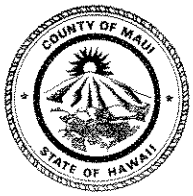
JUN 23 2007 JUN 05 2007

CHARMAINE TAVARES
Mayor

MILTON M. ARAKAWA, A.I.C.P.
Director

MICHAEL M. MIYAMOTO
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975



COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
AND ENVIRONMENTAL MANAGEMENT
ENGINEERING DIVISION
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RECEIVED '07 JUN -8 P1:36
OFC. OF ENVIRONMENTAL QUALITY CONTROL

RALPH NAGAMINE, L.S., P.E.
Development Services
Administration

DAVID TAYLOR, P.E.
Wastewater Reclamation Division

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

TRACY TAKAMINE, P.E.
Solid Waste Division

June 1, 2007

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

SUBJECT: Final Environmental Assessment for Proposed Keawe Street Extension Project, Lahaina, Maui, Hawaii
STP-3075(1)

Dear Ms. Salmonson:

The County of Maui, Department of Public Works and Environmental Management has reviewed the Final Environmental Assessment (Final EA) for the subject project, and has issued a Finding of No Significant Impact (FONSI) determination. Please publish notice of the FONSI issued for this project in the June 13, 2007 OEQC Environmental Notice.

We have enclosed a completed OEQC Publication form and four (4) copies of the Final EA. The project summary remains the same. Please call Karlynn Kawahara of Munekiyo & Hiraga, Inc. at (808) 244-2015 if you have any questions.

Sincerely,

MILTON M. ARAKAWA, A.I.C.P.
Director of Public Works and
Environmental Management

CY/jk(ED07-337)
S:\ENG\ALL\joe\165-KeaweOEQC

Final Environmental Assessment

PROPOSED KEAWE STREET EXTENSION

Prepared for:

County of Maui,
Department of Public Works
and Environmental Management

JUL 9 P1:52 '07

June 2007

MUNEKIYO HIRAGA, INC.

Final Environmental Assessment

PROPOSED KEAWE STREET EXTENSION

Prepared for:

County of Maui,
Department of Public Works
and Environmental Management

June 2007

MUNEKIYO HIRAGA, INC.

CONTENTS

Preface i

Executive Summary ii

I. PURPOSE AND NEED FOR ACTION ..... Page 1

A. GENERAL PROPERTY INFORMATION ..... Page 1

B. PROJECT NEED ..... Page 1

C. PROPOSED IMPROVEMENTS ..... Page 6

D. REGULATORY PROCESSING REQUIREMENTS ..... Page 8

II. ALTERNATIVES TO THE PROPOSED ACTION ..... Page 9

A. NO ACTION ALTERNATIVE ..... Page 9

B. ENGINEERING ALTERNATIVES ..... Page 9

III. DESCRIPTION OF EXISTING ENVIRONMENT, IMPACTS AND MITIGATION MEASURES ..... Page 12

A. LAND USE ..... Page 12
1. Existing Conditions ..... Page 12
2. Impacts and Mitigation Measures ..... Page 12

B. CLIMATE, TOPOGRAPHY AND SOILS ..... Page 12
1. Existing Conditions ..... Page 12
2. Impacts and Mitigation Measures ..... Page 16

C. FLOOD AND TSUNAMI HAZARDS ..... Page 16
1. Existing Conditions ..... Page 16
2. Impacts and Mitigation Measures ..... Page 16

D. FLORA AND FAUNA ..... Page 18
1. Existing Conditions ..... Page 18
2. Impacts and Mitigation Measures ..... Page 18

E. AIR QUALITY AND NOISE CHARACTERISTICS ..... Page 18
1. Existing Conditions ..... Page 18

2. Impacts and Mitigation Measures ..... Page 19

F. ARCHAEOLOGICAL RESOURCES ..... Page 19
1. Existing Conditions ..... Page 19
2. Impacts and Mitigation Measures ..... Page 19

G. CULTURAL RESOURCES ..... Page 20
1. Cultural Landscape ..... Page 20
2. Informant Documentation ..... Page 22
3. Potential Impacts and Mitigation Measures ..... Page 25

H. SCENIC AND OPEN SPACE RESOURCES ..... Page 25
1. Existing Conditions ..... Page 25
2. Potential Impacts and Mitigation Measures ..... Page 25

I. PUBLIC SERVICES ..... Page 25
1. Existing Conditions ..... Page 25
2. Impacts and Mitigation Measures ..... Page 27

J. SOCIO-ECONOMIC ENVIRONMENT ..... Page 28
1. Existing Conditions ..... Page 28
2. Potential Impacts and Mitigation Measures ..... Page 30

K. INFRASTRUCTURE ..... Page 31
1. Roadways ..... Page 31
2. Water ..... Page 37
3. Wastewater ..... Page 38
4. Drainage ..... Page 38
5. Electrical, Telephone and Cable Television Systems ..... Page 40

L. CUMULATIVE AND SECONDARY IMPACTS ..... Page 40

IV. RELATIONSHIP TO LAND USE PLANS, POLICIES AND CONTROLS ..... Page 42

A. STATE LAND USE DISTRICTS ..... Page 42

B. MAUI COUNTY GENERAL PLAN ..... Page 42

C. WEST MAUI COMMUNITY PLAN ..... Page 44

D. COUNTY ZONING ..... Page 46

E. COASTAL ZONE MANAGEMENT OBJECTIVES AND POLICIES ..... Page 46

V. ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED AND IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES ..... Page 55

VI. ANTICIPATED DETERMINATION AND FINDINGS AND REASONS SUPPORTING THE DETERMINATION ..... Page 56

VII. LIST OF PERMITS AND APPROVALS ..... Page 60

VIII. AGENCIES AND ORGANIZATIONS CONSULTED DURING THE PREPARATION OF THE DRAFT ENVIRONMENTAL ASSESSMENT; LETTERS RECEIVED AND RESPONSES TO SUBSTANTIVE COMMENTS ..... Page 61

IX. LETTERS RECEIVED DURING THE DRAFT ENVIRONMENTAL ASSESSMENT REVIEW PERIOD AND RESPONSES TO SUBSTANTIVE COMMENTS ..... Page 155

X. REFERENCES ..... Page i

LIST OF FIGURES

Figure 1. Regional Location Map ..... Page 2
Figure 2. Project Site Map ..... Page 3
Figure 3. Conceptual Typical Sections ..... Page 7
Figure 4. Soil Association Map ..... Page 14
Figure 5. Soil Classification Map ..... Page 15
Figure 6. Flood Insurance Rate Map ..... Page 17
Figure 7. State Land Use District Classifications ..... Page 43
Figure 8. West Maui Community Plan Land Use Designations ..... Page 45

LIST OF APPENDICES

Appendix A. Archaeological Assessment Report
Appendix B. Traffic Assessment Report
Appendix C. Preliminary Drainage Report
Appendix D. Letter from Department of Planning Dated April 1, 2005

Preface

The applicant, the County of Maui, Department of Public Works and Environmental Management, proposes to extend Keawe Street a distance of approximately 2,500 lineal feet from its existing end point to the State of Hawaii's, Phase IA of the Lahaina Bypass Highway in Lahaina, Maui, Hawaii.

The proposed action involves the use of Federal and County funds, as well as the use of State and County rights-of-way (Honoapiilani Highway, Lahaina Bypass Highway and Keawe Street). Accordingly, an Environmental Assessment (EA) has been prepared as required by Chapter 343, Hawaii Revised Statutes (HRS) and Chapter 200 of Title 11, State Department of Health Rules pertaining to Environmental Impact Statement Rules to document the proposed action's technical characteristics, environmental impacts and alternatives, as well as advance findings and conclusions relative to the significance of the project. A Categorical Exclusion (CatEx) will be prepared separately for the project as it was determined by the Federal Highways Administration that the project scope meets the criteria of 23CFR771.117.

Executive Summary

Applicant: County of Maui, Department of Public Works and Environmental Management

Determination Agency: County of Maui, Department of Public Works and Environmental Management

Agencies Consulted: A total of four (4) Federal Government agencies, ten (10) State of Hawaii Government agencies, six (6) County of Maui agencies, six (6) private companies and ten (10) community groups were consulted during the Draft Environmental Assessment comment period. For further information, refer to Chapter IX of this Final Environmental Assessment.

General Description: The applicant is proposing the extension of the existing Keawe Street from its existing terminus in the Lahaina Business Park to the future State Department of Transportation's Lahaina Bypass Highway.

The project proposes the construction of approximately 2,500 lineal feet of roadway, encompassing TMKs (2) 4-5-21:003 and 022, (portions). The proposed Keawe Street extension will establish the required connection between the Lahaina Bypass Highway and Honoapiilani Highway to ensure the functional operation of Phase IA of the Lahaina Bypass Highway. The proposed extension improvements include two (2) 12-foot travel lanes with 6-foot paved shoulders and related improvements such as grading, relocation of utilities, the installation of street lights and landscaping. The project site is located in an area of mixed uses with commercial/light industrial uses, as well as vacant former agricultural lands and single-family residences in the vicinity. An analysis with regards to the action's technical, economic, social and environmental aspects is provided in the following Final Environmental Assessment.

I. PURPOSE AND NEED FOR ACTION

I. PURPOSE AND NEED FOR ACTION

A. GENERAL PROPERTY INFORMATION

The applicant, County of Maui, Department of Public Works and Environmental Management (DPWEM), proposes to extend the current Keawe Street in Lahaina, Maui on lands identified by Tax Map Key (2) 4-5-21:003 and 022 (portions). See **Figure 1** and **Figure 2**. Roadway rights-of-way or roadway reserves are in place for most of the subject project area. The project site is currently vacant land, formerly in agricultural uses.

The project is located within the limits of the State Land Use Commission's "Urban" District. The West Maui Community Plan identifies the Keawe Street extension on its land use map, as a connection to the future Lahaina Bypass Highway.

B. PROJECT NEED

The State of Hawaii, Department of Transportation (HDOT) completed its environmental review process for its proposed Lahaina Bypass Highway (Lahaina Bypass) in 2003, with the publication of the Record of Decision (ROD) on the project. The Lahaina Bypass is proposed to improve highway capacity and alleviate traffic congestion between Launiupoko and Honokowai. In addition, the Lahaina Bypass will provide an alternate transportation route between Launiupoko and Honokowai in the event sections of the existing Honoapiilani Highway are closed due to traffic accidents, fire and smoke hazards or high surf crossing the roadway. The Lahaina Bypass originates from Launiupoko, south of Lahaina Town, and proceeds in a northerly direction to Ikena Avenue in Lahaina. From this point, the Lahaina Bypass will proceed in a northwesterly direction until it reaches Kapunakea Street in Lahaina. The Lahaina Bypass will then continue in a northerly direction as it passes to the east of the Kaanapali Resort and then proceeds in a northwesterly direction until it reaches its terminus near Honokowai, south of Mahinahina Gulch.

