feet travelway to a 48-feet travelway by adding a 12-feet wide travel lane in each direction of traffic flow. In addition, a 4-feet wide bike lane, 2-feet wide concrete curb, gutter and 6-feet wide sidewalk on both sides of the highway will be provided. An 8-feet wide striped median is also proposed. (Refer to Exhibit 2 for Typical Road Sections.)

Retaining walls will be required along various segments of the proposed roadway widening to accommodate the widened roadway section. Wall heights will vary from approximately 2 to 26 feet high. Sound attenuation walls will also be incorporated into the construction to aid in reduction in noise levels due to traffic noise impacts, as recommended by the acoustical engineer Y. Ebisu & Associates sound study report dated August 2009. HDOT criteria will be used to determine feasibility of sound wall construction.

The existing posted speed limits for Piilani Highway varies from 30-miles per hour between the Mokulele highway to the north of Kilohana Drive, 40-mph from Kilohana Drive southbound with a reduced speed of 25-mph near the terminus at Wailea Ike Drive. Based on a speed study of this segment of highway by Austin, Tsutsumi & Associates, Inc. in April 2009, the 85th percentile speed was determined to be 37.7 mph. Under the proposed design, the posted speed limit will be 35 mph and the design speed will be 45 mph for the section of highway under the project scope.

Right-of-way acquisition of approximately 15 feet makai of the existing right-of-way, from approximately Station 81+00 to Station 84+00, affecting Lot 1-A (TMK: (2) 2-1-008:046) and Lot 14-B (TMK: (2) 2-1-008:113) owned by the County of Maui, will be needed to accommodate the proposed roadway widening. Refer to Exhibit 4 for plan. Right-of-way acquisition of at the makai intersection curves of Okolani Drive, affecting Lot 611 (TMK: (2)2-1-026:094)

owned by Wailea Puanani Estates and Lot 307-A (TMK: (2)2-1-008:130) owned by A & B Wailea LLC will also be needed to accommodate the proposed roadway improvements.

The proposed intersection improvements are as follows:

Kilohana Drive/Mapu Place

- Modification of the existing traffic signal system
- Northbound Approach and Southbound Approaches: Provide an exclusive left-turn lane, two (2) exclusive through lanes, and an exclusive right-turn lane.
- Eastbound Approach: Remain as an exclusive left-turn lane and a shared through/right-turn lane.
- Westbound Approach: Provide an exclusive left-turn lane, an exclusive through lane, and an exclusive right-turn lane.

Okolani Drive/Mikioi Place

- Install a traffic signal system.
- Northbound and Southbound Approaches: Provide an exclusive left-turn lane, an exclusive through lane, and a shared through/right-turn lane.
- Eastbound Approach: Provide an exclusive left-turn lane and a shared through/right-turn lane.
- Westbound Approach: Remain as a shared left-turn/through/right-turn lane.

The Piilani Highway/Wailea Ike Drive intersection will be completed in 3 phases. The Year 2016 was selected to reflect the completion year of Phase I of Honua'ula which includes the creation of a tee-intersection at the Piilani Highway/Wailea Ike Drive intersection. Year 2022 was selected to reflect the full build-out of Honua'ula, Wailea Resort and Makena Resort.

Phase I of the Piilani Highway/Wailea Ike Drive intersection is expected to occur prior to the construction of Honua'ula. The Piilani Highway/Wailea Ike Drive intersection will not require any intersection control and will have the following lane configuration:

Wailea Ike Drive – Phase 1

- Southbound Approaches: Provide an exclusive free right-turn lane.
- Eastbound Approach: Provide an exclusive free left-turn lane.

Phase II of the Piilani Highway/Wailea Ike Drive intersection is expected to occur upon completion of Phase I of Honua'ula (Year 2016). The east leg of the Piilani Highway/Wailea Ike Drive intersection will be striped forming a tee-intersection, with Piilani Highway being the stem of the tee. Due to a high southbound right-turn and eastbound left-turn, the intersection will warrant a traffic signal, in accordance with the Highway Capacity Manual (HCM). With the Piilani Highway/Wailea Ike Drive intersection re-striped to a tee-intersection, the following are the recommended lane configuration:

Wailea Ike Drive/ Project Road – Phase 2

- Install a traffic signal system.
- Southbound Approaches: Provide an exclusive left-turn lane, and an exclusive right-turn lane. Also, it is recommended that the Piilani Highway southbound right-turn be a free turning movement by providing an exclusive westbound receiving lane on Wailea Ike Drive.
- Eastbound Approach: Provide two (2) exclusive left-turn lanes and a through lane.
- Westbound Approach: Provide an exclusive through lane and an exclusive right-turn lane.

Phase III of the Piilani Highway/Wailea Ike Drive intersection is expected to occur during Phase II of Honua'ula where an extension of Piilani Highway to

intersection with an extension of Kaukahi Street forming the south leg of the Piilani Highway/Wailea Ike Drive intersection is proposed. The following lane configuration is recommended:

Wailea Ike Drive/ Project Road/Future Piilani Highway Extension South – Phase 3

- Install a traffic signal system.
- Northbound Approach: Provide an exclusive left-turn lane, two (2) exclusive through lanes, and an exclusive right-turn lane.
- Southbound Approaches: Provide two (2) exclusive left-turn lanes, an exclusive through lane, and an exclusive right-turn lane. Also, it is recommended that the Piilani Highway southbound right-turn be a free turning movement by providing an exclusive westbound receiving lane on Wailea Ike Drive.
- Eastbound Approach: Provide two (2) exclusive left-turn lanes and a shared through/right-turn lane.
- Westbound Approach: Provide an exclusive left-turn lane, an exclusive through lane, and an exclusive right-turn lane.

V. CONCLUSION

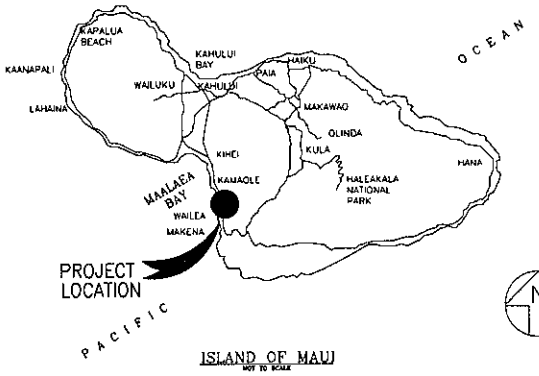
The proposed improvements for this project will be designed in accordance with the applicable rules and regulations of the State of Hawaii and the County of Maui as applicable.

State Department of Transportation (HDOT) Design Criteria for Highway Drainage dated May 15, 2006 and HDOT Storm Water Permanent Best Management Practices Manual dated March 2007 requires retention of the increase in storm water runoff between the post-development flows and pre-development flows and detention of the water quality design volume or treatment of the water quality flow rate. The project storm water management plan and drainage system will be designed to meet these standards.

A National Pollutant Discharge Elimination System (NPDES) permit for discharge of stormwater associated with construction activities will be obtained and the requirements of the approved NPDES permit and best management plan (BMP) will be adhered during construction. At a minimum silt fences, diversion berms, gravel egress, truck wash down areas and dust screens will be included in the BMP. Monitoring of the BMP during construction will be the responsibility of the selected contractor with general oversight by HDOT or their designated representative.

Based on the foregoing, the project will have no adverse effects to the existing facilities and to the surrounding environment.

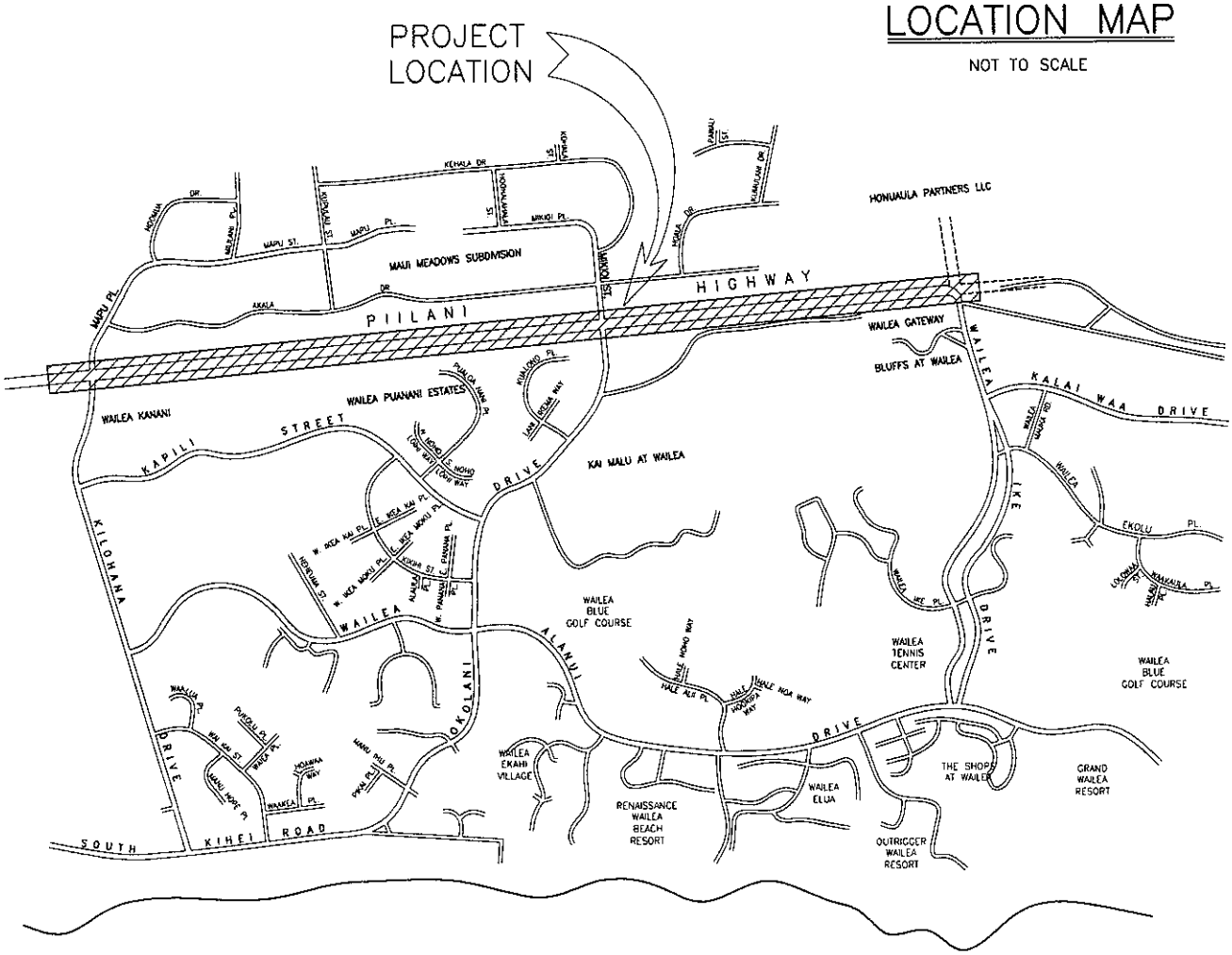
EXHIBITS



ISLAND OF MAUI
NOT TO SCALE

LOCATION MAP

NOT TO SCALE



NORTH

VICINITY MAP

NOT TO SCALE

PRELIMINARY ENGINEERING REPORT

PIILANI HIGHWAY WIDENING
KILOHANA DRIVE TO WAILEA IKE DRIVE

WAILEA, MAUI, HAWAII

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII

PROJECT LOCATION &
VICINITY MAP

EXHIBIT

1

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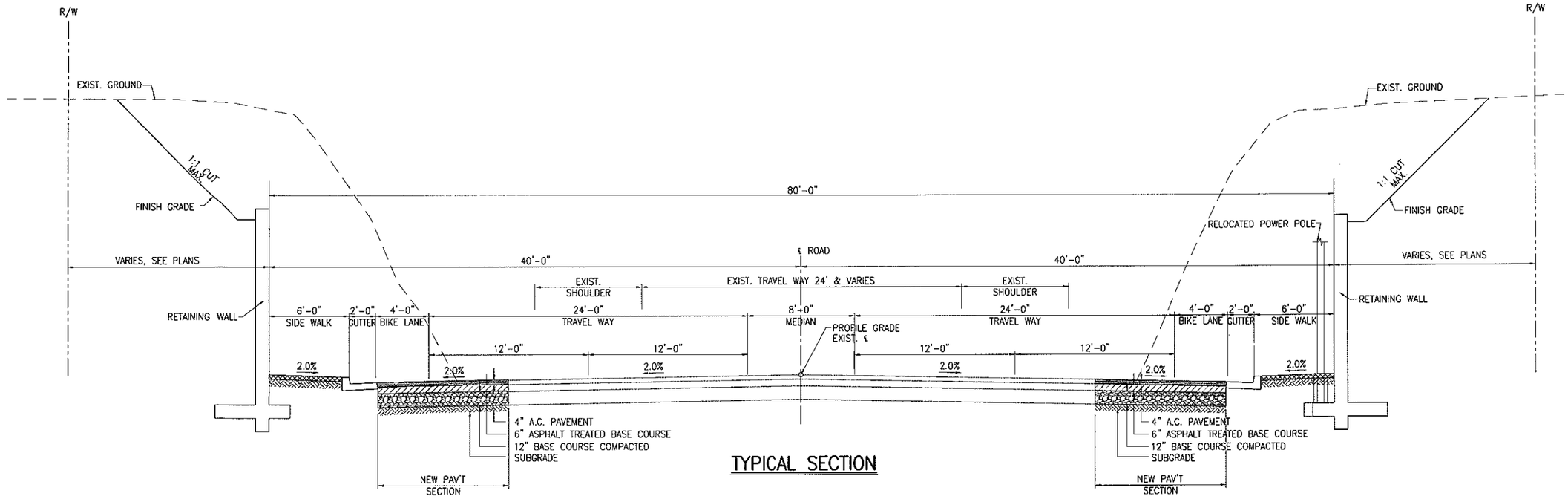
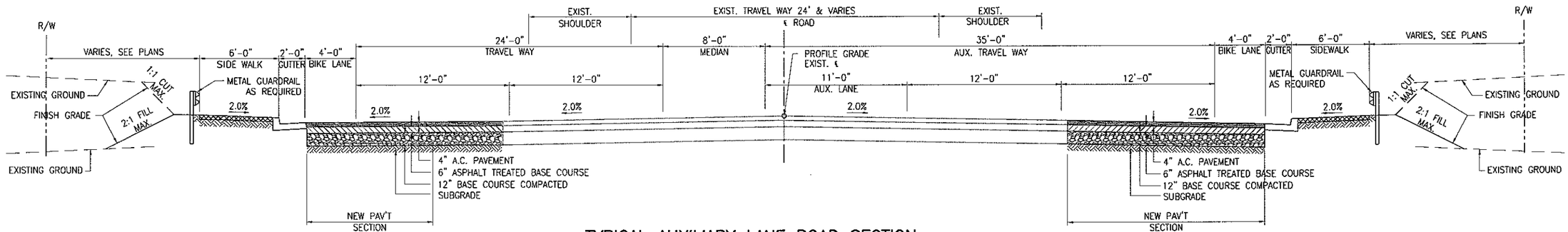
AUGUST 2009



TYPICAL SECTION



TYPICAL AUXILIARY LANE ROAD SECTION

NOTES:

1. EXISTING R.O.W. WIDTH VARIES FROM APPROX. 105' TO 250' FOR SECTION OF HIGHWAY BETWEEN KILOHANA DRIVE AND WAILEA IKE DRIVE.

PRELIMINARY ENGINEERING REPORT PIILANI HIGHWAY WIDENING KILOHANA DRIVE TO WAILEA IKE DRIVE WAILEA, MAUI, HAWAII	AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII TYPICAL ROAD SECTIONS	EXHIBIT 2

JULY 2010

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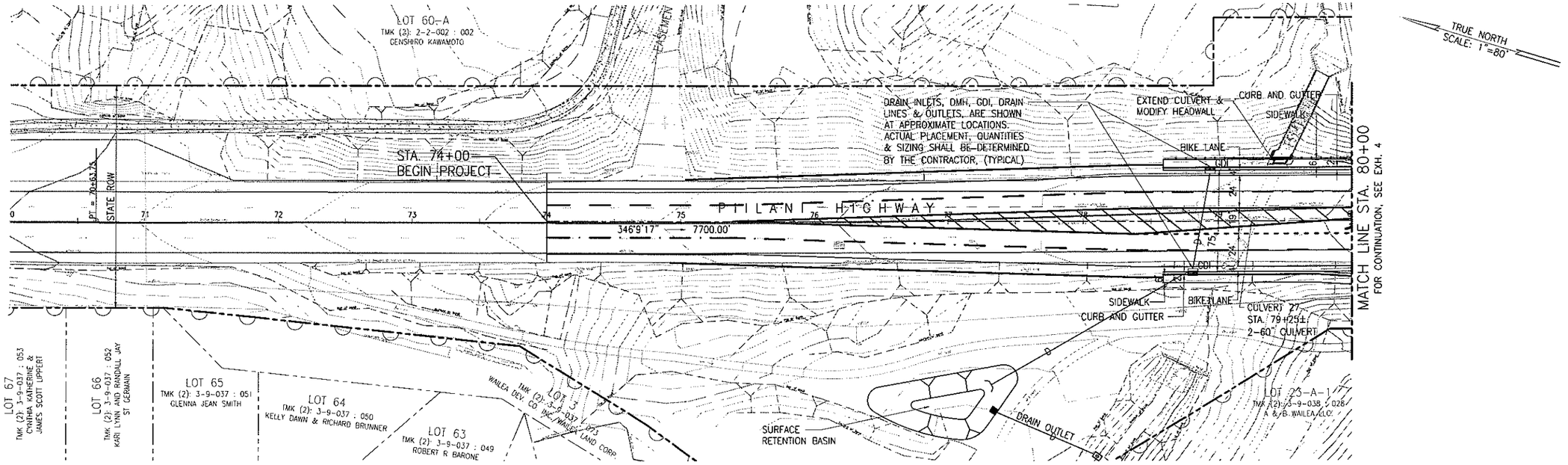
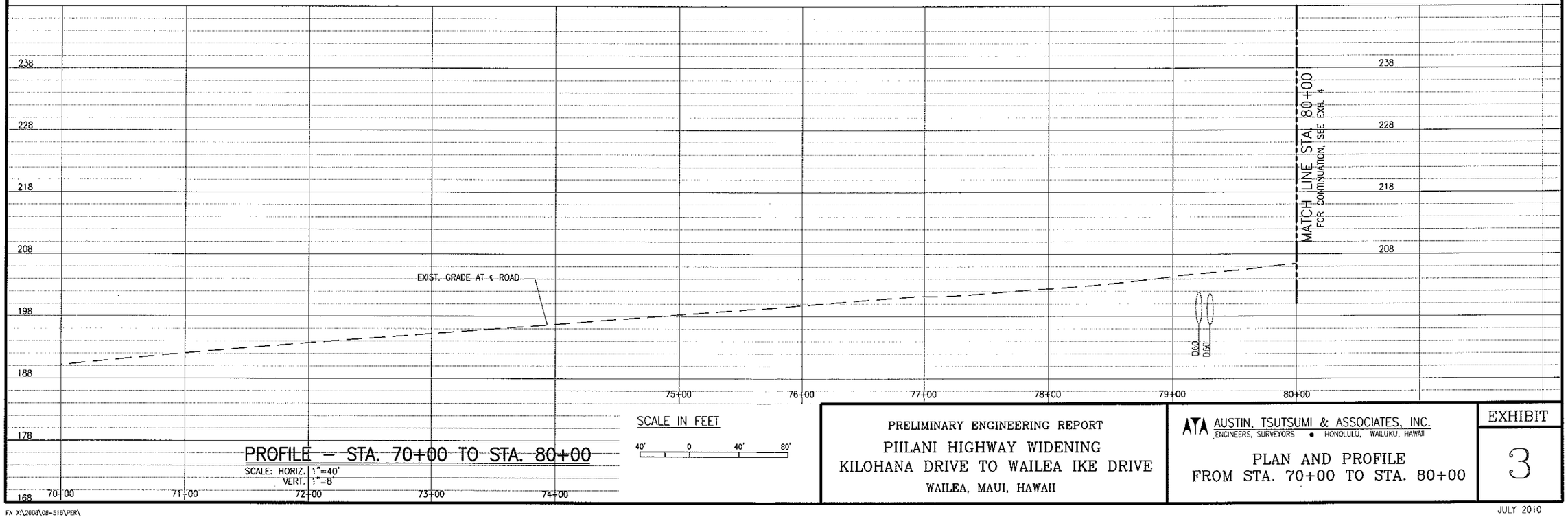


PLAN – STA. 70+00 TO STA. 80+00

SCALE: 1"=40'



PROFILE – STA. 70+00 TO STA. 80+00

SCALE: HORIZ. 1"=40'
VERT. 1"=8'

SCALE IN FEET

40' 0 40' 80'

PRELIMINARY ENGINEERING REPORT

PIILANI HIGHWAY WIDENING
KILOHANA DRIVE TO WAILEA IKE DRIVE
WAILEA, MAUI, HAWAII

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII

PLAN AND PROFILE
FROM STA. 70+00 TO STA. 80+00

EXHIBIT 3

JULY 2010

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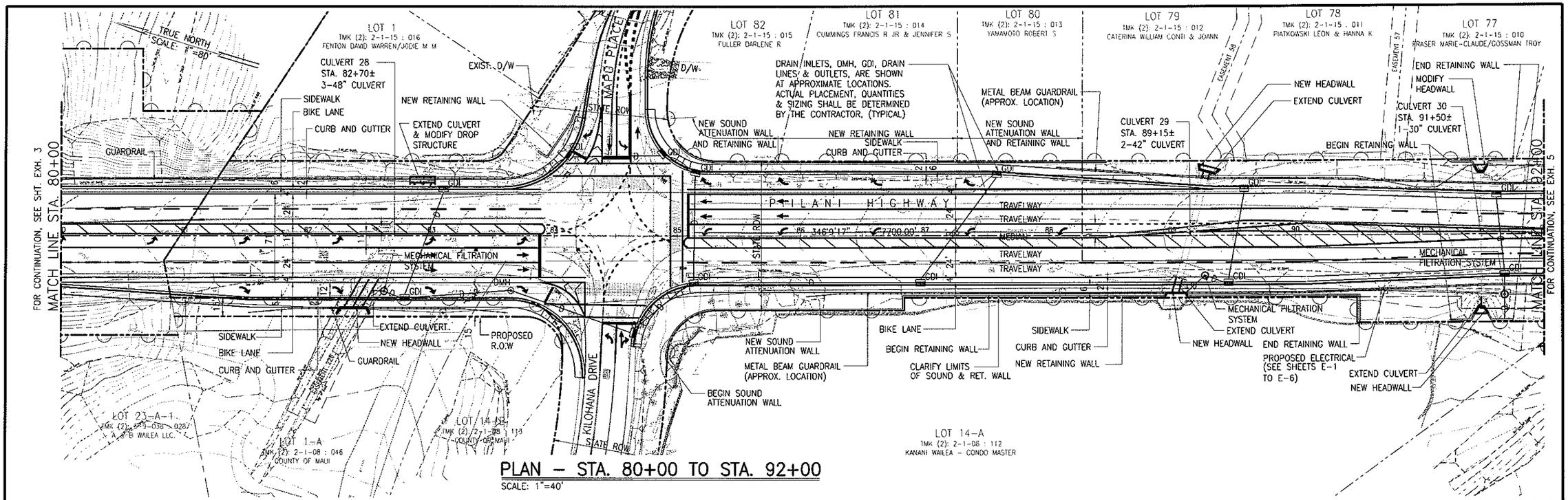
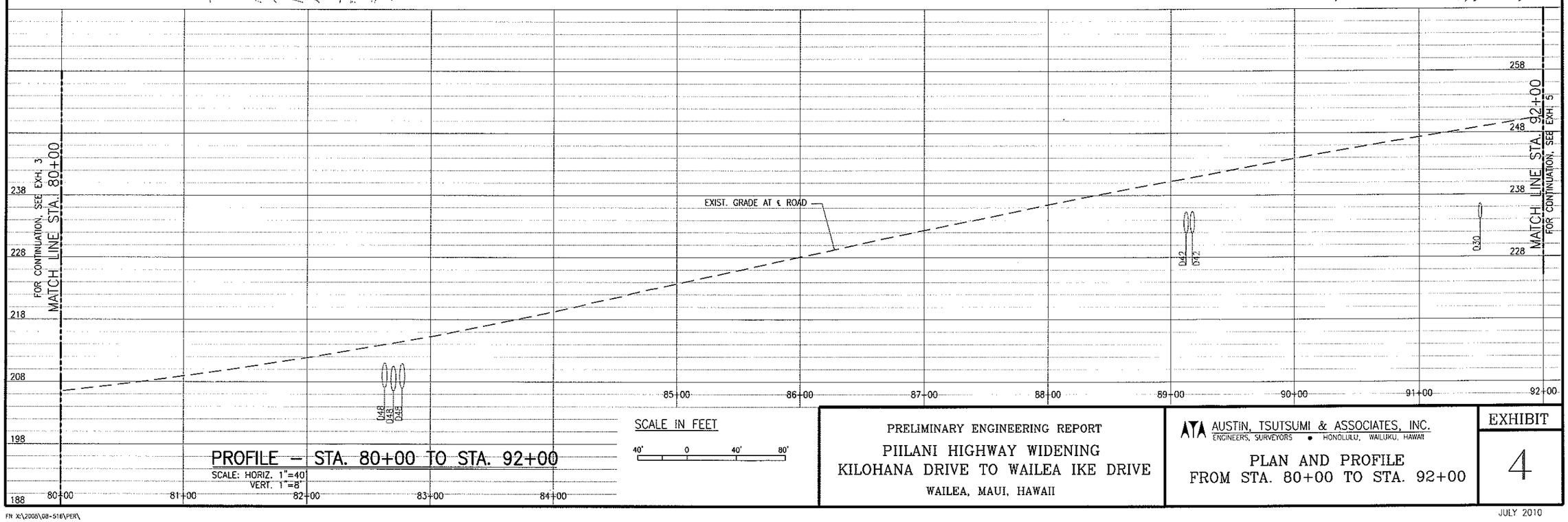