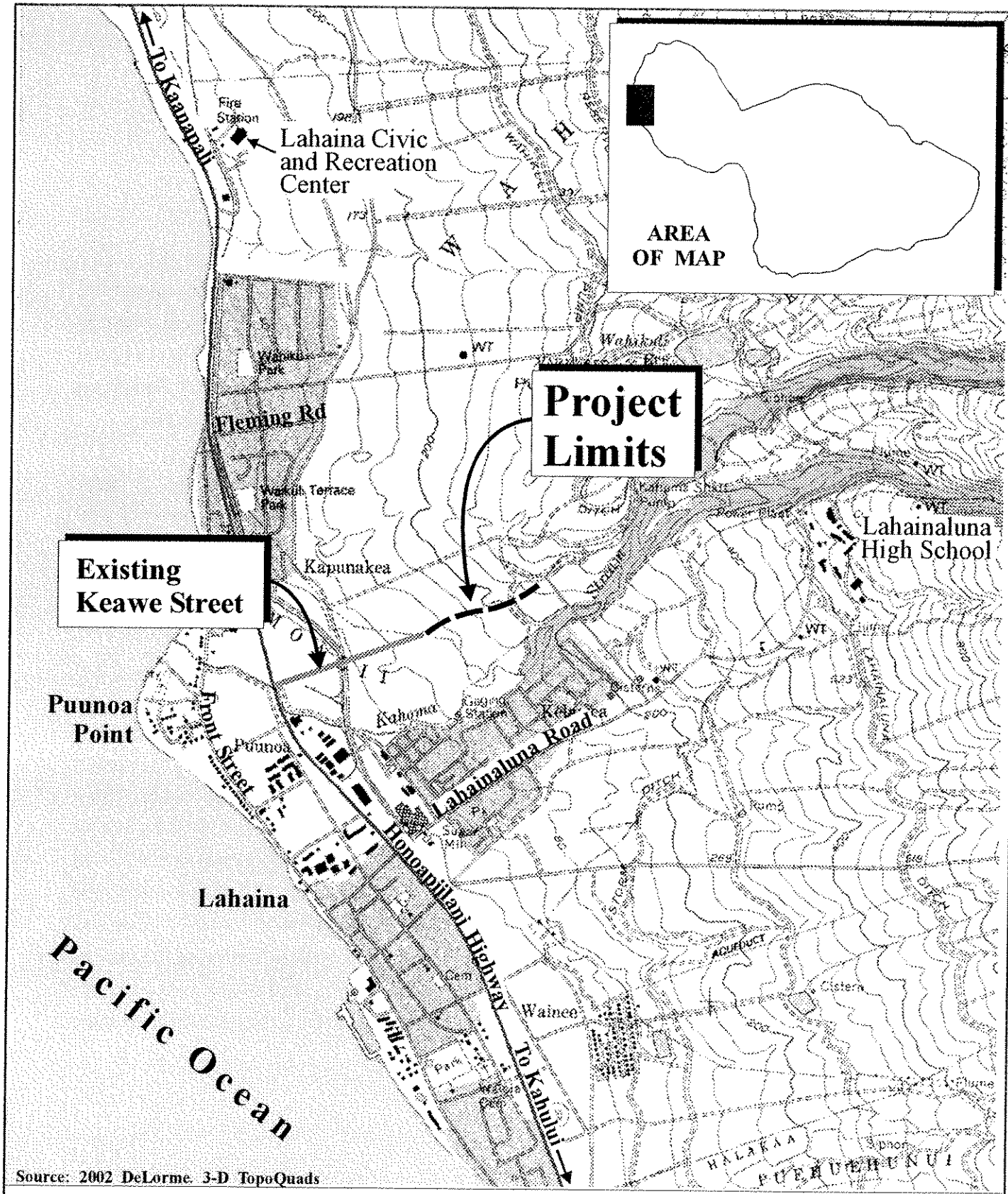


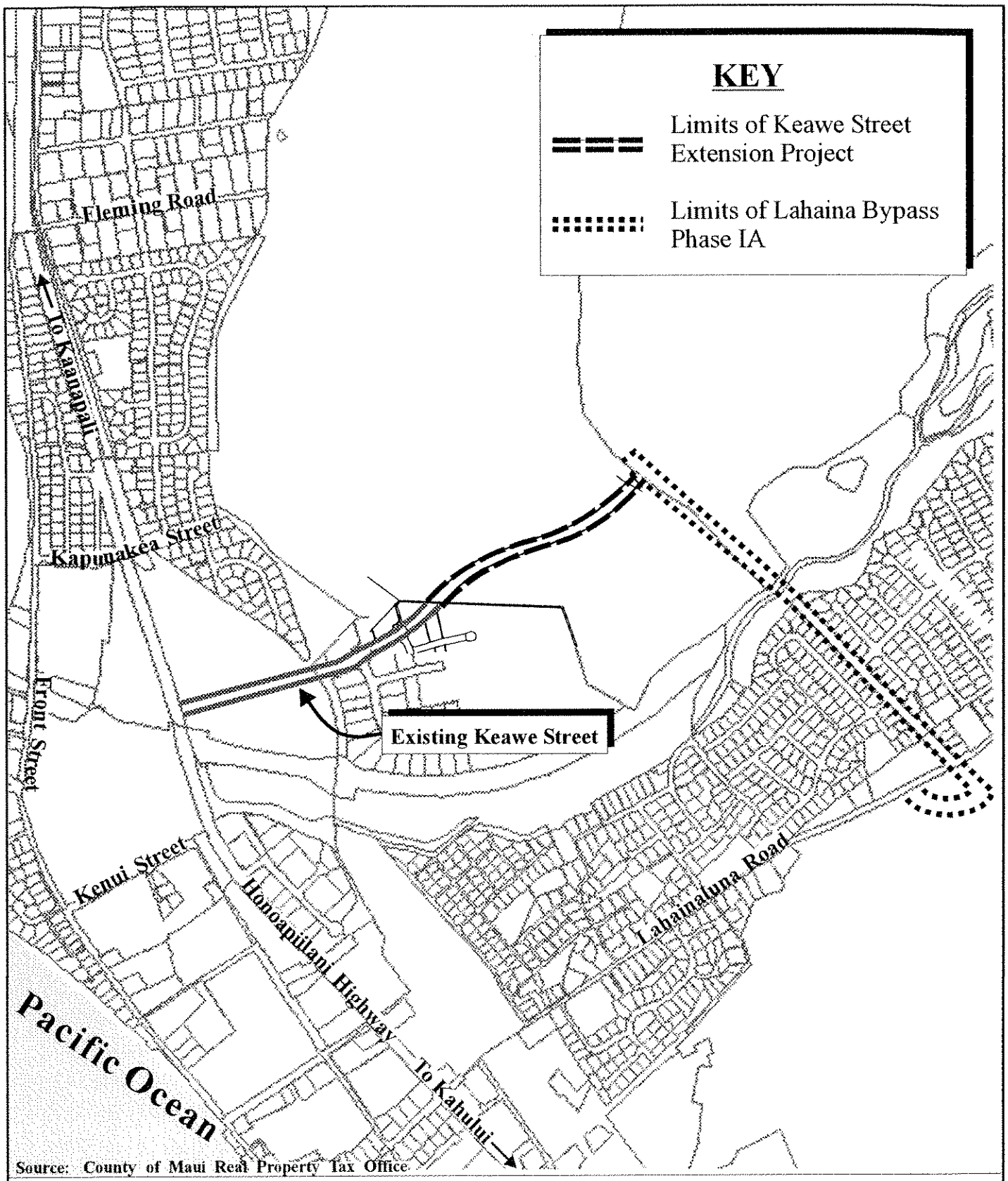
Figure 1 Proposed Keawe Street Extension

Regional Location Map

1050 Feet
0 525 2100

Prepared for: County of Maui, Dept. of Public Works and Environmental Management

MUNEKIYO & HIRAGA, INC.



Source: County of Maui Real Property Tax Office

Figure 2 Proposed Keawe Street Extension

Project Site Map

0 300 600 1200 Feet

Prepared for: County of Maui, Dept. of Public Works and Environmental Management

MUNEKIYO & HIRAGA, INC.

As approved, the Lahaina Bypass provides for a four-lane highway with controlled access from Launiupoko to Honokowai in West Maui for a distance of approximately nine (9) miles. The minimum right-of-way for the highway is 150 feet. The highway is anticipated to be built in multiple phases. The proposed roadway alignment runs parallel to the Honoapiilani Highway. The traffic study prepared for the Final Supplemental Environmental Impact Statement (FSEIS) for the Lahaina Bypass concluded that based on Year 2020 traffic projections, Honoapiilani Highway would be operating at overcapacity conditions from Launiupoko to Honokowai in the northbound direction during the AM peak hour and in the southbound direction during the PM peak hour. With the Lahaina Bypass in place, Level of Service (LOS) at the study intersections of Puukolii Connector and Honoapiilani Highway, Kaanapali Connector and Honoapiilani Highway and Keawe Street Extension and Honoapiilani Highway are anticipated to improve or stay the same overall for the AM and PM peak hours of traffic. The greatest improvement is anticipated at the Kaanapali Connector and Honoapiilani Highway intersection during the AM peak hour of traffic, when the LOS will improve from LOS D without the Lahaina Bypass to LOS B with the Lahaina Bypass. Thus, the construction of the Lahaina Bypass is required to accommodate future traffic demand.

The HDOT will be awarding a design/build contract for Phase IA of the Lahaina Bypass which will provide approximately 2,800 lineal feet of roadway, from Lahainaluna Road in the south and following the existing alignment of Ikena Avenue to the north. The contract for Phase IA of the Lahaina Bypass was awarded by the HDOT in late 2006. The Phase IA will provide an alternative access point for the State Department of Education's Princess Nahienaena Elementary School, Lahaina Intermediate School, Lahainaluna High School, and the residences in this part of Lahaina which is currently provided solely via Lahainaluna Road. This condition results in heavy traffic flow conditions affecting both resident and school-dependent traffic. The intersection of Lahainaluna Road and Honoapiilani Highway is fully improved with a traffic signal, as well as turning/storage lanes. The right-of-way along Lahainaluna Road ranges from 30 to 60 feet in width with the narrowest section lying in the vicinity of the former Pioneer Mill sugar mill. Generally, the pavement width along the upper and lower sections of the road are narrow, while the middle segment is wider. Widening the narrower sections of Lahainaluna Road to provide additional vehicle storage capacity and improve traffic flow is constrained by adjoining developed properties which limit right-of-way expansion.

The FSEIS highlighted eight (8) connector roads which would provide access to Honoapiilani Highway from the Lahaina Bypass and vice versa. These connector roads will

aid in the traffic circulation between the two (2) facilities and within the Lahaina area. Within the Keawe Street project area, two (2) options discussed in the FSEIS were the Dickenson Street connection and the Kapunakea Street connector.

The Dickenson Street connector is located south of the Keawe Street connector, in close proximity to the Lahainaluna Road connector. While the Dickenson Street connector would join with the Lahaina Bypass to the south of its connection with Lahainaluna Road, the County of Maui determined that Dickenson Street would provide less functional operating benefits than other options. While the Dickenson Street connection may be pursued in the future, funding limitations required the County to evaluate the roadway connector that would provide the most traffic relief for the Lahainaluna Road and Honoapiilani Highway intersection.

The Kapunakea Street connector was proposed in relation to the Housing and Community Development Corporation of Hawaii's (HCDCH) Villages of Leiali`i project. While a portion of the Villages of Leiali`i site was recently turned over to the State of Hawaii, Department of Hawaiian Home Lands for development, the portion in the vicinity of the Keawe Street extension remained with the HCDCH. At the time of the FSEIS, it was noted that HCDCH intended to review and possibly update the master plan for Villages of Leiali`i project, however, there are legal issues remaining for the project, regarding the use of ceded lands. Therefore, the development time frame is uncertain.