PLAN – STA. 80+00 TO STA. 92+00

SCALE: 1"=40'



PROFILE – STA. 80+00 TO STA. 92+00

SCALE: HORIZ. 1"=40
VERT. 1"=8'

SCALE IN FEET

40' 0 40' 80'

PRELIMINARY ENGINEERING REPORT

PIILANI HIGHWAY WIDENING
KILOHANA DRIVE TO WAILEA IKE DRIVE

WAILEA, MAUI, HAWAII

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII

PLAN AND PROFILE
FROM STA. 80+00 TO STA. 92+00

EXHIBIT 4

JULY 2010

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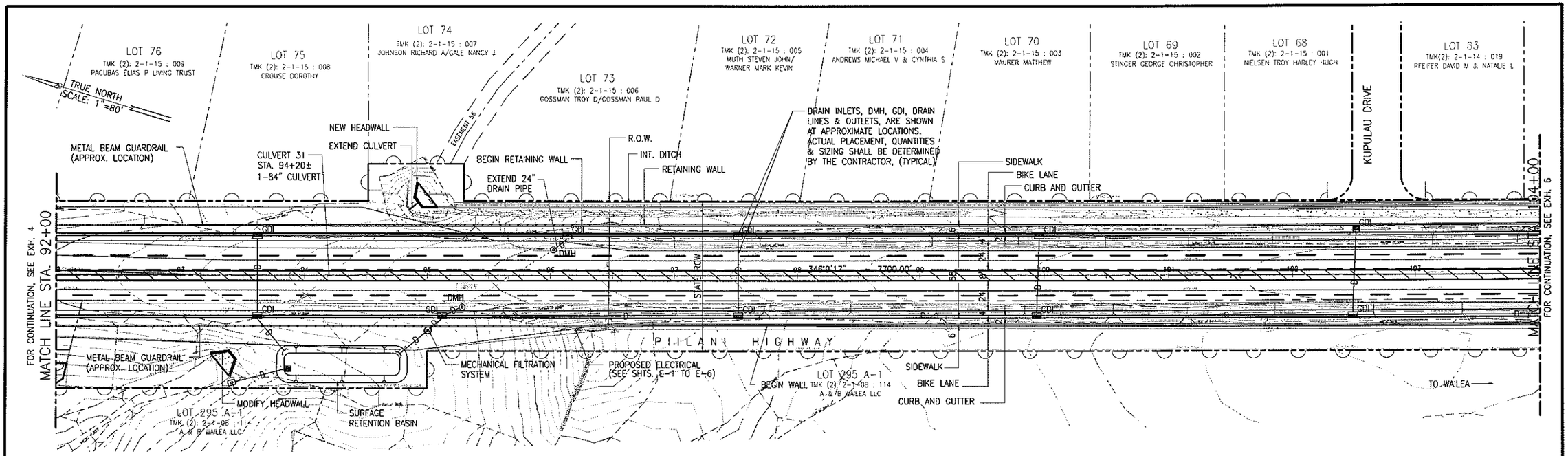

PLAN – STA. 92+00 TO STA. 104+00

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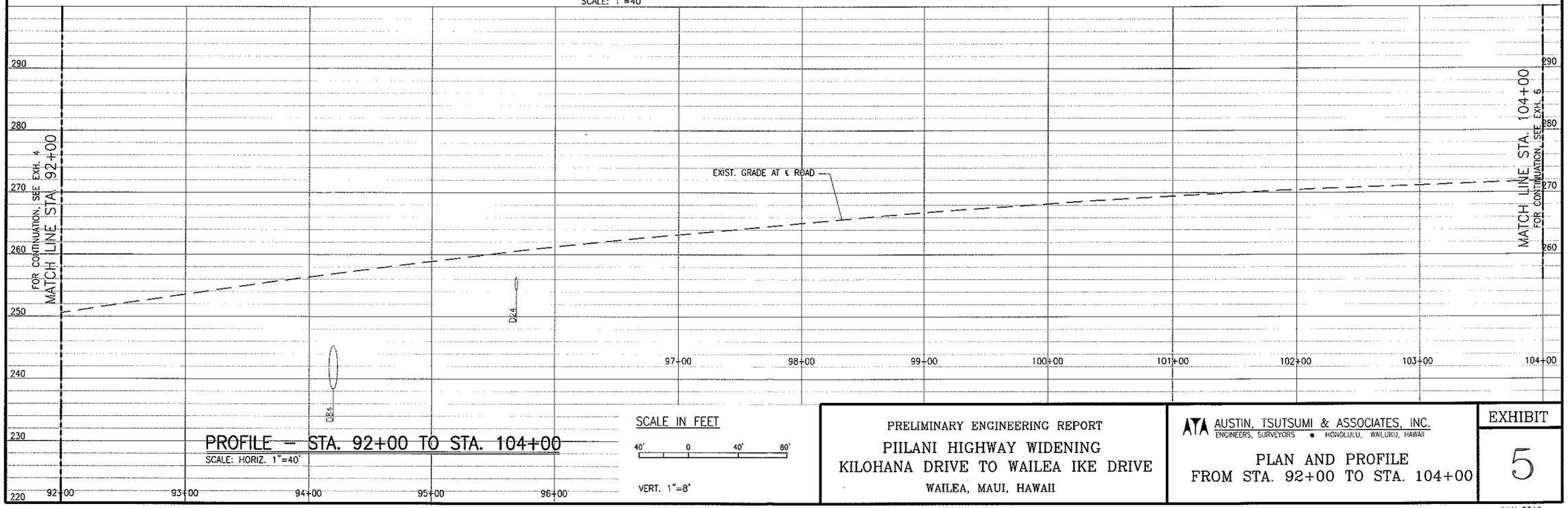

PROFILE – STA. 92+00 TO STA. 104+00

SCALE: HORIZ. 1"=40'

SCALE IN FEET

40' 0 40' 80'

VERT. 1"=8'

PRELIMINARY ENGINEERING REPORT

PIILANI HIGHWAY WIDENING
KILOHANA DRIVE TO WAILEA IKE DRIVE
WAILEA, MAUI, HAWAII

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII

PLAN AND PROFILE
FROM STA. 92+00 TO STA. 104+00

EXHIBIT 5

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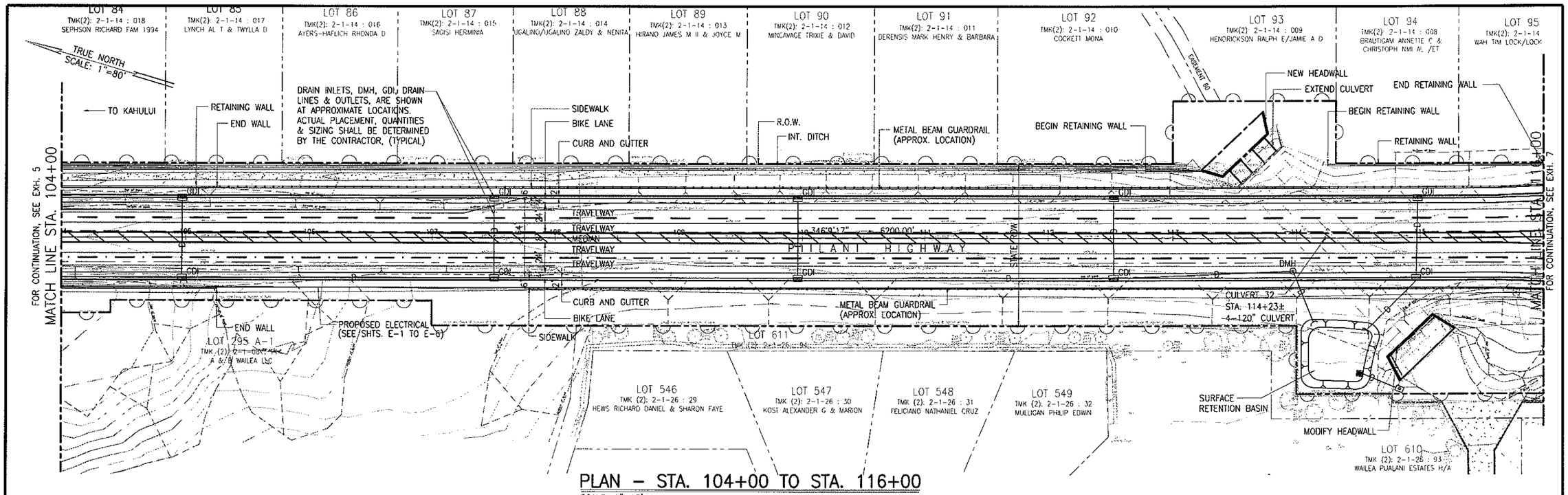
JULY 2010



PRELIMINARY ENGINEERING REPORT

PIILANI HIGHWAY WIDENING
KILOHANA DRIVE TO WAILEA IKE DRIVE
WAILEA, MAUI, HAWAII

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII

PLAN AND PROFILE
FROM STA. 104+00 TO STA. 116+00

EXHIBIT 6

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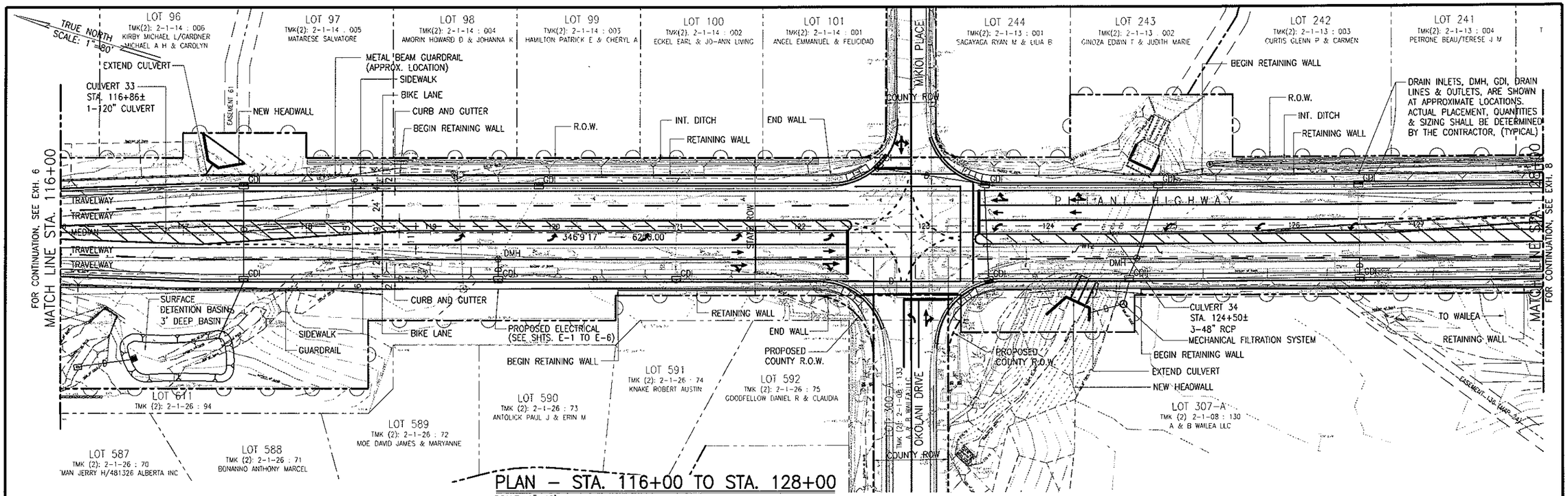
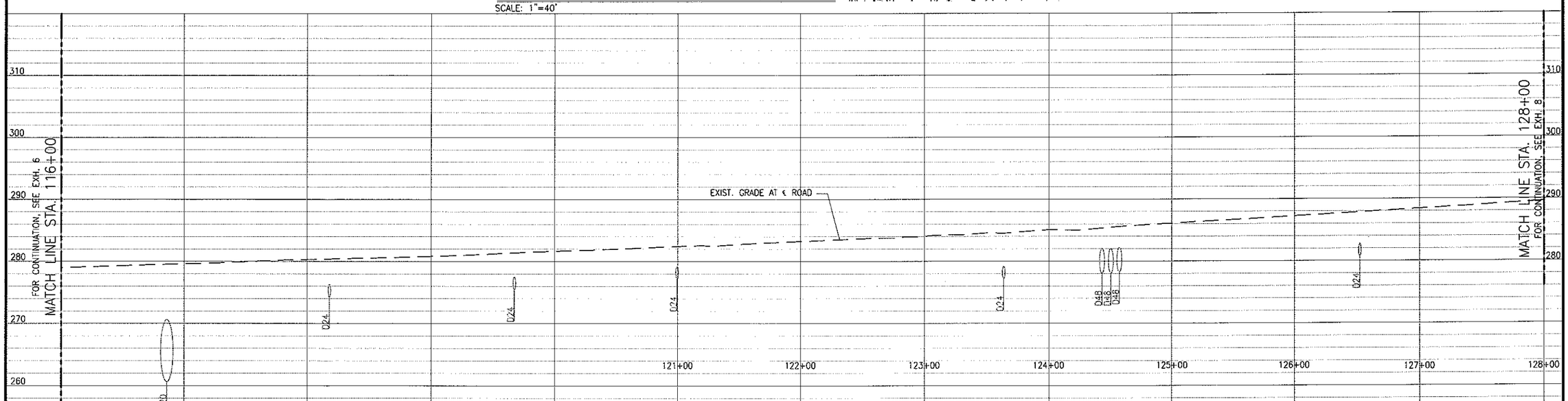
JULY 2010



PLAN – STA. 116+00 TO STA. 128+00

SCALE: 1"=40'



PROFILE – STA. 116+00 TO STA. 128+00

SCALE: HORIZ. 1"=40'
VERT. 1"=8'

SCALE IN FEET

40' 0 40' 80'

PRELIMINARY ENGINEERING REPORT
PIILANI HIGHWAY WIDENING
KILOHANA DRIVE TO WAILEA IKE DRIVE
WAILEA, MAUI, HAWAII

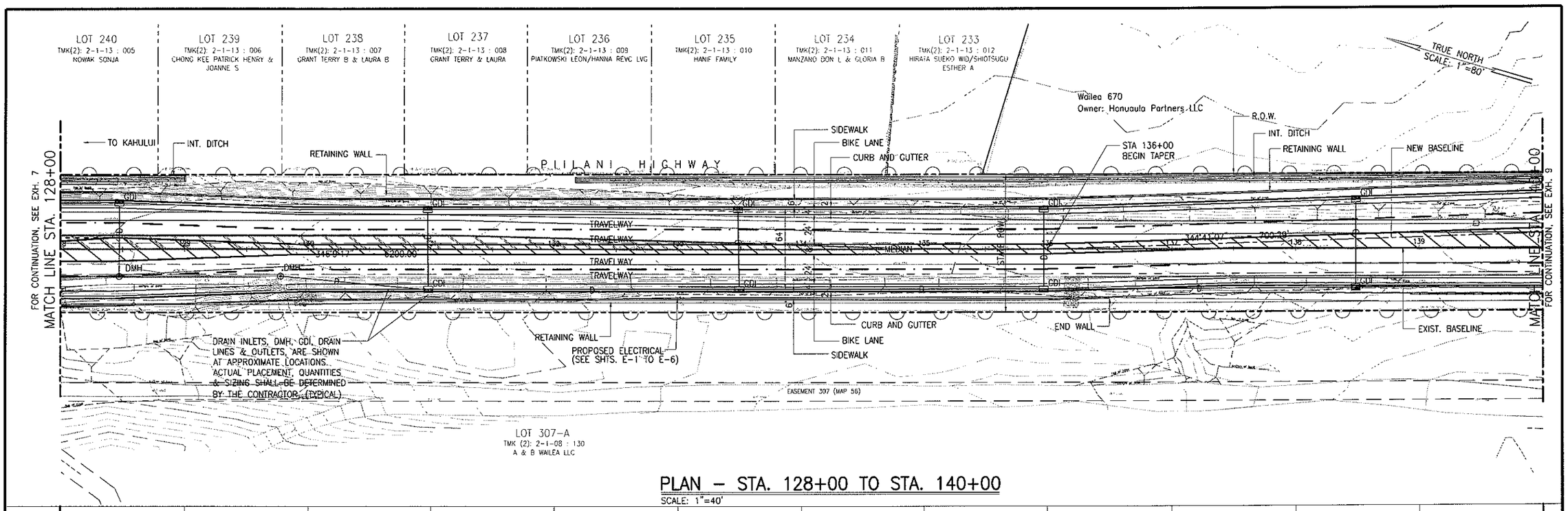
AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII

PLAN AND PROFILE
FROM STA. 116+00 TO STA. 128+00

EXHIBIT
7

JULY 2010

FN X:\2008\08-516\PER\



PROFILE – STA. 128+00 TO STA. 140+00

SCALE: HORIZ. 1"=40'
VERT. 1"=8'

SCALE IN FEET

40' 0 40' 80'

PRELIMINARY ENGINEERING REPORT

PIILANI HIGHWAY WIDENING
KILOHANA DRIVE TO WAILEA IKE DRIVE
WAILEA, MAUI, HAWAII

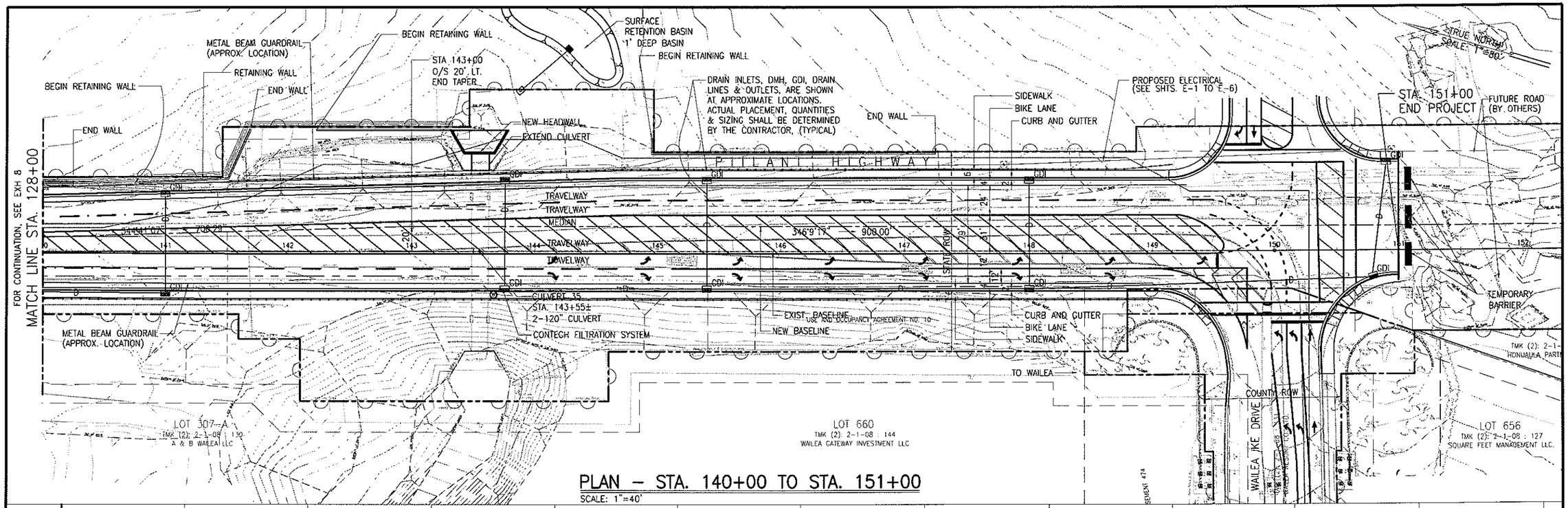
AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII

PLAN AND PROFILE
FROM STA. 128+00 TO STA. 140+00

EXHIBIT 8

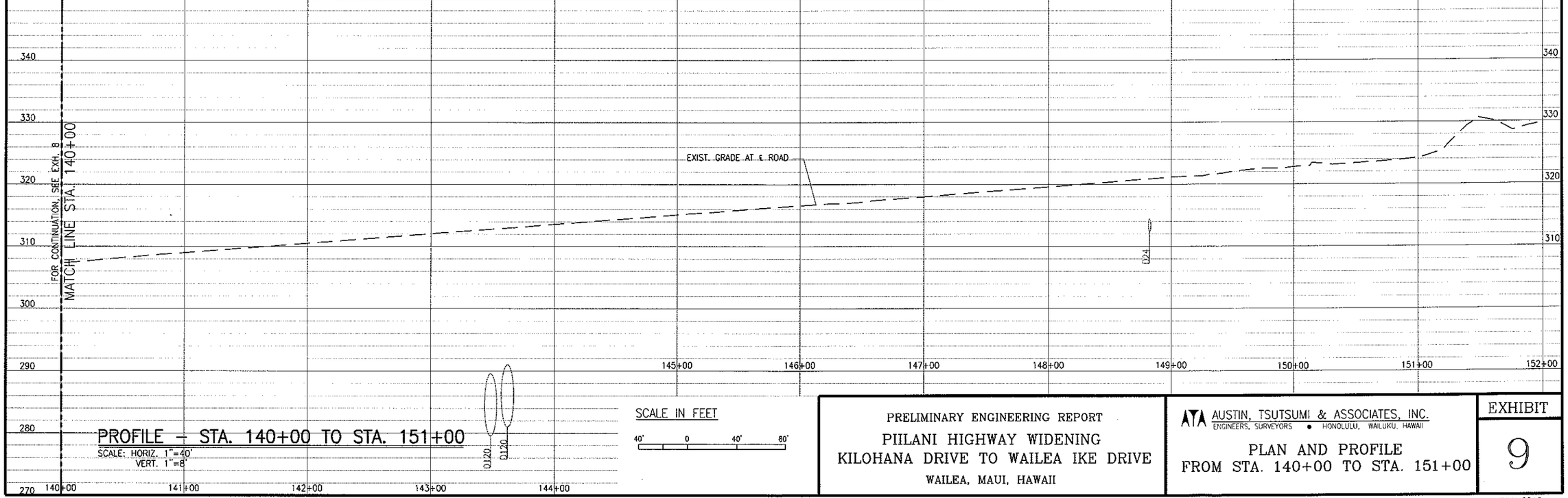
JULY 2010

FN X:\2008\08-516\PER\



PLAN – STA. 140+00 TO STA. 151+00

SCALE: 1"=40'



PROFILE – STA. 140+00 TO STA. 151+00

SCALE: HORIZ. 1"=40'
VERT. 1"=8'

SCALE IN FEET

40' 0 40' 80'