While the Keawe Street connector was not originally proposed in the FSEIS for the Lahaina Bypass, the ROD noted that the County of Maui had changed its focus and abandoned the Dickenson Street extension, in favor of the Keawe Street option. The County of Maui determined that the Keawe Street connector was the best alternative because (1) it is in close proximity to and can be designed to connect with the Phase IA portion of the Lahaina Bypass; (2) will alleviate and provide traffic relief to the Lahainaluna Road and Honoapiilani Highway intersection by providing southbound traffic traveling to the three DOE schools on Lahainaluna Road with an alternate transportation route; and (3) the roadway right-of-way runs through State of Hawaii property, and thus would not require the County to negotiate with private landowners. Additionally, the traffic assessment report (TAR) prepared for the Keawe Street connector noted that without the project, the Lahainaluna Road and Honoapiilani Highway intersection LOS is anticipated to deteriorate from LOS D to LOS E during the AM peak period and decrease from LOS C to LOS D during the PM peak period by 2007. With the proposed Keawe Street extension, the Lahainaluna Road LOS for the westbound left-turn and right-turn movements are anticipated to improve from LOS E to

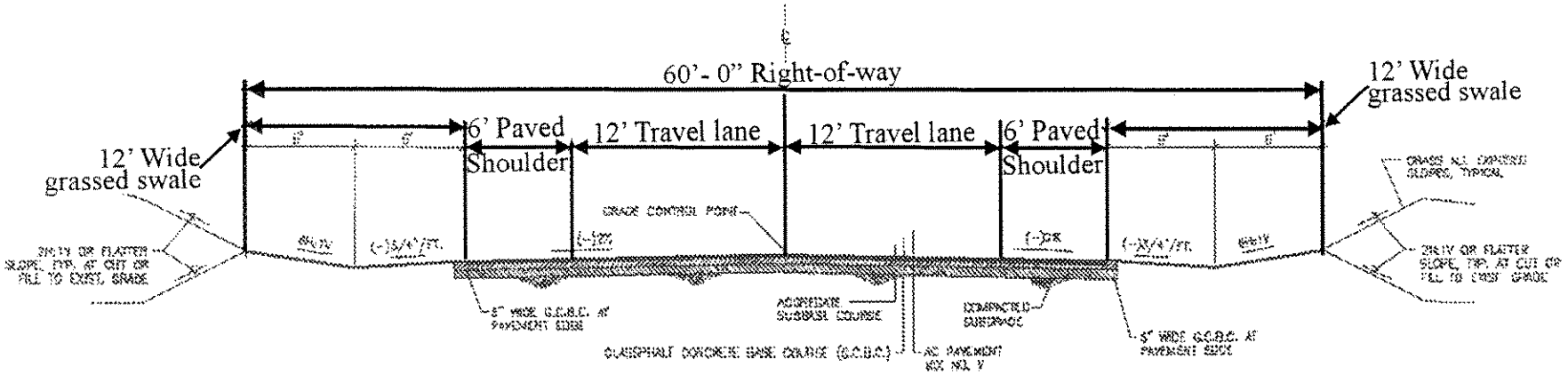
LOS D during the AM peak hour of traffic, while the remainder of the traffic movements are expected to continue operating at LOS similar to Year 2007 without project conditions. The Keawe Street TAR concluded that the total traffic volumes entering the intersection of Honoapiilani Highway and Lahainaluna Road are expected to decrease by approximately 7 percent and 3 percent during the AM and PM peak hours of traffic, respectively, while the traffic volume at the Keawe Street and Honoapiilani Highway are expected to increase proportionately.

Since the HDOT has decided to move forward with Phase IA of the Lahaina Bypass, which will provide for two (2) travel lanes from the intersection of Lahainaluna Road and Ikena Avenue and follow the existing alignment of Ikena Avenue, heading north, the Keawe Street extension is the best alternative to meet the project need. The proposed Keawe Street extension will connect with Phase IA of the Lahaina Bypass, at its northern terminus and provide traffic functionality for Phase IA. It will also meet the project need of providing traffic relief for the Lahainaluna Road and Honoapiilani Highway intersection, as well as an alternate emergency access to the DOE schools and residences which utilize Lahainaluna Road as their sole vehicle access to Honoapiilani Highway.

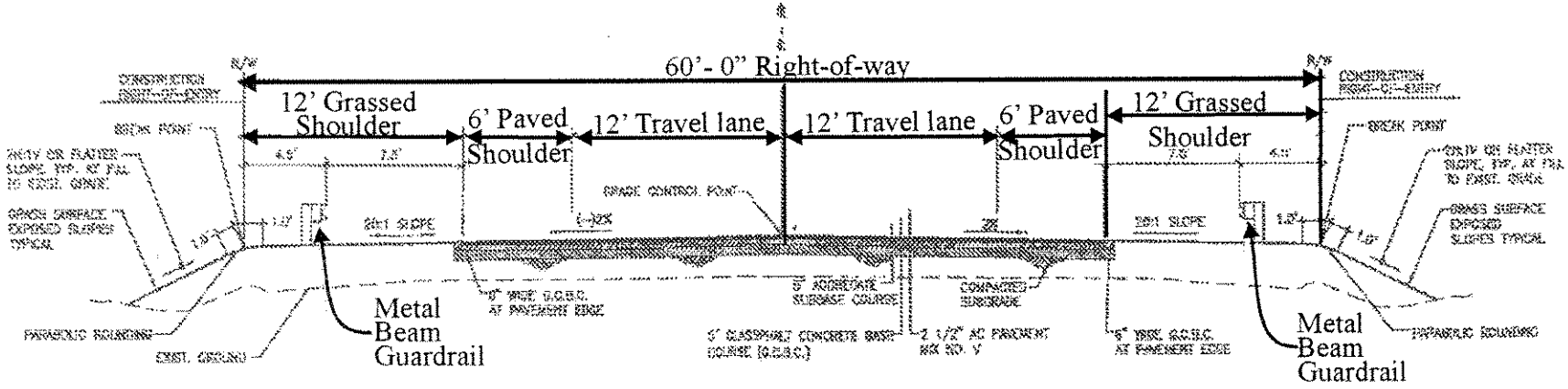
C. PROPOSED IMPROVEMENTS

The applicant proposes to construct approximately 2,500 lineal feet of roadway, to extend the existing portion of Keawe Street to the future HDOT's Lahaina Bypass Highway. As a separate but related project, the HDOT plans to construct Phase IA of the Lahaina Bypass Highway between Lahainaluna Road and the proposed Keawe Street extension. Refer to **Figure 2**. The proposed Keawe Street extension improvements will provide a 60-foot right-of-way and include construction of two (2) 12-foot travel lanes with 6-foot paved shoulders and related improvements, such as grading, relocation of utilities and the installation of landscaping and street lights. See **Figure 3**. Additionally, the applicant plans to modify the existing intersection of Keawe Street and Honoapiilani Highway. The intersection improvements include demolition of a portion of an existing traffic island, removal of existing landscaping and restriping of pavement to create an exclusive left-turn lane on the Keawe Street portion.

It is estimated that the project will cost approximately $2.5 million. Federal funds will be provided through the Transportation Efficiency Act for the 21st Century (TEA 21). The proposed project is included in the currently approved Statewide Transportation Improvement Program. Construction of the project is anticipated to begin in Spring 2008



Typical Cross Section in Cut



Typical Cross Section in Fill

Source: Shimabukuro, Endo & Yoshizaki, Inc.

Figure 3

Proposed Keawe Street Extension
Conceptual Typical Sections

NOT TO SCALE

Prepared for: County of Maui, Dept. Of Public Works and Environmental Management

MUNEKIYO & HIRAGA, INC.

and is expected to last 12 months.

D. REGULATORY PROCESSING REQUIREMENTS

Since Federal and County funds, as well as the use of State and County roadway rights-of-way (Honoapiilani Highway, Lahaina Bypass Highway and Keawe Street) will be utilized, an Environmental Assessment (EA) has been prepared, as required by Chapter 343, Hawaii evised Statutes and Chapter 200, of Title 11, State Department of Health Rules. A Categorical Exclusion (CE) will be prepared separately for the use of Federal funds for the project. The Federal Highway Administration (FHWA) has determined that the project qualifies for a CE under Section 23CFR771.117.

II. ALTERNATIVES TO THE PROPOSED ACTION

II. ALTERNATIVES TO THE PROPOSED ACTION

A. NO ACTION ALTERNATIVE

The no action or no build alternative would forego the implementation of the proposed project and maintain the status quo. As previously noted, the FSEIS for the Lahaina Bypass project noted that traffic capacities at key intersections of the Honoapiilani Highway would be exceeded by Year 2007. The FSEIS also recognized that the projected traffic volumes estimated in the Maui Long Range Highway Planning Study indicated even higher volumes than projected by the FEIS for the Lahaina Bypass. Further, the supplemental traffic study provided in the ROD provided the following conclusion:

> *Future Year without the Lahaina Bypass Road*
>
> *Based upon the Year 2020 Traffic Projections, Honoapiilani Highway will be operating at over capacity conditions from Launiupoko through Honokowai in the northbound direction during the AM peak hour of traffic and in the southbound direction during the PM peak hour of traffic. In addition, Honoapiilani Highway in the northbound direction between the Puukolii Connection and Dickenson Street will operate at over capacity conditions during the PM peak hour of traffic. Therefore, the Lahaina Bypass (Highway) would be required to accommodate the future traffic demand (Austin Tsutsumi & Associates, 2003).*

The proposed Keawe Street extension is located in the area between the Puukolii Connection and Dickenson Street and as noted, that area will operate at over capacity during the PM peak hour. As such, the no action alternative is not considered a viable scenario in light of existing and projected traffic conditions in the Lahaina area.

B. ENGINEERING ALTERNATIVES

Various alternative roadway alignments including an extension of Dickenson Street, an extension of Kuhua Street in the area above the sugar mill, and the construction of a one lane, contra-flow roadway along the southern part of Kahoma Stream were examined to ensure that all feasible options were not overlooked. The identification of an appropriate alignment involved an analysis of Federal funding and project cost considerations, construction efficiency, operational objectives, and maintenance accessibility, design integration with

existing and planned roadway facilities, as well as lineal and spatial relationships and adjacencies. As previously noted, the FSEIS highlighted eight (8) connector roads which would provide access to Honoapiilani Highway from the Lahaina Bypass and vice versa. These connector roads would aid in the traffic circulation between the two (2) facilities and within the Lahaina area. Within the Keawe Street project area, two (2) options discussed in the FSEIS were the Dickenson Street connection and the Kapunakea Street connector.

The Dickenson Street connector is located south of the Keawe Street connector, in close proximity to Lahainaluna Road. As previously noted, HDOT intends to develop the Lahaina Bypass in multiple phases. The first phase of the Lahaina Bypass, Phase IA, will be the portion from Lahainaluna Road, heading north, along the former Ikena Avenue. While the Dickenson Street connector would join with the Lahaina Bypass to the south of its connection with Lahainaluna Road, the County of Maui determined that Dickenson Street would provide less vehicle capacity to the Lahaina Bypass than other options. The Dickenson Street connection may be pursued in the future, however, funding limitations required the County to evaluate the roadway connector that would provide the most traffic relief for the Lahainaluna Road and Honoapiilani Highway intersection. Thus, the Dickenson Street alternative was not selected. Further, although the Dickenson Street alternative would meet the purpose and need of providing an alternative emergency access to the schools and residences along Lahainaluna Road, the DPWEM determined that the Dickenson Street project would provide minimal relief to the Lahainaluna Road and Honoapiilani Highway intersection. Thus, this alternative was not considered.