PRELIMINARY ENGINEERING REPORT

PIILANI HIGHWAY WIDENING
KILOHANA DRIVE TO WAILEA IKE DRIVE
WAILEA, MAUI, HAWAII

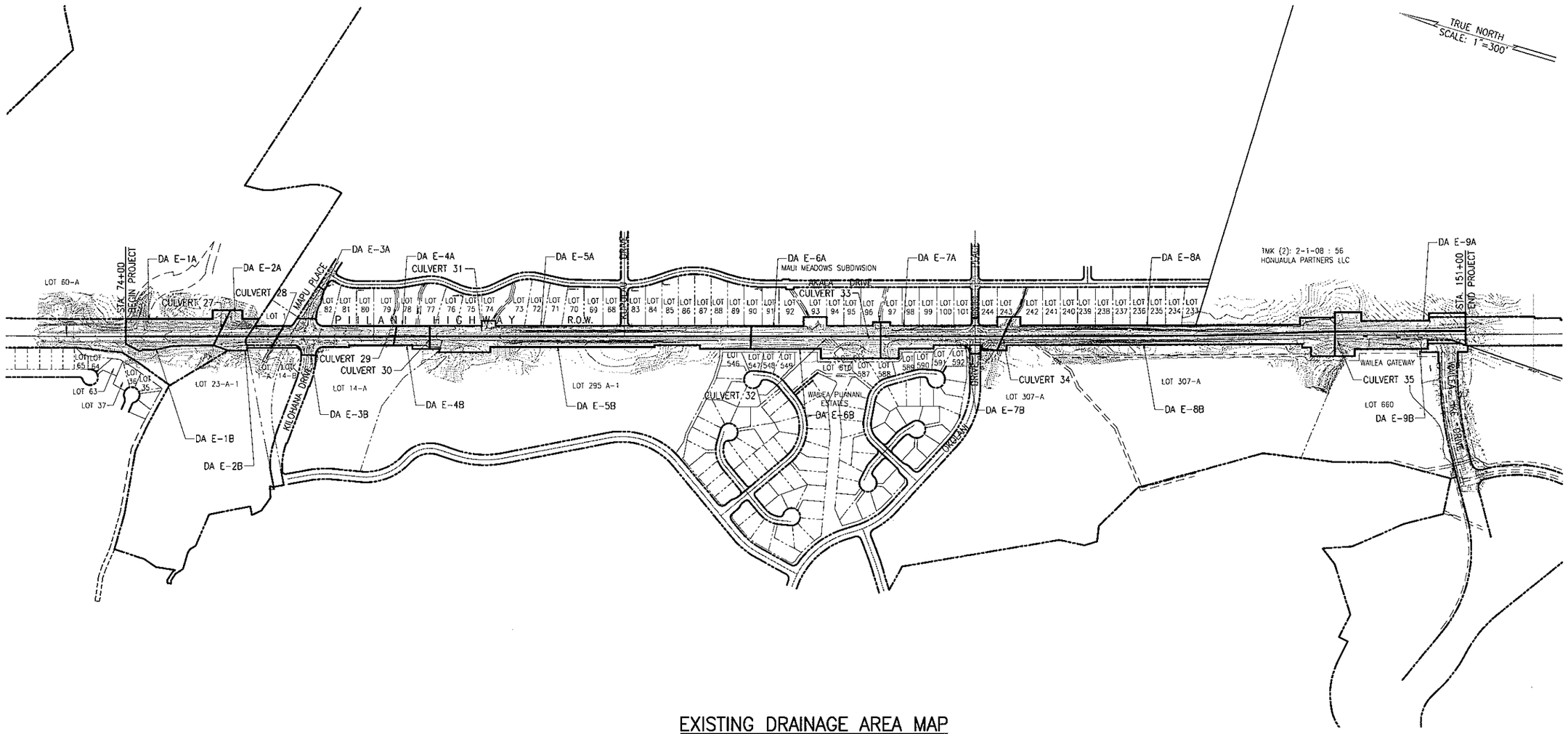
AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII

PLAN AND PROFILE
FROM STA. 140+00 TO STA. 151+00

EXHIBIT 9

JULY 2010

FN X:\2008\08-516\PER\

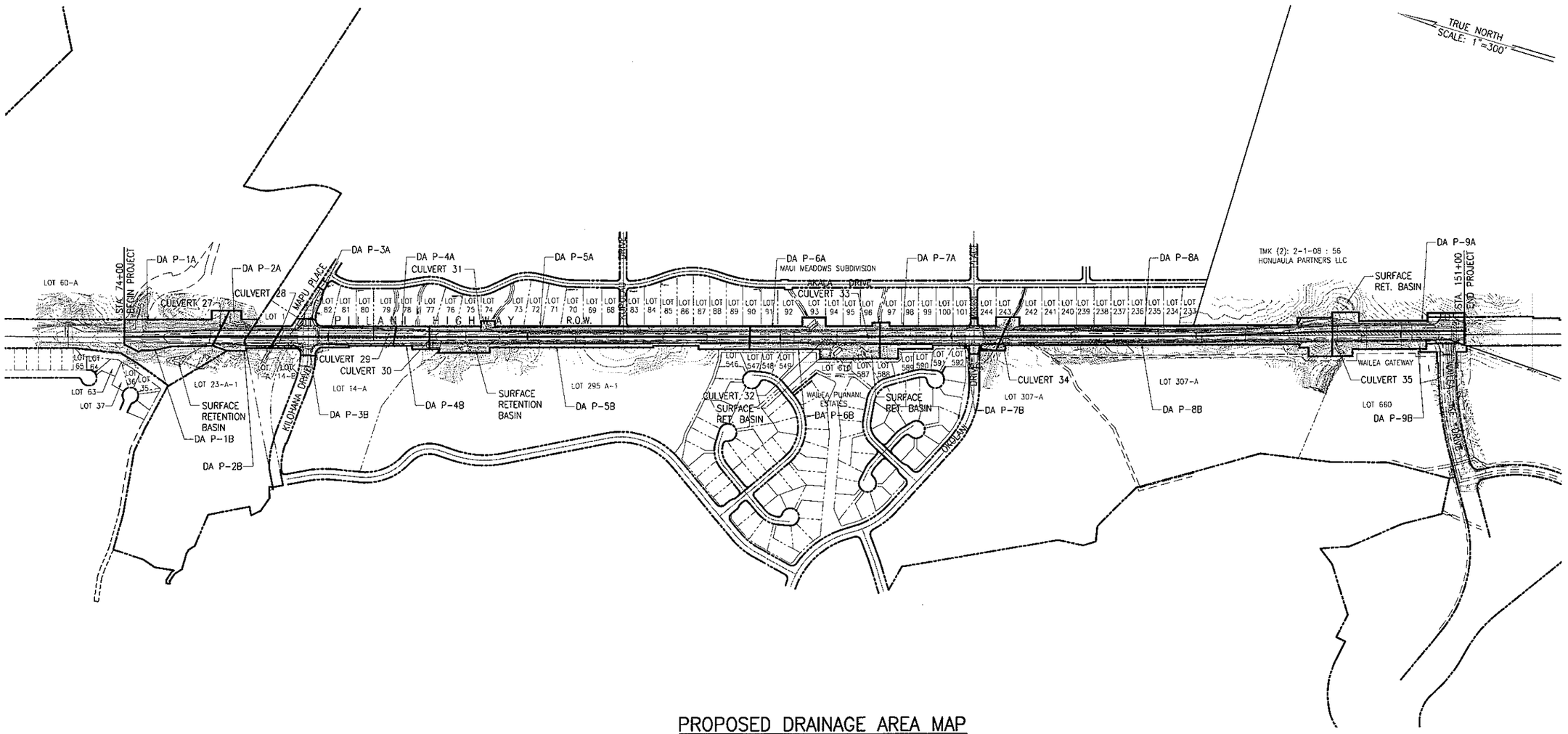


EXISTING DRAINAGE AREA MAP
SCALE: 1"=300'

PRELIMINARY ENGINEERING REPORT PIILANI HIGHWAY WIDENING KILOHANA DRIVE TO WAILEA IKE DRIVE WAILEA, MAUI, HAWAII	AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII EXISTING DRAINAGE AREA MAP	EXHIBIT 10

FN X:\2008\08-516\PER\

JULY 2010



PROPOSED DRAINAGE AREA MAP
SCALE: 1"=300'

PRELIMINARY ENGINEERING REPORT
PIILANI HIGHWAY WIDENING
KILOHANA DRIVE TO WAILEA IKE DRIVE
WAILEA, MAUI, HAWAII

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII

PROPOSED DRAINAGE AREA MAP

EXHIBIT
11

FN X:\2008\08-516\PER\

JULY 2010

APPENDICES

APPENDIX A

PRELIMINARY HYDROLOGY CALCULATIONS

PIILANI HWY WIDENING (Q existing)
HYDROLOGY CALCULATIONS

Drainage Area	Area, A, (sq ft.)	Area, A, (acres)	Runoff Coeff, C	Rainfall Intensity, I (in/hr), 25-yr-1hr	Length of Reach, L, (ft)	Slope, S (ft/ft)	Time of Conc, Tc, (min)	Initial Destination	Final Destination	Q25	WQFR (cfs)
E-1A	59,396.00	1.364	0.59	4.1	540	0.02	10.0	Offsite	Offsite	3.30	0.32
E-1B	31,505.00	0.723	0.70	4.1	540	0.02	10.0	Offsite	Offsite	2.08	0.20
E-2A	32,274.00	0.741	0.66	4.1	350	0.03	10.0	CULVERT 27	Offsite	2.00	0.20
E-2B	23,819.00	0.547	0.66	3.8	350	0.03	10.0	CULVERT 27	Offsite	1.37	0.14
E-3A	45,543.00	1.046	0.77	4.1	460	0.04	10.0	CULVERT 28	Offsite	3.30	0.32
E-3B	44,175.00	1.014	0.70	4.1	460	0.04	10.0	CULVERT 28	Offsite	2.91	0.28
E-4A	11,788.00	0.271	0.72	4.1	200	0.03	10.0	CULVERT 29	Offsite	0.80	0.08
E-4B	12,332.00	0.283	0.63	4.1	200	0.03	10.0	CULVERT 29	Offsite	0.73	0.07
E-5A	112,991.00	2.594	0.67	3.8	1470	0.01	13.0	CULVERT 31	Offsite	6.60	0.70
E-5B	121,316.00	2.785	0.61	3.8	1470	0.01	13.0	CULVERT 31	Offsite	6.46	0.68
E-6A	52,522.00	1.206	0.63	4.1	750	0.01	10.0	CULVERT 32	Offsite	3.11	0.30
E-6B	71,979.00	1.652	0.56	4.1	750	0.01	10.0	CULVERT 32	Offsite	3.79	0.37
E-7A	49,822.00	1.144	0.75	4.1	490	0.01	10.0	CULVERT 33	Offsite	3.52	0.34
E-7B	54,144.00	1.243	0.68	4.1	490	0.01	10.0	CULVERT 33	Offsite	3.47	0.34
E-8A	116,047.00	2.664	0.71	3.8	1470	0.01	13.0	CULVERT 34	Offsite	7.19	0.76
E-8B	116,317.00	2.670	0.64	3.8	1470	0.01	13.0	CULVERT 34	Offsite	6.49	0.68
E-9A	61,943.00	1.422	0.53	4.1	800	0.01	10.0	CULVERT 35	Offsite	3.09	0.30
E-9B	73,774.00	1.694	0.72	4.1	800	0.01	10.0	CULVERT 35	Offsite	5.00	0.49
	TOTAL:	25.061							TOTAL:	**65.21**	

Recurrence interval = 2.0 in. (25yr-1hr)

PIILANI HWY WIDENING (Q proposed)
HYDROLOGY CALCULATIONS

Drainage Area	Area, A, (sq ft.)	Area, A, (acres)	Runoff Coeff, C	Rainfall Intensity, I (in/hr), 25-yr-1hr	Length of Reach, L, (ft)	Slope, S (ft/ft)	Time of Conc, Tc, (min)	Initial Destination	Final Destination	Q25	WQDV (cf)	WQFR (cfs)	Q increase cfs	Q proposed cfs	Q capacity cfs	Q retained cfs	V retained cf
P-1A	59,396.00	1.364	0.61	4.1	540	0.02	10.0	Offsite	Offsite	3.41	3019	0.33	0.23	5.60	0.00	0.00	0
P-1B	31,505.00	0.723	0.74	4.1	540	0.02	10.0	Offsite	Offsite	2.19	1943	0.21					
P-2A	32,274.00	0.741	0.69	4.1	350	0.03	10.0	SYSTEM 27	Offsite	2.10	1858	0.20	0.56	3.93	3.00	3.00	5400
P-2B	23,819.00	0.547	0.82	4.1	350	0.03	10.0	SYSTEM 27	Offsite	1.84	1628	0.18					
P-3A	45,543.00	1.046	0.88	4.1	460	0.04	10.0	MECH/ CULVERT 28	Offsite	3.77	3340	0.37	1.22	7.43	0.00	0.00	0
P-3B	44,175.00	1.014	0.88	4.1	460	0.04	10.0	MECH/ CULVERT 28	Offsite	3.66	3239	0.36	0.31	1.84	0.00	0.00	0
P-4A	11,768.00	0.271	0.81	4.1	200	0.03	10.0	MECH/ CULVERT 29	Offsite	0.90	796	0.09					
P-4B	12,332.00	0.283	0.81	4.1	200	0.03	10.0	MECH/ CULVERT 29	Offsite	0.94	832	0.09					
P-5A	112,991.00	2.594	0.81	3.8	1470	0.01	13.0	MECH/ SYSTEM 31	Offsite	7.98	7627	0.84	2.88	15.92	3.50	3.50	6300
P-5B	121,316.00	2.785	0.75	3.8	1470	0.01	13.0	MECH/ SYSTEM 31	Offsite	7.94	7582	0.84	1.27	8.18	4.00	4.00	7200
P-6A	52,522.00	1.206	0.75	4.1	750	0.01	10.0	SYSTEM 32	Offsite	3.71	3283	0.36					
P-6B	71,979.00	1.652	0.66	4.1	750	0.01	10.0	SYSTEM 32	Offsite	4.47	3959	0.44					
P-7A	49,822.00	1.144	0.82	4.1	490	0.01	10.0	SYSTEM 33	Offsite	3.85	3404	0.38	0.84	7.62	4.00	4.00	7200
P-7B	54,144.00	1.243	0.78	4.1	490	0.01	10.0	SYSTEM 33	Offsite	3.97	3519	0.39					
P-8A	116,047.00	2.664	0.80	3.8	1470	0.01	13.0	MECH/ CULVERT 34	Offsite	8.10	7736	0.85	2.74	16.42	0.00	0.00	0
P-8B	116,317.00	2.670	0.82	3.8	1470	0.01	13.0	MECH/ CULVERT 34	Offsite	8.32	7948	0.88					
P-9A	61,943.00	1.422	0.77	4.1	800	0.01	10.0	MECH/ CULVERT 35	Offsite	4.49	3975	0.44	1.61	9.70	2.00	2.00	3600
P-9B	73,774.00	1.694	0.75	4.1	800	0.01	10.0	MECH/ CULVERT 35	Offsite	5.21	4611	0.51					
	TOTAL:	25.061							TOTAL:	76.85	70296.60		11.63			16.50	29700

APPENDIX K.

April 16, 2009
Community Meeting

MUNEKIYO & HIRAGA, INC.

MICHAEL T. MUNEKIYO
GWEN OHASHI HIRAGA
MITSURU "MICH" HIRANO
KARLYNN FUKUDA

MARK ALEXANDER ROY

March 20, 2009

Madge Schaefer, President
Maui Meadows Neighborhood Association
P. O. Box 160
Kihei, Hawai`i 96753

SUBJECT: Pi`ilani Highway Road Widening Project Between Kilohana Drive and Wailea Ike Drive and Wailea Ike/Wailea Alanui Intersection Improvements, Kihei, Maui, Hawai`i

Dear Ms. Schaefer:

During the County of Maui's review of the re-zoning application for Kihei-Makena Project District 9 (Honua`ula), it included a condition in which Honua`ula Partners, LLC (applicant) was made responsible for the widening improvements to Pi`ilani Highway to four (4) lanes from Kilohana Drive to Wailea Ike Drive, including intersection improvements along the project corridor. See **Figure 1**, location map.

The applicant was also required to improve the signalized intersection of Wailea Ike Drive and Wailea Alanui Drive. See **Figure 2**, location map. The condition states

> *"Modify the Wailea Alanui/Wailea Ike Drive intersection to add a signalized double right-turn movement from northbound to eastbound turning traffic and provide two left-turn lanes for southbound traffic from Wailea Ike Drive prior to occupancy of the first unit in Kihei-Makena Project District 9."*

The Pi`ilani Highway widening improvements will be located within the highway right-of-way and involves the use of lands owned by the State of Hawai'i. Pursuant to Chapter 343, Hawai`i Revised Statutes (HRS), an environmental assessment (EA) is required. Also, the improvements to the Wailea Alanui/Wailea Ike Drive intersection involves the use of County of Maui lands which will also require an EA. As part of the EA early consultation process, on behalf of the applicant, we are seeking early community input. In this regard, we have scheduled a community meeting on

Date: April 16, 2009
Time: 6:00 p.m.
Place: Kihei Community Center
303 East Lipoa Street
Kihei Hawai`i 96793

We invite your community association and members to attend this community meeting to become informed of the project and to voice your concerns that should be addressed in the EA document.

We look forward to your participation in the scheduled community meeting. If additional clarification is required, please contact me at 244-2015.

Very truly yours,

Gwen Ohashi Hiraga, Principal

GOH:yp
Enclosures
cc: Charles Jencks, Honua`ula Partners, LLC (w/out enclosures)
Keith Niiya, Austin Tsutsumi & Associates (w/out enclosures)
Stan Watanabe, Austin Tsutsumi & Associates (w/out enclosures)
F:\DATA\WCPT\PiilaniWidening\association.ltrs.wpd

Source: County of Maui

Figure 1

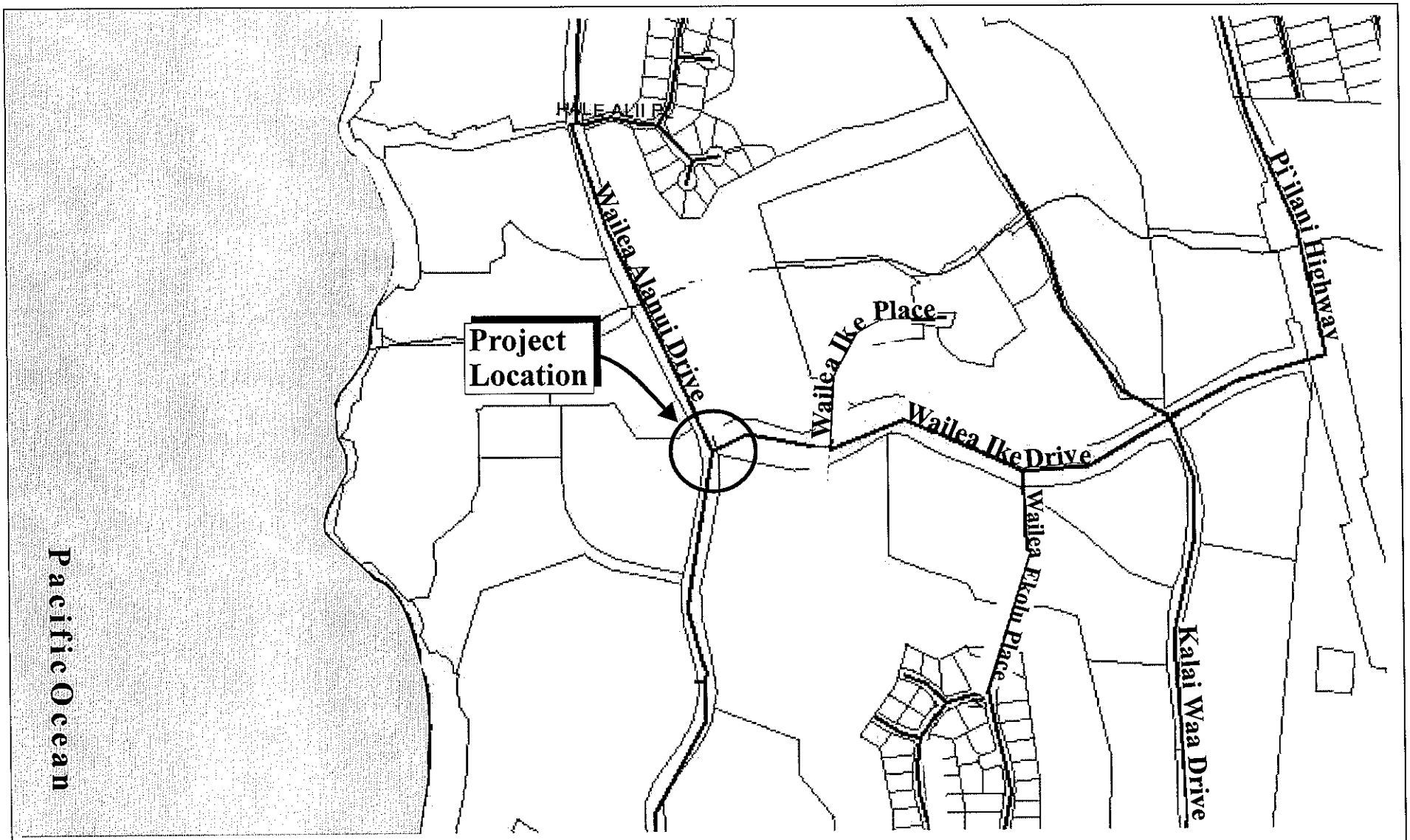
Pi`ilani Highway Widening to Four (4) Lanes
Between Kilohana Drive and Wailea Ike Drive
Location Map

NOT TO SCALE

Prepared for: Honua`ula Partners, LLC

MUNEKIYO & HIRAGA, INC.

WCPT\Pi`ilani Widening\LocationMap



Source: County of Maui

Figure 2

Wailea Ike Drive and Wailea Alanui Drive Intersection Improvements

Location Map

NOT TO SCALE

Prepared for: WPCT/GW Land Associates, LLC

MUNEKIYO & HIRAGA, INC.

WCPT\Intersection\LocationMap

MUNEKIYO & HIRAGA, INC.

MICHAEL T. MUNEKIYO
GWEN OHASHI HIRAGA
MITSURU "MICH" HIRANO
KARLYNN FUKUDA

MARK ALEXANDER ROY

March 20, 2009

Bud Pikrone
Wailea Community Association
555 Kaukahi Street, Suite 214
Wailea, Hawai`i 96753-8333

SUBJECT: Pi`ilani Highway Road Widening Project Between Kilohana Drive and Wailea Ike Drive and Wailea Ike/Wailea Alanui Intersection Improvements, Kihei, Maui, Hawai`i

Dear Mr. Pikrone:

During the County of Maui's review of the re-zoning application for Kihei-Makena Project District 9 (Honua`ula), it included a condition in which Honua`ula Partners, LLC (applicant) was made responsible for the widening improvements to Pi`ilani Highway to four (4) lanes from Kilohana Drive to Wailea Ike Drive, including intersection improvements along the project corridor. See **Figure 1**, location map.

The applicant was also required to improve the signalized intersection of Wailea Ike Drive and Wailea Alanui Drive. See **Figure 2**, location map. The condition states

> *"Modify the Wailea Alanui/Wailea Ike Drive intersection to add a signalized double right-turn movement from northbound to eastbound turning traffic and provide two left-turn lanes for southbound traffic from Wailea Ike Drive prior to occupancy of the first unit in Kihei-Makena Project District 9."*

The Pi`ilani Highway widening improvements will be located within the highway right-of-way and involves the use of lands owned by the State of Hawai'i. Pursuant to Chapter 343, Hawai`i Revised Statutes (HRS), an environmental assessment (EA) is required. Also, the improvements to the Wailea Alanui/Wailea Ike Drive intersection involves the use of County of Maui lands which will also require an EA. As part of the EA early consultation process, on behalf of the applicant, we are seeking early community input. In this regard, we have scheduled a community meeting on

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Time: 6:00 p.m.
Place: Kihei Community Center
303 East Lipoa Street
Kihei Hawai`i 96793

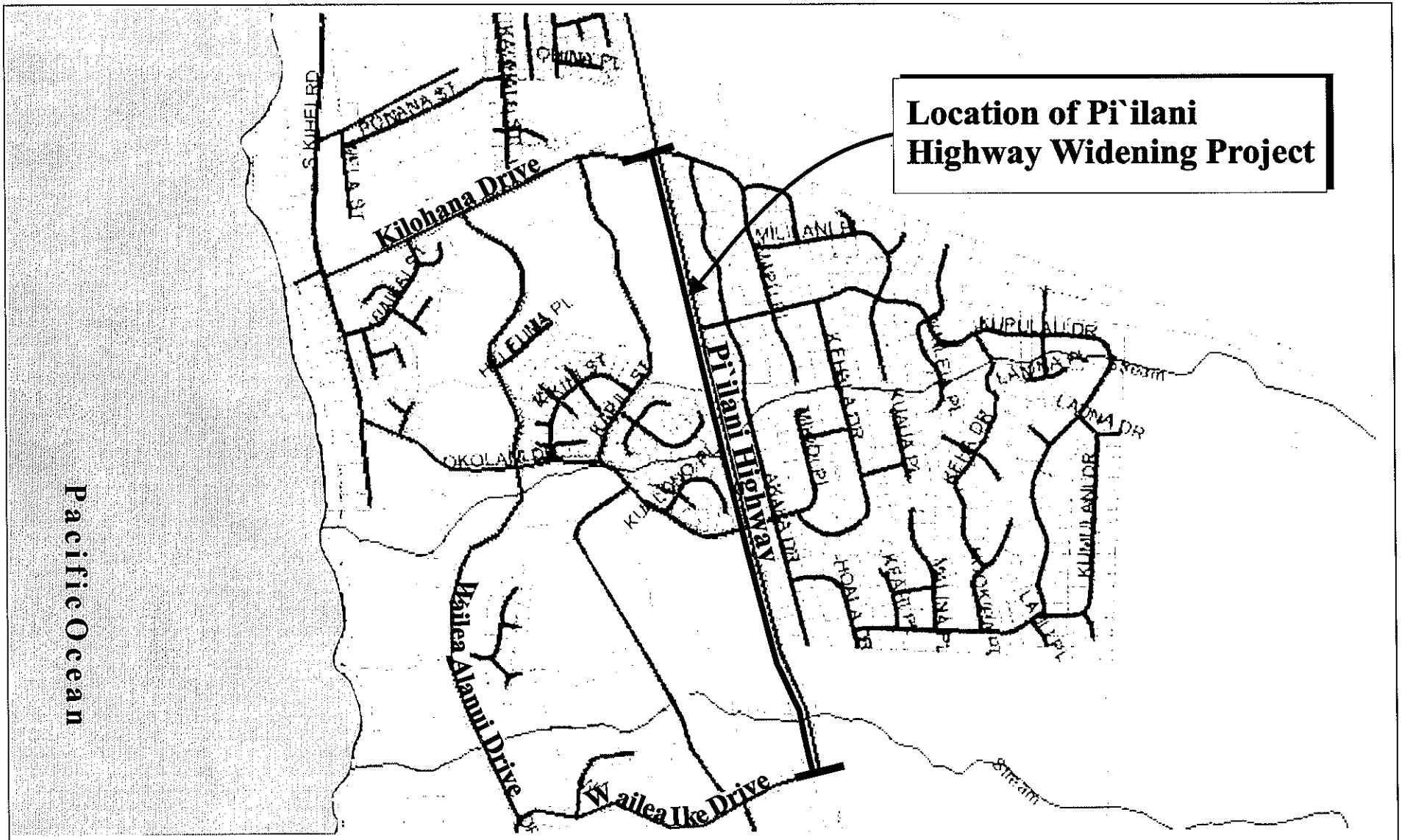
We invite your community association and members to attend this community meeting to become informed of the project and to voice your concerns that should be addressed in the EA document.