The Kapunakea Street connector was proposed in relation to the HCDCH's Villages of Leiali`i project. While a portion of the Villages of Leiali`i site was recently turned over to the State of Hawaii, Department of Hawaiian Home Lands for development, the portion in the vicinity of the Keawe Street extension remains with the HCDCH. At the time of the FSEIS, it was noted that HCDCH intended to review and possibly update the master plan for Villages of Leiali`i project, however, there are legal issues remaining for the project, regarding the use of ceded lands. Therefore, the development time frame for the Kapunakea Street connector is uncertain. Further, it is unclear as to when the HDOT will design and construct the Lahaina Bypass in the vicinity of the Kapunakea Street connection. As such, if the Kapunakea Street connection was built today, it would not provide functional connectivity with the Lahaina Bypass. Thus, the Kapunakea Street connection was not considered as it will not meet the project purpose and need.

While the Keawe Street connector was not originally proposed in the FSEIS for the Lahaina

Bypass, the ROD noted that the County of Maui had changed its focus and abandoned the Dickenson Street extension, in favor of the Keawe Street option. The County of Maui determined that the Keawe Street connector was the best alternative because (1) it is in close proximity to and can be designed to connect with the Phase IA portion of the Lahaina Bypass; (2) will alleviate and provide traffic relief to the Lahainaluna Road and Honoapiilani Highway intersection by providing southbound traffic traveling to the three DOE schools on Lahainaluna Road with an alternate transportation route; and (3) the roadway right-of-way runs through State of Hawaii property, and thus would not require the County to negotiate with private landowners. Thus, the Keawe Street extension was selected as the preferred alternative.

Although there may be other alignments and methodologies which could be examined, the proposed alternative best addresses the project's development and operational criteria.

III. DESCRIPTION OF EXISTING ENVIRONMENT, IMPACTS AND MITIGATION MEASURES

III. DESCRIPTION OF EXISTING ENVIRONMENT, IMPACTS AND MITIGATION MEASURES

A. LAND USE

1. Existing Conditions

Portions of the project site are located within an area of urban development, while the remainder is surrounded by former agricultural lands. The Lahaina Business Park, a light industrial subdivision, is located west of the project site, abutting the portion of Keawe Street which has already been completed. The existing Keawe Street intersects with the State of Hawaii's, Honoapiilani Highway, which contains mainly commercial uses in the vicinity, such as the Lahaina Cannery Mall and the Mind's Eye Square. To the south of the project site are single-family residential uses, as well as three (3) Department of Education Schools. The County of Maui's, Lahainaluna Road is located further south, beyond the residences. North of the project site are additional vacant agricultural lands and single-family residences, while to the east are vacant lands.

2. Impacts and Mitigation Measures

The proposed roadway extension is not anticipated to adversely impact surrounding land uses. The proposed action is intended to enhance the existing roadway system in Lahaina by improving system operations and is not expected to alter land uses along the project corridor. In addition, as an infrastructure component located within existing and designated rights-of-way, the proposed extension will not create any long-term physical impacts to surrounding uses.

B. CLIMATE, TOPOGRAPHY AND SOILS

1. Existing Conditions

a. Climate

Like most areas of Hawaii, Lahaina's climate is relatively uniform year-round. Lahaina's tropical latitude, its position relative to storm tracts and the Pacific

anticyclone, and the surrounding ocean combine to produce this stable climate. Variations in climate among different regions, then, is largely left to local terrain.

In Lahaina, August is historically the warmest month with an average high temperature of approximately 88 degrees Fahrenheit and average low temperature of 69 degrees Fahrenheit. February is normally the coolest month of the year with an average high temperature of 81 degrees Fahrenheit and an average low temperature of approximately 63 degrees Fahrenheit (Maui County Data Book, 2004).

Rainfall at Lahaina is highly seasonal, with most precipitation occurring from October to March when winter storms hit the area. Precipitation data for West Maui in 2003 shows that on average, January was the wettest month, with 7.83 inches of rainfall. Total precipitation for the year was 27.07 inches (Maui County Data Book, 2004).

The winds in the region are also seasonal. Wind patterns also vary on a daily basis, with tradewinds generally being stronger in the afternoon. During the day, winds blow onshore toward the warmer land mass. In the evening, the reverse occurs, as breezes blow toward the relatively warm ocean.

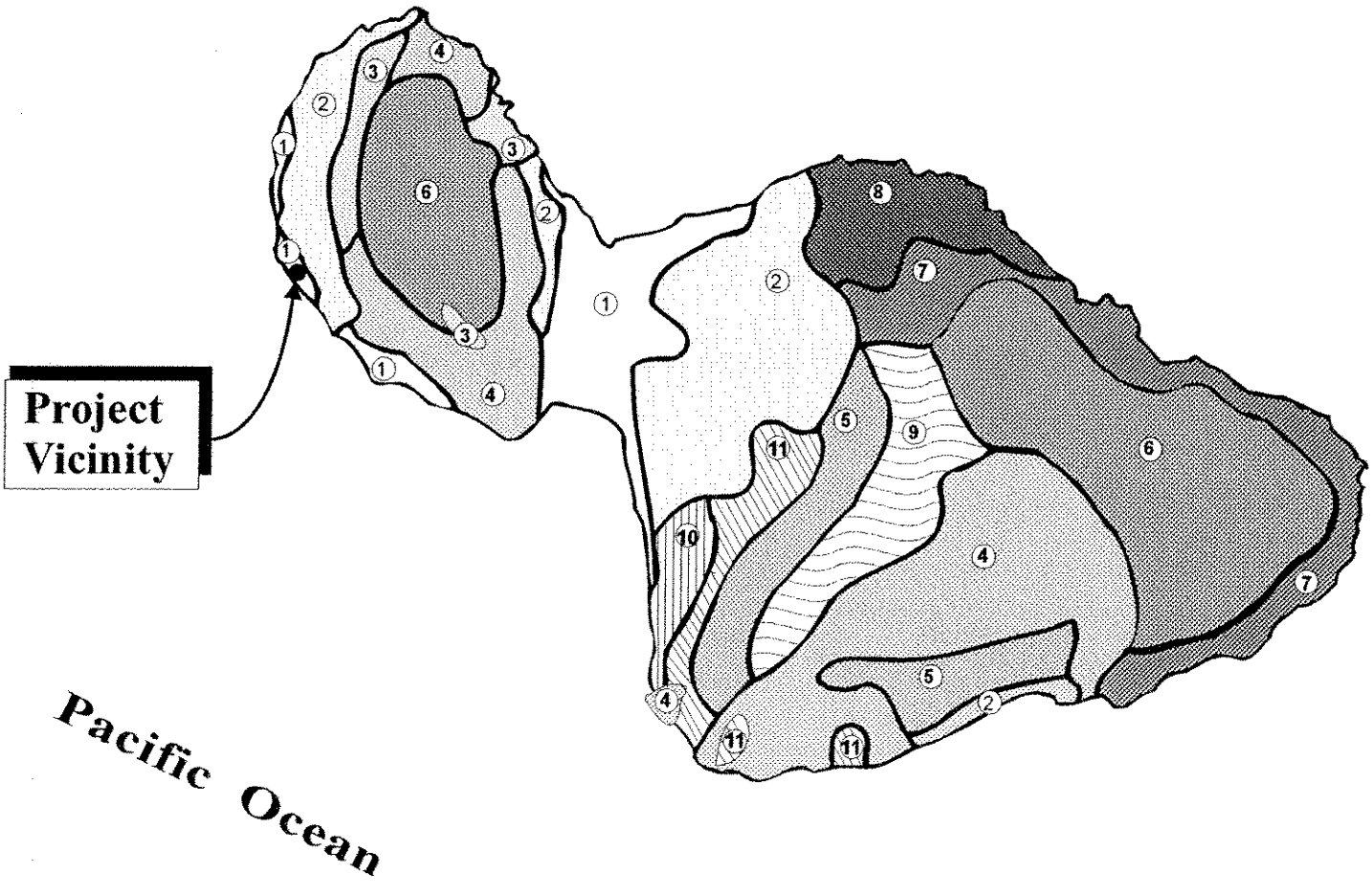
b. Topography and Soils

The topography along the project corridor is characterized by gentle to moderately sloping terrain. Elevations range from about 20 feet above mean sea level (amsl) at Honoapiilani Highway to approximately 300 feet at the future Lahaina Bypass Highway.

Soils underlying the project corridor belong to the Pulehu-Ewa-Jaucas and the Waiakoa-Keahua-Molokai associations. See **Figure 4**. Soils from the Ewa Series and Wahikuli Series underlie the lands in the vicinity of the project corridor. See **Figure 5**. Ewa silty clay loam (EaA) is characterized by slopes of 0 to 3 percent, very slow runoff, and very slight erosion hazard. Vegetation normally associated with this series include fingergrass, kiawe, koa haole and uhaloa.

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



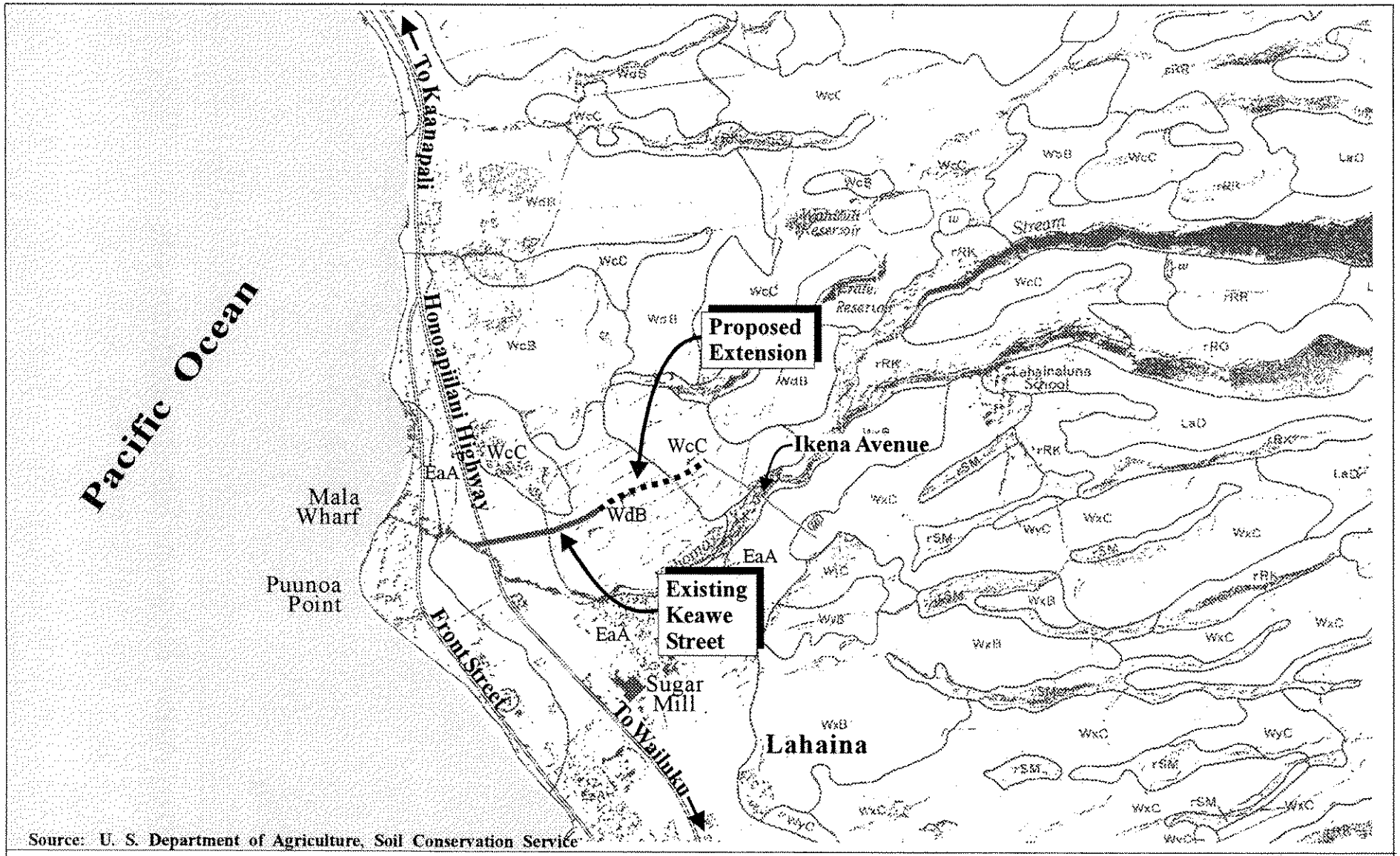
Map Source: USDA Soil Conservation Service

Figure 4 Proposed Keawe Street Extension
Soil Association Map

NOT TO SCALE

Prepared for: County of Maui, Dept. of Public Works and Environmental Management

MUNEKIYO & HIRAGA, INC.



Source: U. S. Department of Agriculture, Soil Conservation Service

Figure 5

Proposed Keawe Street Extension

Soil Classification Map

1000 Feet
0 500 2000

Prepared for: County of Maui, Dept. Of Public Works and Environmental Management

MUNEKIYO & HIRAGA, INC.

Wahikuli very stony silty clay, 3 to 7 percent slopes (WdB) is similar to Wahikuli silty clay, except that as much as 3 percent of the surface is covered by stones. The Wahikuli silty clay is characterized by dark reddish-brown silty clay about 15 inches thick. Permeability is moderate. Runoff is slow and the erosion hazard is slight. Wahikuli very stony silty clay is used mostly for sugarcane cultivation.

Wahikuli stony silty clay (WcC), 7 to 15 percent slopes, is similar to Wahikuli silty clay, 3 to 7 percent slopes, except that there are enough stones on the surface to hinder cultivation. Runoff is slow to medium, and the erosion hazard is slight to moderate. This soil is mostly used for sugarcane cultivation.

2. Impacts and Mitigation Measures

No negative effects to these elements of the natural environment are expected as a result of the proposed action. The proposed roadway extension will be constructed within existing and designated rights-of-way. Vertical roadway profile cuts and fills will not alter local topographic and soil conditions significantly.

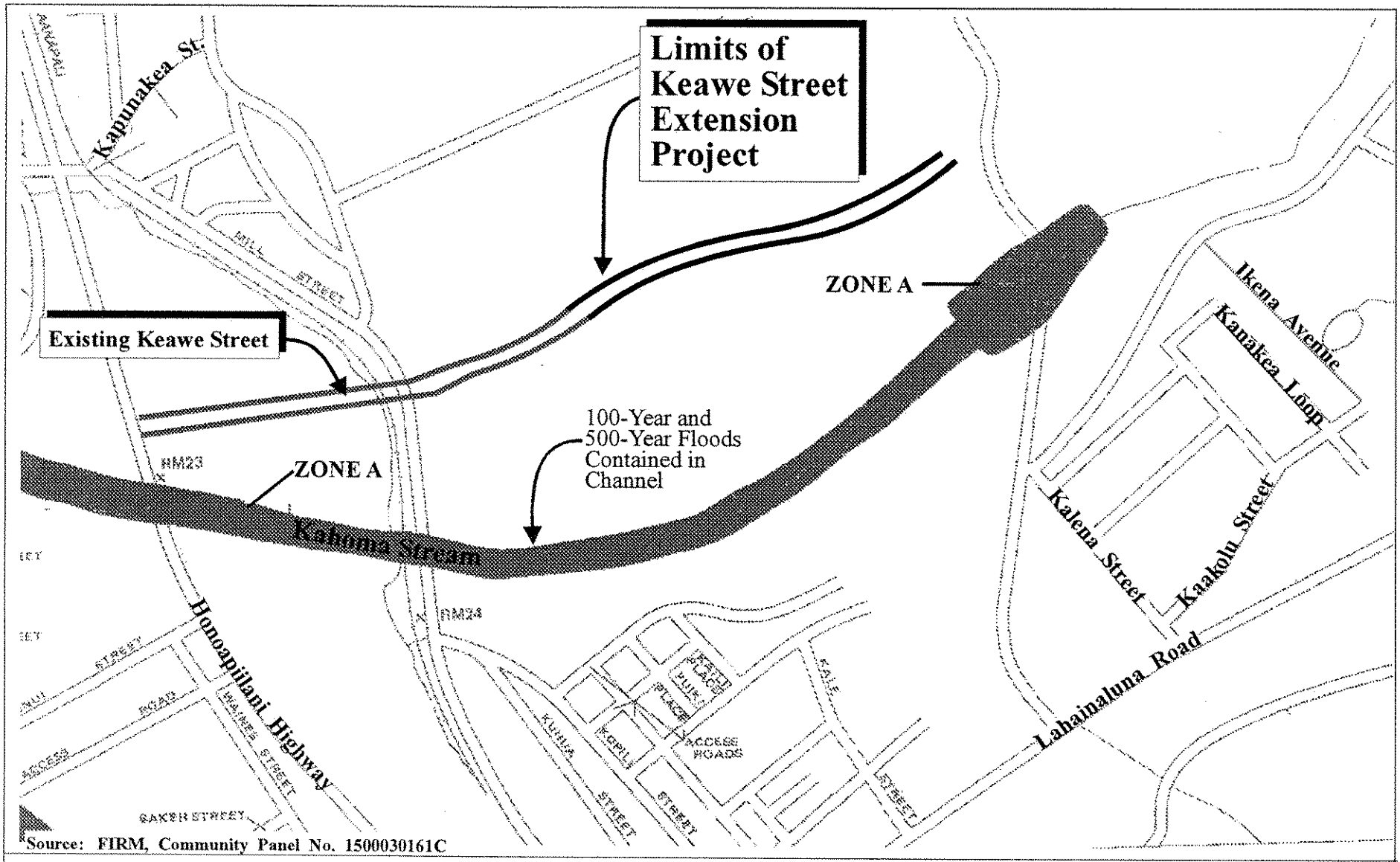
C. FLOOD AND TSUNAMI HAZARDS

1. Existing Conditions

According to the flood insurance rate map for this region of Maui, the proposed roadway extension traverses lands which fall within Zone C, areas of minimal flooding. See **Figure 6**.

2. Impacts and Mitigation Measures

No adverse effects from flood and tsunami hazards are expected as a result of the proposed action. By providing an alternate transportation route, the proposed roadway extension will facilitate evacuations during tsunamis.



Source: FIRM, Community Panel No. 1500030161C

Figure 6

Proposed Keawe Street Extension

Flood Insurance Rate Map

0 125 250 500 Feet

Prepared for: County of Maui, Dept. Of Public Works and Environmental Management

MUNEKIYO & HIRAGA, INC.

D. FLORA AND FAUNA

1. Existing Conditions

Plant life along the project corridor is typical of fallow agricultural lands and primarily consists of grasses, weeds and shrubs.

Due to former sugarcane cultivation along the project corridor, there are no known rare, threatened or endangered species of plant life in the vicinity of the proposed project corridor.

Animal life along the project corridor is typical of the undeveloped regions of West Maui. Fauna typically found in the vicinity include feral cats, rats, and mongoose. Avifauna include the House Finch, Zebra Dove, Spotted Dove, Common Mynah, and the Japanese White-Eye. There are no known rare, threatened or endangered species of animal life or significant habitats found in the vicinity of the proposed project.

In addition, the U.S. Department of the Interior's National Wetlands Inventory Map does not reveal any wetland areas located along or in close proximity of the project corridor.

2. Impacts and Mitigation Measures

The proposed roadway extension will occur within existing and designated rights-of-way formerly used for sugar cultivation. No adverse impacts to flora, fauna or avifauna within the project corridor are anticipated.

E. AIR QUALITY AND NOISE CHARACTERISTICS

1. Existing Conditions

The Lahaina region in general does not experience adverse air quality conditions. There are no point sources of airborne emissions in the immediate vicinity and the air quality at the project corridor is considered good. Airborne pollutants that do exist can largely be attributed to vehicular exhaust from Honoapiilani Highway and other surrounding roadways. These sources are intermittent, however, and the prevailing tradewinds will disperse particulates generated by these temporary sources.

Existing background noise in the vicinity of the site is principally attributed to traffic on Honoapiilani Highway, the existing Keawe Street, and surrounding local roadways. In addition, the flight paths of arriving and departing aircraft at the Kapalua West Maui Airport, located about four (4) miles to the north of the project corridor, place the route beyond the limits of aircraft noise exposure.

2. Impacts and Mitigation Measures

Situated along the lower portion of the project corridor, an approximately 300-foot long section of the proposed roadway extension will traverse existing Lahaina Business Park.

As may be required, a Community Noise Permit from the State Department of Health will be obtained for project-related construction activities. Beyond the construction period, no adverse impacts to air and noise parameters along the project corridor are expected. The proposed extension is not anticipated to create significant adverse impacts to ambient air and noise conditions.

F. ARCHAEOLOGICAL RESOURCES

1. Existing Conditions

The lands underlying the existing and proposed Keawe Street right-of-way was previously disturbed during the initial construction of the roadway, as well as during subsequent roadway and utilities improvements, and repair and maintenance activities. In addition, the lands underlying the undeveloped portion of the proposed roadway extension were extensively disturbed in connection with former sugarcane cultivation activities. However, to ascertain the presence of any previously unidentified archaeological sites or features, an Archaeological Inventory Survey was conducted for the undeveloped lands underlying the project corridor. See **Appendix "A"**.

2. Impacts and Mitigation Measures

The archaeological inventory survey conducted subsurface testing. A total of eight (8) backhoe trenches were excavated with negative findings. The subject area may have been devoid of subsurface historic properties prior to cultivation clearing, or

trenching may have been placed in areas with no historic remains. Observations within the trenches were of geologic significance. As trenching continued *mauka* it appears that the "blue" rock or bedrock was evident at more shallow depths within the trenches, and conversely, soil accumulations were deeper in the trenches at lower elevations. Trenches which were placed in areas with little vegetation were more crumbly and drier, probably due to a lack of water.

Prior to the advent of sugarcane cultivation, the project area's close proximity to Kahoma Stream would have been advantageous for permanent habitation settlement. Sites to be expected within this area would be small enclosures for sleeping, food preparation and work areas, as well as agricultural sites consisting of terraces for *lo`i* and *`auwai* for channeling water from the stream. Ceremonial sites such as *heiau* and *ko`a* would also be expected. These site types, as well as burials have been previously documented in earlier studies.