We look forward to your participation in the scheduled community meeting. If additional clarification is required, please contact me at 244-2015.

Very truly yours,

Gwen Ohashi Hiraga, Principal

GOH:yp
Enclosures
cc: Charles Jencks, Honua`ula Partners, LLC (w/out enclosures)
Keith Niiya, Austin Tsutsumi & Associates (w/out enclosures)
Stan Watanabe, Austin Tsutsumi & Associates (w/out enclosures)
F:\DATA\WCPT\PiilaniWidening\association.ltrs.wpd



Source: County of Maui

Figure 1

Pi`ilani Highway Widening to Four (4) Lanes Between Kilohana Drive and Wailea Ike Drive

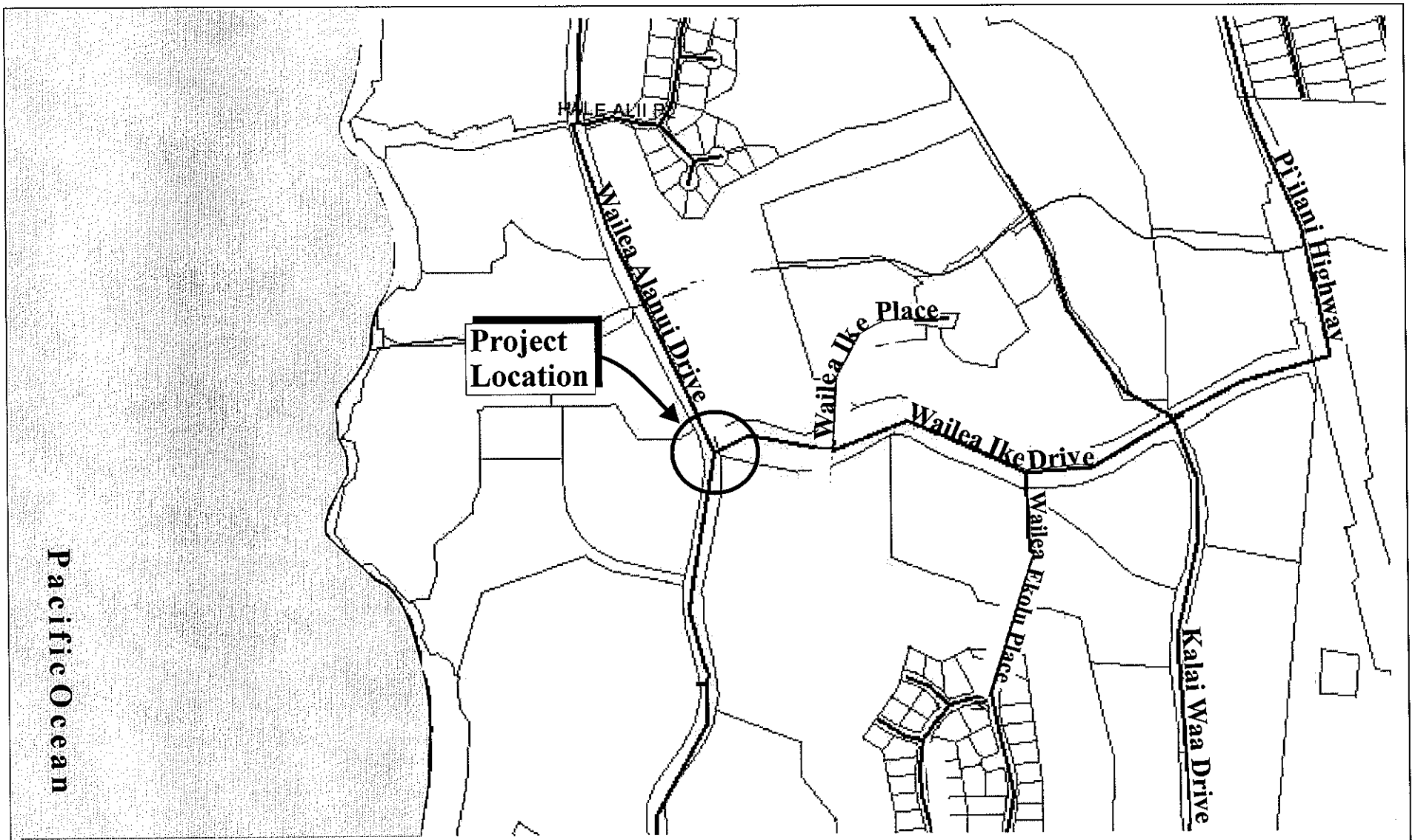
Location Map

NOT TO SCALE

Prepared for: Honua`ula Partners, LLC

MUNEKIYO & HIRAGA, INC.

WCPT\Pi`ilani Widening\LocationMap



Source: County of Maui

Figure 2

Wailea Ike Drive and Wailea Alanui Drive Intersection Improvements

Location Map

NOT TO SCALE

Prepared for: WPCT/GW Land Associates, LLC

MUNEKIYO & HIRAGA, INC.

WCPT\Intersection\LocationMap

MUNEKIYO & HIRAGA, INC.

MICHAEL T. MUNEKIYO
GWEN OHASHI HIRAGA
MITSURU "MICH" HIRANO
KARLYNN FUKUDA

MARK ALEXANDER ROY

March 20, 2009

Kihei Community Association
P. O. Box 662
Kihei, Hawa`ii 96753

SUBJECT: Pi`ilani Highway Road Widening Project Between Kilohana Drive and Wailea Ike Drive and Wailea Ike/Wailea Alanui Intersection Improvements, Kihei, Maui, Hawai`i

Dear Sir or Madam:

During the County of Maui's review of the re-zoning application for Kihei-Makena Project District 9 (Honua`ula), it included a condition in which Honua`ula Partners, LLC (applicant) was made responsible for the widening improvements to Pi`ilani Highway to four (4) lanes from Kilohana Drive to Wailea Ike Drive, including intersection improvements along the project corridor. See **Figure 1**, location map.

The applicant was also required to improve the signalized intersection of Wailea Ike Drive and Wailea Alanui Drive. See **Figure 2**, location map. The condition states

> *"Modify the Wailea Alanui/Wailea Ike Drive intersection to add a signalized double right-turn movement from northbound to eastbound turning traffic and provide two left-turn lanes for southbound traffic from Wailea Ike Drive prior to occupancy of the first unit in Kihei-Makena Project District 9."*

The Pi`ilani Highway widening improvements will be located within the highway right-of-way and involves the use of lands owned by the State of Hawai'i. Pursuant to Chapter 343, Hawai`i Revised Statutes (HRS), an environmental assessment (EA) is required. Also, the improvements to the Wailea Alanui/Wailea Ike Drive intersection involves the use of County of Maui lands which will also require an EA. As part of the EA early consultation process, on behalf of the applicant, we are seeking early community input. In this regard, we have scheduled a community meeting on

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Kihei Hawai`i 96793

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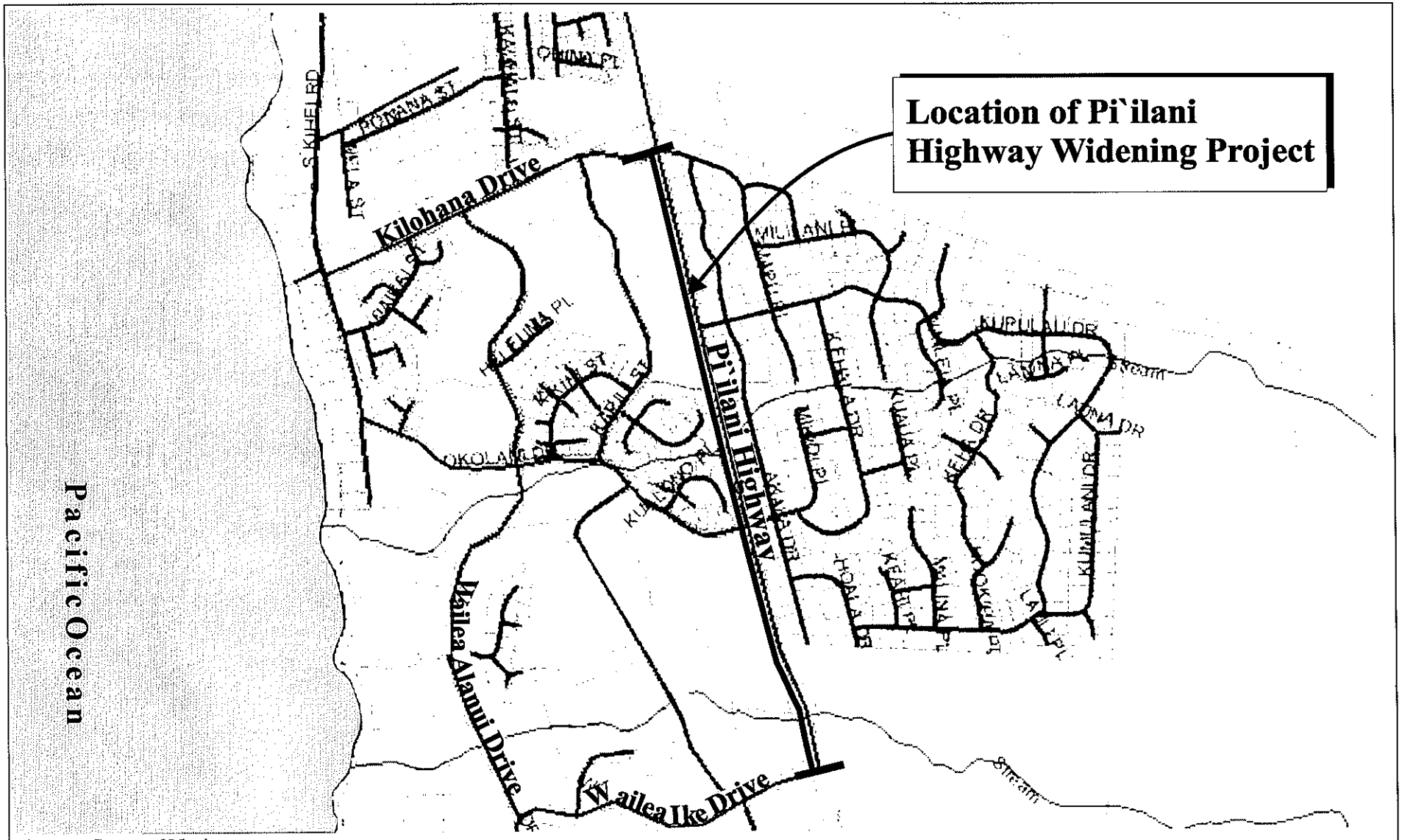
Very truly yours,

Gwen Ohashi Hiraga, Principal

GOH:yp
Enclosures
cc: Charles Jencks, Honua`ula Partners, LLC (w/out enclosures)
Keith Niiya, Austin Tsutsumi & Associates (w/out enclosures)
Stan Watanabe, Austin Tsutsumi & Associates (w/out enclosures)
F:\DATA\WCPT\PiilaniWidening\association.ltrs.wpd



Source: County of Maui

Figure 1

Pi`ilani Highway Widening to Four (4) Lanes Between Kilohana Drive and Wailea Ike Drive