By letter dated May 22, 2006, the SHPD accepted the archaeological assessment report and noted that, *"Development of the project areas will have 'no effect' on significant historical sites."* See Chapter IX of this report.

In the event that archaeological features, cultural artifacts, or human remains are encountered during construction, work shall cease in the immediate area of the find and the find shall be protected from further damage. In addition, the SHPD shall be promptly notified to assess the significance of the find and recommend appropriate mitigative measures, if necessary.

G. CULTURAL RESOURCES

1. Cultural Landscape

The Lahaina District is described as a rich agricultural oasis watered from nearby valleys (Handy and Handy, 1972). This oasis "extended about three leagues in length (about nine miles along the coast) and one (three miles) in breadth. Beyond this, all is dry and barren." The name Lahaina ("cruel sun") likely refers to the droughts that affected the surrounding area from time to time (Pukui et al., 1974). In pre-contact times, Lahaina itself was apparently a garden-like area with taro lo`i, ditches (`auwai) and separating embankments creating a verdant landscape. Brackish water and fresh water ponds (loko) were also present. At lower elevations, dry land cultivation took

place in areas around alluvial fans, while at higher elevations lo`i and `auwai systems were constructed within valleys for taro production. In coastal settlement areas, marine resources were utilized for subsistence. In Lahaina, several fishponds existed, of which two (2) were most prominent, Loko o Mokuhinia and the smaller Loko Puako, around which intensive taro and breadfruit cultivation occurred. Scattered around the fishponds and taro loi`i, and situated on higher ground, were the homes of the laborers who worked the land. As suggested by Handy (1940, 1972), by late pre-contact times, the fairly sizable population dwelling in the region utilized coastal fishing areas and inland garden plots for subsistence, cultivating sweet potatoes near shore, or taro in terraced lo`i in the wetter valleys inland.

By the time of contact, the Lahaina region had become an important socio-political center and the residence of several powerful chiefs, most notably Kahekili, one of the highest ranking on Maui. Lahaina was considered by high chiefs to be a favorable place due to the abundance of natural resources and its close proximity to the islands of Lana`i and Moloka`i (Handy and Handy, 1972).

In 1789, Kamehameha I invaded Maui and defeated Kahekili at the Battle of Kepaniwai O Iao (Speakman, 1978). In post-contact times, Lahaina became the center of the Hawaiian monarchy. Kamehameha I spent time there between his battles of conquest, while his son, Kamehameha III, resided in Lahaina in preference to Honolulu. Many high status individuals connected with the monarchy lived in Lahaina, even after the official capitol of the kingdom was moved to Honolulu in 1845.

In 1820, about 40 years after Captain James Cook's discovery of the Hawaiian Islands, the islands transitioned from the traditional Hawaiian social system to one influenced by New England whaling ships and missionaries. The population of West Maui continued to decline in the second half of the 19 th century followed by the collapse of the Pacific whaling industry in the 1860's which was prompted by the discovery of oil in Pennsylvania a decade or so earlier. In the Lahaina area, sugar production developed in the mid-1800s, while further north, different crops were tried, including coffee and pineapples.

With the introduction of sugarcane cultivation and the importation of foreign labor to work on the plantation, the character of Lahaina changed. Combined with the industrialization of the local sugar industry, Lahaina emerged as a plantation town

with residential camps surrounding the downtown commercial area. Although now reliant on the visitor industry, Lahaina Town's present character reflects a blend of its whaling and plantation era past.

2. Informant Documentation

To obtain a perspective about cultural resources relative to the project corridor, informant interviews were conducted with Mr. John Kuia and Mr. Akira Imano. Summaries of their interviews follow.

a. John Kuia

Mr. John Kuia was born in Lahaina, Maui in 1942. He has lived in Lahaina all of his life and was raised on Kilauea Street, which is located off of Lahainaluna Road. He was raised by his grandparents as his father passed away when he was only 11 years old. His father worked for Pioneer Mill and later worked on Lanai for Dole. He has three (3) sisters and three (3) brothers. Mr. Kuia served in the National Guard Reserve for 11 years and has worked for Kaanapali Golf Course since the late 1960's. Although ownership of the golf course has changed over the years, he has worked at the golf course for 35 years and currently serves as an Assistant Superintendent.

Growing up in Lahaina, Mr. Kuia remembers that the project site for the proposed Keawe Street extension was planted in sugarcane and part of the Pioneer Mill lands. He did not recall any other uses for the land in the area until the Lahaina Business Park was built. Mr. Kuia travels to the Lahaina Business Park to patronize some of the businesses in the area.

Mr. Kuia was not aware of any cultural practices that had been carried out on the property. He was unsure if there would be any cultural remains in the project area, however, he reiterated that for as long as he remembered, the land was planted in sugarcane. He liked the proposed Keawe Street extension project because he thought it would relieve the traffic in the area, as long as people stayed at the same pace. He thought that there would always be traffic in the area no matter what. He felt that there would still be traffic even after the project was done.

In terms of the effect of the project on agriculture, Mr. Kuia felt that agriculture cannot make a profit in West Maui. He thought that it was sad, but he did not think it would happen.

Mr. Kuia is a member of the Kaanapali 2020 community based planning

group, as well as the Wainee community based planning group. He joined the Kaanapali 2020 group when it first began in 1999. He was employed by Amfac at the time, the previous owners of the Kaanapali Resort and Golf Course, and was asked to participate as a company representative. He served on the Recreation and Cultural Overlay Committees and continues to attend Kaanapali 2020 meetings today. Mr. Kuia is also participating in the master planning of the Wainee Residential Subdivision, being proposed by Kaanapali Development Corp. (KDC), the successor to Amfac. He serves on the Fast-Track and Land Use Committees, assisting KDC with the development of a conceptual master plan for approximately 200 acres above the Lahaina Aquatics Center and Lahaina Recreation Center.

Mr. Kuia noted that being born and raised in Lahaina, he believes that the future lies in someone's grandchildren. It is possible to remember the past, but he thought that it is important to look to the future and see how things will be for them. Finally, he stated that it will be important for all projects to make it *pono*, or make it right for the community.

b. **<u>Akira Imano</u>**

Akira Imano was born in Lahaina in 1929. He was raised in Lahaina and with the exception of a few years in military service, has lived his entire life in West Maui. His father was born in Japan and his mother was born in Hawaii. The Imano family had seven (7) children. Mr. Imano is married and has three (3) grown children. His eldest daughter lives on the Mainland, while his second daughter and son live in Hawaii. Mr. Imano is a former resident of Wainee Village, a plantation camp owned by Pioneer Mill. He lived there until 1960 when he moved into his current residence on Lahainaluna Road.

Mr. Imano is the former manager for the Pioneer Mill Employee's Credit Union. He retired from the business 13 years ago. Prior to managing the credit union, he worked in the experimental lab division for Pioneer Mill. They would test the soils and study the conditions of the land before deciding what type of sugarcane to plant in the area. Mr. Imano is also a member of the Lahaina Veteran's Club and the Lahaina Hongwanji Mission.

Mr. Imano noted that while growing up in the Wainee Village, he would also go to the Keawe Camp to play. His wife grew up at the Keawe Camp, which was located in the vicinity of the Keawe Street extension project. He also recalled that his father-in-law had a piggery in the area and that he would go on weekends to help him out. They would supply Nagasako Supermarket. With regards to the project site however, Mr. Imano remembered that it was in sugarcane cultivation for Pioneer Mill. He stated that Amfac had all the lands planted in sugarcane down to Front Street. Overtime, however, they

began selling off parcels and those areas were developed. Mr. Imano also stated that he knew the Army Corps of Engineers project manager for the Kahoma Stream Channel project. He was Mr. Imano's classmate at Lahainaluna High School.

Mr. Imano was not aware of any cultural practices that were carried out in the past, nor is he aware of any present cultural practices being conducted on the subject property.

Regarding use of the land today, Mr. Imano stated he does not go to any of the businesses located on Keawe Street currently. However, he noted that the Keawe Street extension project has been long awaited and had been talked about for sometime. As a resident on Lahainaluna Road, he stated that often times it is difficult for him to get out of the driveway and during the morning and after school hours, it is nearly impossible because of the traffic generated by the three (3) schools located off of Lahainaluna Road. He felt that a majority of the school traffic was generated by residents living on the north side of town and that the Keawe Street project will greatly reduce the amount of traffic on Lahainaluna Road.

In terms of existing problems in the area, Mr. Imano thought that for Lahaina in general, there are three (3) major problems: (1) roads; (2) affordable housing; and (3) the homeless. He noted that the roads in West Maui are terrible and that it takes a long time even to get to Wailuku. He thought that the roads need to be fixed before any more subdivision are built in West Maui. He also stated that he thought the Launiupoko traffic signal is bad because it causes a bottleneck in traffic. Affordable housing is a problem in the area because the local people cannot afford to buy homes. He felt bad for the younger generations because he did not think that they would be able to purchase a home due to the rising cost. Finally, Mr. Imano noted that homeless has become a bigger problem. He heard that many homeless people will take whatever money they have to buy drugs. He stated however, that it was his understanding that the West Maui Resource Center is a transitional housing project, which allows people to live there until they find a job and a place of their own to rent.

Mr. Imano also noted that the families on Ikena Street had been compensated many years ago and was glad that the Bypass/Keawe Street project would finally be moving forward. As the proposed project proceeds, he wondered what the connection would be like for the Lahaina Bypass to Lahainaluna Road and stated that he hoped that it would not be a STOP sign on Lahainaluna Road, but rather an overpass or underpass. Mr. Imano noted that he is in support of any project that builds road to help traffic on the north side of Lahaina. He believes that about 80 percent of the school traffic will utilize the new road.

3. Potential Impacts and Mitigation Measures

The construction of the proposed roadway extension is not expected to have an adverse effect on cultural beliefs, practices, resources, or gathering rights along the project corridor.

In general, the proposed project will employ appropriate management and coordination practices to ensure that impacts to cultural values and practices are appropriately mitigated.

H. SCENIC AND OPEN SPACE RESOURCES

1. Existing Conditions

The proposed alignment is not located within a scenic view corridor. Scenic resources in the vicinity of the proposed roadway extension include the West Maui Mountains, which are to the east of the project corridor, as well as the Pacific Ocean and the offshore island of Lanai, which are to the west of the site. Open space resources in the region are also characterized by the West Maui Mountains, as well as the vast expanse of former agricultural lands that lie between the mountains and existing urbanized areas near the coastline.

2. Potential Impacts and Mitigation Measures

The proposed project is not anticipated to have an adverse effect on scenic view corridors or open space resources, as the proposed roadway extension will be constructed at grade within existing and designated roadway rights-of-way.

I. PUBLIC SERVICES

1. Existing Conditions

a. Police and Fire Protection

The project corridor is within the Maui Police Department's service area, which services all of the Lahaina district. The Department's Lahaina Station is located in the Lahaina Civic Center complex at Wahikuli, approximately

1.0 mile north of the project corridor.

Fire prevention, suppression and protection services for the Lahaina District are provided by the Department of Fire and Public Safety's, Lahaina Fire Station, also located in the Lahaina Civic Center and the Napili Fire Station, located in Napili. The Lahaina Fire Station includes an engine and a ladder company, and is staffed by 30 full-time personnel. The Napili Fire Station consists of an engine company including 15 full-time firefighting personnel.

b. **Health Care**

The only major medical facility on the island is Maui Memorial Medical Center, located approximately 20.0 miles from Lahaina, midway between Wailuku and Kahului. The 196-bed facility provides general, acute, and emergency care services.

In addition, regular hours are offered by the Maui Medical Group, Lahaina Physicians, West Maui Healthcare Center, and Kaiser Permanente's Lahaina Clinic.

c. **Recreational Facilities**

West Maui is served by numerous recreational facilities offering diverse opportunities for the region's residents. There are nearly 20 County parks in West Maui. Approximately one-third of the County parks are situated along the shoreline and provide for excellent swimming, diving, and snorkeling, as well as fishing, surfing, picnicking, sun bathing, and other shoreline-related activities.

In addition, Kaanapali and Kapalua Resorts operate world-class golf courses which are available for public use.

Recreational facilities in the vicinity of the project site include the Lahaina Aquatic Center, the Lahaina Recreation Center and Expansion Area, Malu Ulu Olele Park, and Kamehameha Iki Park.

d. Educational Facilities

The West Maui area is served by four (4) public schools operated by the State Department of Education: Lahainaluna High School, Lahaina Intermediate School, King Kamehameha III Elementary School, and Princess Nahienaena Elementary School. The region is also served by privately operated pre-elementary and elementary schools.

e. Solid Waste Disposal

Single-family residential solid waste collection service is provided by the County of Maui on a once-a-week basis. Residential solid waste collected by County crews is disposed at the County's 55-acre 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.

A refuse transfer station located about 7.5 miles south of the project corridor at Olowalu serves West Maui residents and accommodates household refuse and green waste, as well as used oil; no commercial waste is accepted at this facility. A private waste disposal service has been contracted by the County to transport waste from this facility to the Central Maui Landfill.

2. Impacts and Mitigation Measures

The proposed project will not affect the service area limits or requirements for fire, police, and emergency medical services, nor will it impact educational, recreational, and solid waste facilities. In the long term, the proposed roadway extension will provide an alternate travel route to the schools and residences along the mauka section of Lahainaluna Road for the public, as well as for fire, police, and emergency medical services.

J. SOCIO-ECONOMIC ENVIRONMENT

1. Existing Conditions

a. Regional Setting

The majority of lands in West Maui are either State designated "Conservation" or "Agricultural". Generally, "Conservation" lands occupy the higher elevations, while the "Agricultural" district spans the foothills of the West Maui Mountains.

"Urban" designated lands occupy the lower elevations along the coast and include the communities of Kahana-Napili-Kapalua and Kaanapali. These resort communities include several hotels and visitor-oriented condominiums. Lahaina, meanwhile, is more typical of a residential community. Single-family, business, light industrial, and agricultural zones prevail in this part of West Maui.

The town of Lahaina is the commercial center for West Maui. The town contains a number of shopping centers and retail business areas, and serves as a core for the region's residential housing.

Part of West Maui's attraction can be attributed to its year-round dry and warm climate, complemented by many white-sand beaches and scenic landscape. Most of the visitor accommodations are located in Lahaina and the resort communities of Kaanapali, Honokowai, Kahana, Napili and Kapalua.

The Kapalua-West Maui Airport at Mahinahina conveniently links West Maui to Oahu and other neighbor islands.

Diversified agriculture and pineapple fields occupy much of the land in the area. Pioneer Mill cultivates their agricultural lands in the Kaanapali area with sweet corn, seed corn, and coffee. Maui Land & Pineapple Company's fields are located along the slopes of the West Maui Mountains north of Kaanapali.

b. Population

The resident population of the West Maui Community Plan region has demonstrated a substantial increase over the last three decades. In 2000, the population of the island of Maui was 117,644, with 17,967 persons (15 percent) of the island's population residing in West Maui (SMS, June 2002). Since 1970, West Maui has seen a growth in population, with the population increasing from about 5,500 persons in 1970, to approximately 10,300 persons in 1980, and to about 14,600 persons in 1990. The resident population of the West Maui region is projected to increase to 21,663 in the year 2010 (SMS, June 2002).

West Maui's annual average population growth over the last three decades has kept pace with that of Maui County. Between 1970 and 1980, Maui County grew at an average rate of 4.4 percent a year, while from 1980 to 1990, and from 1990 to 2000 it grew at an average rate of 3.5 percent and 2.8 percent a year, respectively. Compared to Maui County, West Maui had a higher average annual growth rate of 6.4 percent during the 1970's, but shared a 3.5 percent average growth rate between 1980 and 1990, and a slightly lower growth rate of 2.3 percent in the 1990's. The resident population of Maui County is projected to increase to 151,269 in the year 2010 (SMS, June 2002).

c. Economy

The economy of Maui is heavily dependent upon the visitor industry. The dependency on the visitor industry is especially evident in West Maui, which is one of the State's major resort destination areas. Major hotels in this region include the Hyatt Regency Maui (806 rooms), the Westin Maui (759 rooms), the Royal Lahaina Resort (592 rooms), the Ritz-Carlton Kapalua (548 rooms), the Sheraton Maui Resort (510 rooms) and the Kaanapali Beach Hotel (430 rooms).

West Maui's visitor orientation is reflected in the character of Lahaina Town, which serves as a center for visitor-related retail outlets and activities.

Agriculture, another vital component of the West Maui economy, is handled

by Pioneer Mill and Maui Land & Pineapple. Until the termination of sugarcane cultivation in September 1999, Pioneer Mill cultivated most of its approximately 6,700 acres of fee simple and leased lands with sugarcane. Pioneer Mill is diversifying its agricultural operations by utilizing portions of its lands for sweet corn, seed corn, and coffee cultivation.

Maui Land & Pineapple's fields remain an important component of the region's agricultural base. In 1988, Maui Land & Pineapple entered the fresh fruit market, air shipping pineapples to the mainland in an effort to diversify its operations.

As of April 2007, the unemployment rate (seasonally unadjusted) for Maui County and the island of Maui stood at 2.2 percent and 2.1 percent, respectively (State Department of Labor and Industrial Relations, May 2007).

2. Potential Impacts and Mitigation Measures

During the construction phase of project development, benefits will accrue to the local economy as a direct result of construction expenditures. These beneficial impacts include contributions made in the form of wages, salaries and sales taxes, as well as goods and services purchased from local vendors. In the long term, the proposed roadway extension will improve existing roadway system operations for Lahaina's residents, visitors, and businesses by providing an alternate travel route and facilitating traffic movement along Lahainaluna Road. The Keawe Street extension will increase the amount of traffic on the existing Keawe Street. The TAR noted that the highest projected increase during the AM peak hour of traffic would be approximately 190 vehicles, and 115 vehicles during the PM peak hour for one (1) traffic movement at the Honoapiilani Highway and Keawe Street intersection while these increases were not deemed significant, specific improvements at the Keawe Street - Honoapiilani Highway intersection are proposed to mitigate the added traffic volumes. These improvements include the reconfiguration of the existing Keawe Street and Honoapiilani Highway intersection to install a dedicated left-turn lane on the Keawe Street portion, restriping of the lanes and adjustments to the traffic signal timing to accommodate the additional vehicles.

K. INFRASTRUCTURE

1. Roadways

A Traffic Assessment Report has been prepared for the proposed project. See **Appendix "B"**.

The public roadway system within the project corridor consists of various State and County roadways.

Honoapiilani Highway (State Highway 30) is the main roadway serving the West Maui region. This arterial highway is the only link between West Maui and the rest of the island (although an unimproved segment of highway extends around the north coast of the island to Waihee, providing limited access). Within the project corridor, the highway has an 80-foot wide right-of-way and a typical two-lane configuration except for a segment from Lahaina to Honokowai where four (4) travel lanes are provided.

At the intersection with Lahainaluna Road, the northbound and southbound approaches of Honoapiilani Highway include exclusive left-turn lanes and two (2) lanes designated for through and right-turn traffic movements. Lahainaluna Road is a two-lane, two-way County of Maui roadway generally oriented in the east-west direction. Lahainaluna Road originates near the coast at Front Street and continues northeast past the intersection with Honoapiilani Highway to its terminus near Lahainaluna High School. The westbound approach of Lahainaluna Road includes an exclusive left-turn lane, a through lane, and an exclusive right-turn lane. The eastbound approach of Lahainaluna Road consists of an exclusive left-turn lane and a shared through and right-turn lane.

Approximately 3,300 feet (0.6 mile) northwest of the Honoapiilani Highway and Lahainaluna Road intersection, Honoapiilani Highway intersects with Keawe Street. At this intersection, the northbound and southbound approaches of the highway both have exclusive left-turn lanes, as well as one (1) lane for through traffic movements and one (1) shared lane, servicing through and right-turn traffic movements. Keawe Street comprises the westbound approach of this intersection and is generally a two-lane, two-way County of Maui roadway that currently serves the light industrial development in the area. At the intersection with Honoapiilani Highway, Keawe

Street includes a shared left-turn and through lane and an exclusive right-turn lane. The eastbound approach of this intersection provides the driveway to the Lahaina Cannery Mall, which has a shared left-turn and through lane and an exclusive right-turn lane.

Further north, approximately 0.2 mile from the Keawe Street intersection, Honoapiilani Highway intersects with Kapunakea Street. Kapunakea Street is generally a two-lane, two-way County of Maui roadway that originates near the coast at Front Street and continues northeast past its terminus at Nahale Place. At the intersection with Honoapiilani Highway, the westbound approach of Kapunakea Street consists of an exclusive left-turn lane and a shared through and right-turn lane, while the eastbound approach includes a shared left-turn and through lane and an exclusive right-turn lane.

The TAR reviewed existing conditions at three (3) study intersections, Honoapiilani Highway and Lahainaluna Road, Honoapiilani Highway and Keawe Street and Honoapiilani and Kapunakea Street.

Honoapiilani Highway and Lahainaluna Road: North of the intersection of Honoapiilani Highway and Lahainaluna Road, Honoapiilani Highway carries 2,305 vehicles during the AM peak hour of traffic, 1,240 vehicles traveling northbound and 1,065 vehicles traveling southbound. During the PM peak hour of traffic, the highway carries 2,364 vehicles, 1,020 vehicles traveling northbound and 1,344 vehicles traveling southbound. All of the traffic movements along Honoapiilani Highway at the intersection with Lahainaluna Road operate at Level of Service (LOS) D during both peak hours of traffic, with the exception of the northbound through and right-turn traffic movement, which operates at LOS C during the PM peak period.

East of the intersection, Lahainaluna Road carries 1,440 vehicles during the AM peak hour of traffic, 821 traveling westbound and 619 traveling eastbound. During the PM peak hour of traffic, Lahainaluna Road carries 906 vehicles, 375 traveling westbound and 531 vehicles traveling eastbound. The eastbound left-turn movement of Lahainaluna Road at the intersection of Honoapiilani Highway operates at LOS C and LOS D during the AM and PM peak hours, respectively, while the through and right-turn movement of that approach operates at LOS D during both peak hours. On the westbound approach of the intersection, all of the traffic movements operate at

LOS D during both peak hours of traffic.

Honoapiilani Highway and Keawe Street : At the intersection of Honoapiilani Highway and Keawe Street, the highway carries 2,568 vehicles during the AM peak hour of traffic, 1,263 traveling northbound and 1,305 traveling southbound. During the PM peak hour of traffic, Honoapiilani Highway carries 2,751 vehicles, 1,305 traveling northbound and 1,446 traveling southbound. All traffic movements on the southbound approach to Honoapiilani Highway at the intersection with Keawe Street operate at LOS D during both peak hours of traffic, while the northbound left-turn movement and through and right-turn movement operate at LOS D and C, respectively, during both peak periods.