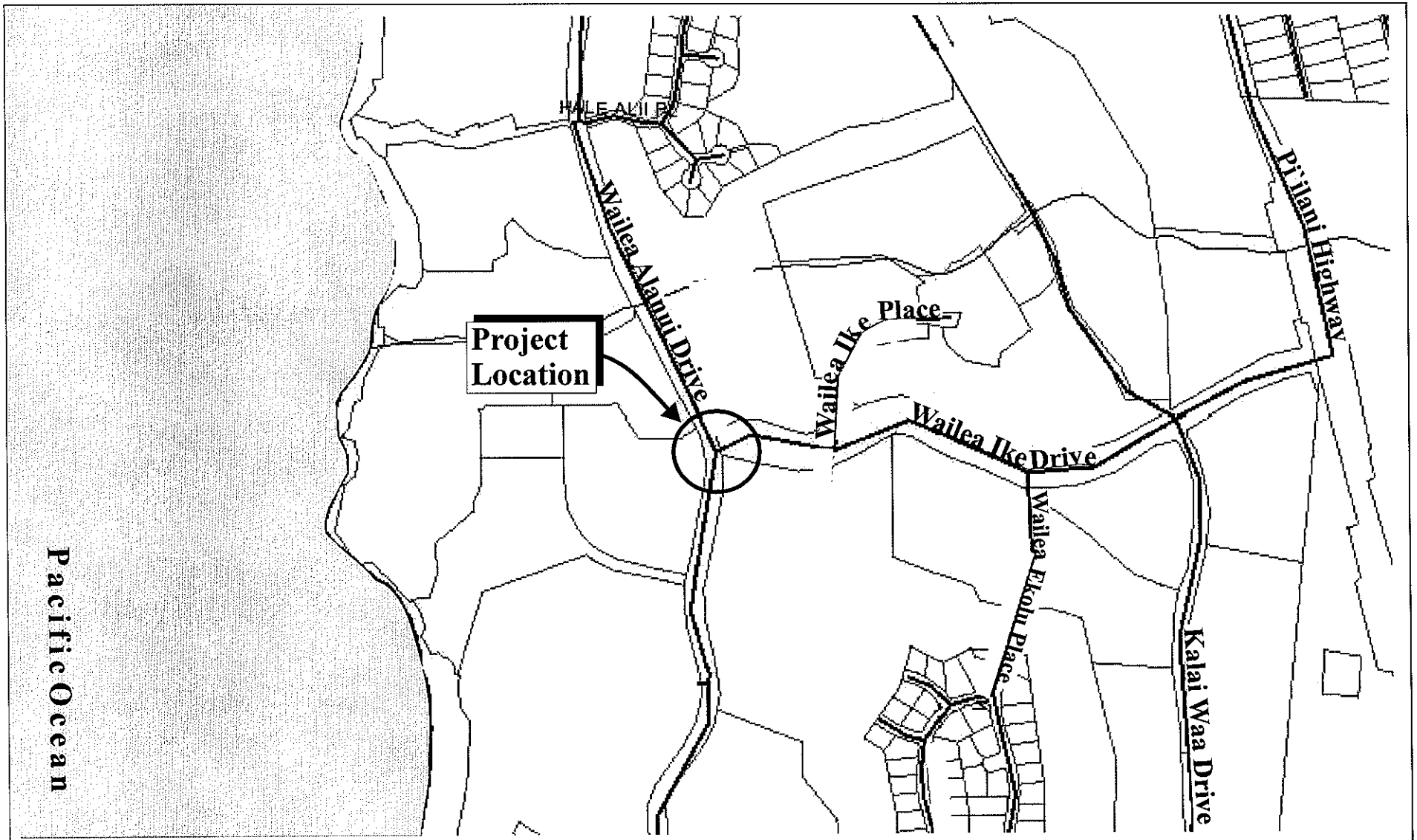
Location Map

NOT TO SCALE

Prepared for: Honua`ula Partners, LLC

MUNEKIYO & HIRAGA, INC.

WCPT\Pi`ilani Widening\LocationMap



Source: County of Maui

Figure 2

Wailea Ike Drive and Wailea Alanui Drive Intersection Improvements

Location Map

NOT TO SCALE

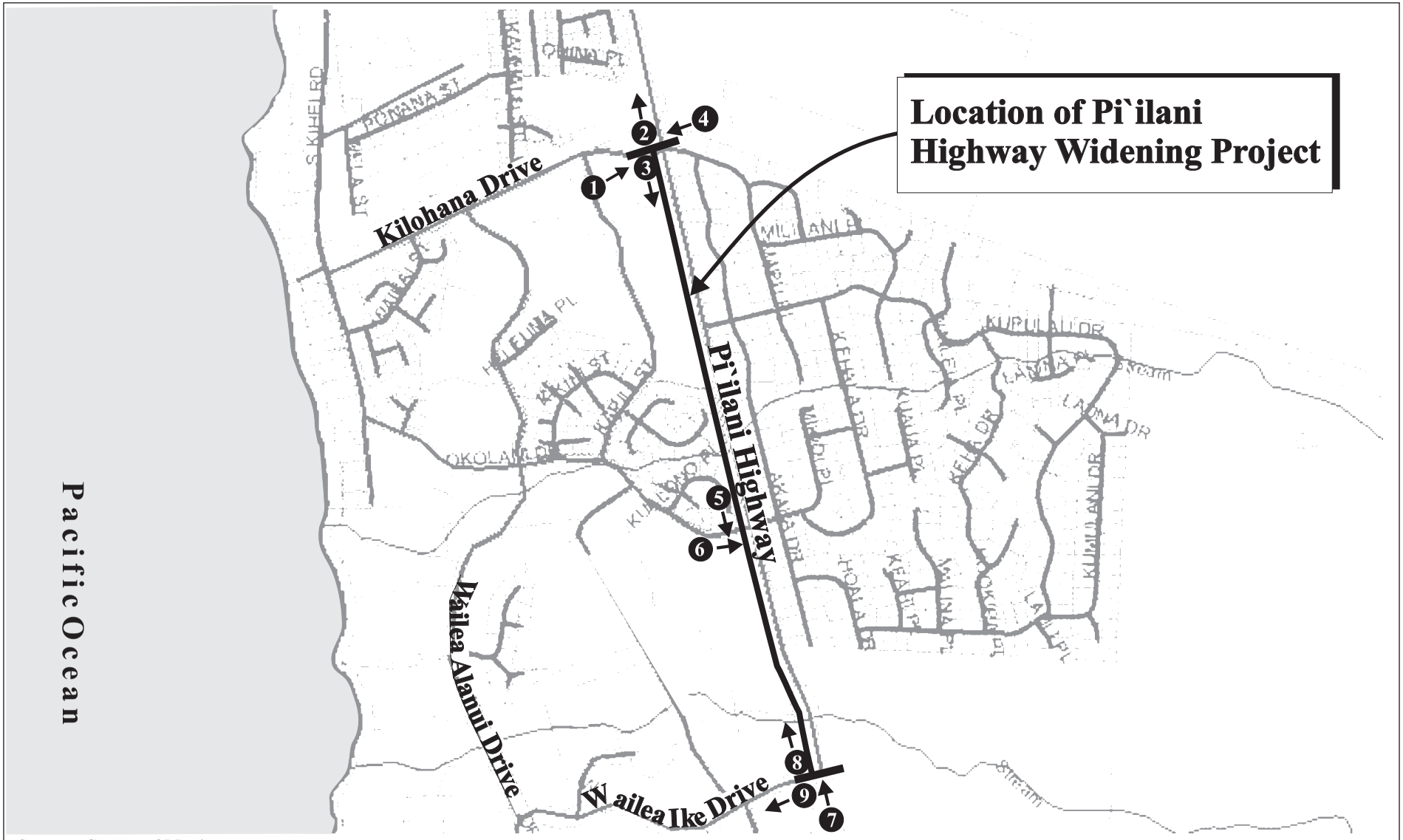
Prepared for: WPCT/GW Land Associates, LLC

MUNEKIYO & HIRAGA, INC.

WCPT\Intersection\LocationMap

APPENDIX L.

Photographs



Source: County of Maui

Pi`ilani Highway Widening Project

Photographic Reference Map

NOT TO SCALE

Prepared for: Honua`ula Partners, LLC, A&B Wailea LLC, Keaka LLC and ATC Makena Holdings LLC

MUNEKIYO & HIRAGA, INC.

WCPT\Pi`ilani Widening\PhotoRef

PHOTO NO. 1 - Kilohana/Mapu/Pi`ilani Intersection
View East

PHOTO NO. 2 - Kilohana/Mapu/Pi`ilani Intersection
View North

PHOTO NO. 3 - Kilohana/Mapu/Pi`ilani Intersection
View South

PHOTO NO. 4 - Kilohana/Mapu/Pi`ilani Intersection
View West

PHOTO NO. 5 - Pi`ilani Highway View South Toward Okolani/Mikioi Street

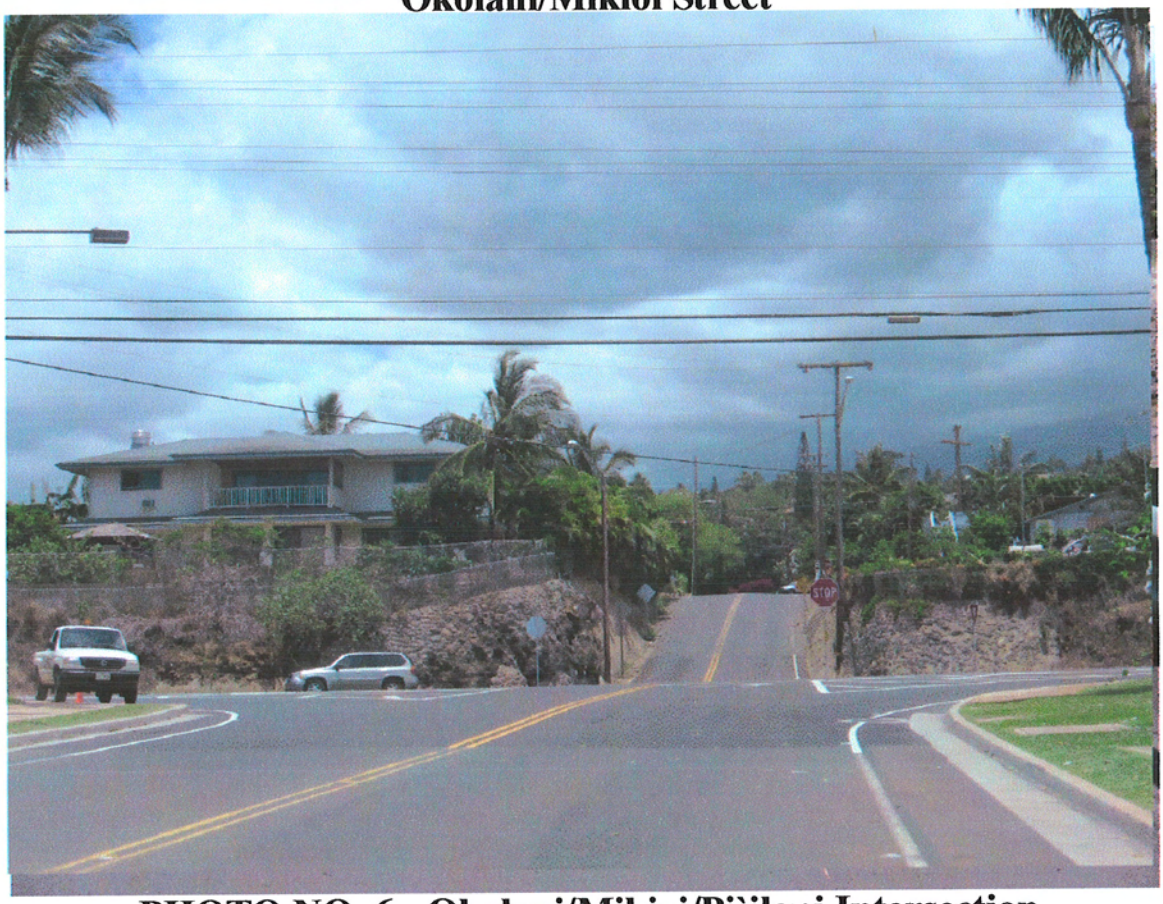


PHOTO NO. 6 - Okolani/Mikioi/Pi`ilani Intersection View East

PHOTO NO. 7 - Wailea Ike/Pi`ilani Intersection View North

PHOTO NO. 8- Pi`ilani Highway View North From Wailea Ike Drive

PHOTO NO. 9- Wailea Ike Drive View West From Pi`ilani Highway