East of the intersection, Keawe Street carries 148 vehicles during the AM peak hour of traffic, 52 traveling westbound and 96 traveling eastbound. During the PM peak hour of traffic, Keawe Street carries 111 vehicles, 69 traveling westbound and 42 traveling eastbound. All traffic movements on the westbound approach of Keawe Street operate at LOS C during both peak hours of traffic. On the Lahaina Cannery Mall approach to the intersection, the westbound left-turn and through movement operates at LOS C and LOS D during the AM and PM peak periods, respectively, while the right-turn movement operates at LOS D during both peak hours of traffic.

Honoapiilani Highway and Kapunakea Street : North of the intersection of Honoapiilani Highway and Kapunakea Street, Honoapiilani Highway carries 2,487 vehicles during the AM peak hour of traffic, 1,272 traveling northbound and 1, 215 traveling southbound. During the PM peak hour of traffic, Honoapiilani Highway carries 2,762 vehicles, 1,282 traveling northbound and 1,480 traveling southbound. All of the traffic movements on the southbound approach operate at LOS D during both peak hours of traffic, while the northbound left-turn movement and through and right-turn movement operate at LOS D and LOS C during both peak periods.

East of the intersection of Honoapiilani Highway and Kapunakea Street, Kapunakea Street carries 394 vehicles during the AM peak hour of traffic, 247 traveling westbound and 147 traveling eastbound. During the PM peak hour of traffic, Kapunakea Street carries 427 vehicles, 204 traveling westbound and 223 traveling eastbound. The westbound left-turn and eastbound left-turn and through movements operate at LOS D during both peak periods, while the westbound through and right-turn and eastbound right-turn movements operates at LOS C during both peak hours

of traffic.

Total Traffic Volumes Without Project: Traffic operations under year 2007 without project conditions are expected to deteriorate slightly from existing conditions within the project vicinity. At the intersection of Honoapiilani Highway and Lahainaluna Road, the westbound left-turn and right-turn movements are expected to deteriorate from LOS D to LOS E during the AM peak period, while the westbound left-turn and through movement at the intersection with Keawe Street is expected to deteriorate from LOS C to LOS D during both peak periods. The remaining movements at the study intersections are expected to operate at levels of service similar to existing conditions during both projected peak hours of traffic.

Total Traffic Volumes With Project: The year 2007 cumulative AM and PM peak hour of traffic conditions resulting from the projected ambient growth and extension of Keawe Street are summarized in **Table 1** below. The proposed roadway extension is intended to provide an alternate route between the residential areas located east of Honoapiilani Highway. As such, the proposed extension is expected to divert local trips from Honoapiilani Highway to Keawe Street rather than increase regional trips in the vicinity.

Table 1

EXISTING AND PROJECTED (WITH AND WITHOUT PROJECT) INTERSECTION LOS TRAFFIC OPERATING CONDITIONS

Intersection	Traffic Movement		AM			PM		
			Existing	Year 2007 w/out Project	Year 2007 w/ Project	Existing	Year 2007 w/out Project	Year 2007 w/ Project
Honoapiilani Highway and Lahainaluna Road	WB	LT	D	E	D	D	D	C
		TH	D	D	D	D	D	D
		RT	D	E	D	D	D	D
	EB	LT	C	C	C	D	D	D
		TH-RT	D	D	D	D	D	D
	NB	LT	D	D	D	D	D	D
		TH-RT	D	D	D	C	C	C
	SB	LT	D	D	D	D	D	D
		TH-RT	D	D	D	D	D	D
Honoapiilani Highway and Keawe Street	WB	LT	C	D	C	C	D	D
		TH			C			C
		RT	C	D	D	C	C	D
	EB	LT-TH	C	D	C	D	D	D
		RT	D	D	C	D	D	D
	NB	LT	D	D	D	D	D	D
		TH-RT	C	C	C	C	C	C
	SB	LT	D	D	D	D	D	D
		TH-RT	D	D	D	D	D	D
Honoapiilani Highway and Kapunakea Street	WB	LT	D	D	D	D	D	D
		TH-RT	C	C	C	C	C	C
	EB	LT-TH	D	D	D	D	D	D
		RT	C	C	C	C	C	C
	NB	LT	D	D	D	D	D	D
		TH-RT	D	D	D	C	C	C
	SB	LT	D	D	D	D	D	D
		TH-RT	D	D	D	D	D	D

The cumulative volumes consist of vehicle trip reassignments superimposed over year 2007 projected traffic demands. The TAR assumed that the Keawe Street approach of the intersection with Honoapiilani Highway would be modified to provide a dedicated left-turn, through, and right-turn lanes prior to the year 2007.

Traffic operations under year 2007 with project conditions at the intersection of Honoapiilani Highway and Lahainaluna Road are expected to improve slightly from year 2007 without project conditions, due to the decrease in traffic volumes at that intersection. The westbound left-turn and right-turn movements are expected to improve from LOS E to LOS D during the projected AM peak hour of traffic. The remainder of the traffic movements at that intersection are expected to continue operating at levels of service similar to year 2007 without project conditions during both peak hours of traffic.

At the intersection of Honoapiilani Highway and Keawe Street, traffic operations are expected, in general, to remain similar to Year 2007 without project conditions despite the increase in traffic volumes at that intersection due to the provision of exclusive left-turn, through, and right-turn lanes on the Keawe Street approach of the intersection. The westbound left-turn and through movements are anticipated to operate at LOS C during the AM peak period and LOS D and LOS C, respectively, during the PM peak period. The right-turn approach is expected to operate at LOS D during both peak periods. On the Lahaina Cannery Mall approach of the intersection, all of the traffic movements are anticipated to improve slightly from LOS D to LOS C due to adjustments to the traffic signal timing at that intersection to accommodate the increased traffic volumes along Keawe Street.

At the Honoapiilani Highway and Kapunakea Street intersection, all traffic operating conditions are anticipated to remain the same as year 2007 without project conditions. Although traffic volumes at the other two (2) study intersections are anticipated to change due to the proposed project, the traffic volumes at the Kapunakea Street intersection are anticipated to remain the same. Therefore, the associated levels of service for each of the traffic movements are also expected to remain unchanged.

Recommendations and Conclusions: The TAR provided the following recommendations for the proposed Keawe Street extension project:

1. Maintain adequate traffic control measures during construction to ensure motorist safety.

2. Provide adequate turning radii and sight distances at all roadway connections to ensure safe access to and from the extension.

3. Provide exclusive westbound left-turn, through and right-turn lanes on the Keawe Street approach of the intersection with Honoapiilani Highway. The dimensions of these lanes should be determined during the design phase of the project.

4. Provide exclusive southbound left-turn and right-turn lanes on the Keawe Street approach of the intersection with Ikena Street. The dimensions of these lanes should be determined during the design phase of the project.

The TAR concluded that the proposed project, which is anticipated to serve as an alternate route between the residential areas located east of Honoapiilani Highway and is expected to divert vehicles from Honoapiilani Highway, would decrease the total traffic volumes entering the intersection of Honoapiilani Highway and Lahainaluna Road. The Keawe Street extension is anticipated to decrease traffic volumes at the Honoapiilani Highway and Lahainaluna Road intersection by approximately seven percent (7%) and three percent (3%) during the AM and PM peak hours of traffic, respectively. Traffic volumes at the Honoapiilani Highway and Keawe Street intersection are anticipated to increase proportionately. With the implementation of the recommendations, traffic movements at all study intersections are expected to operate at acceptable levels of service during both peak periods.

2. Water

The West Maui region is served by the domestic water system operated by the County's Department of Water Supply. The County water system services the coastal areas from Launiupoko to Kaanapali and from Honokowai to Napili. Three (3) surface sources and eight (8) wells are used to supply the County domestic system. In addition to the County system, the West Maui region is served by private water systems, including the Hawaii Water Corporation, which services the Kaanapali

Resort, and the Kapalua Water Company, which provides water service to the Kapalua Resort.

The proposed Keawe Street extension is not anticipated to create an increased demand for water services as it is a roadway improvement project.

3. Wastewater

The County's wastewater collection and transmission system and the Lahaina Wastewater Reclamation Facility (LWRF) accommodate the region's wastewater needs. The LWRF, located along Honoapiilani Highway just north of the Kaanapali Resort, has been upgraded and expanded to a design capacity of 9.0 million gallons per day (MGD). The cumulative wastewater flow currently allocated to the facility is approximately 6.138 MGD (Wilson Okamoto, 2003). A series of force mains and gravity lines convey wastewater from Lahaina Town to the LWRF.

The proposed project is not anticipated to create an additional demand for wastewater services as it is limited to extension of the existing Keawe Street.

4. Drainage

A Preliminary Drainage Report has been prepared for the proposed project. See **Appendix "C"**.

Existing Conditions: The roadway extension alignment traverses through fallow sugarcane fields. The land is currently vegetated with short brush that covers rocky soil. The terrain has a fairly steep slope from northwest to southeast.

Stormwater runoff from the project site enters an existing concrete cutoff ditch in the north (mauka) portion of the Lahaina Business Park development, which is located at the eastern terminus of the existing Keawe Street. The cutoff ditch flows from east to west into an underground storm drain system that runs through the Lahaina Business Park and outlets into the Kahoma Stream. This "offsite drainage system" was constructed as part of the Lahaina Business Park improvements. The Lahaina Business Park also has a separate storm drainage system that intercepts and conveys storm runoff from within the business park to Kahoma Stream. This internal storm drainage system is referred to as the "onsite drainage system." The two (2) existing

drainage systems both discharge into the Kahoma Stream at a common outlet structure, however, they are not interconnected prior to the outlet.

Proposed Improvements: The proposed drainage improvements for the Keawe Street extension project includes a new concrete cutoff ditch along a portion of the western bank of the roadway; grass swales, inlets and an underground drainage system within the roadway and a detention basin along the existing concrete cutoff ditch. The new drainage system will connect to the existing "offsite drainage system" that was installed by the Lahaina Business Park.

The Keawe Street extension project's drainage improvements will include storm drain inlets and underground storm drain piping. The inlets will be placed approximately 250 feet apart in the grass swale portion of the typical excavated roadway section. The inlets will be connected with underground drain pipes that will connect the new drainage system to an existing catch basin on Keawe Street. An 860-foot long concrete cutoff ditch along a portion of the western end of the roadway is proposed along the embanked section of the road extension. The new cutoff ditch will collect runoff and will help prevent erosion along the toe of the embankment which is anticipated to be severe due to the steep longitudinal slope of the existing ground (approximately 15 percent). Flows from the new concrete ditch will be diverted to the new drainage system at the end of the embankment slope. The existing concrete cutoff ditch will be intersected by the proposed roadway. The upper (eastern) portion of the ditch will be intercepted by the new roadway drainage system. The lower (western) portion of the ditch, after the roadway, will remain in its existing condition and flow into the existing "offsite drainage system."

Increases in the peak flow runoff rate 12.9 cubic feet per second (cfs) due to the project are proposed to be stored and discharged at a slower rate by installing a detention basin. The basin is proposed to be located along the upper portion of the existing concrete cutoff ditch. In accordance with the County's storm drainage standards, the basin is designed to accommodate a 50-year interval storm. The allowable discharge into the drainage system based on downstream capacity and existing peak flow rate is 24.45 cfs. Based on the anticipated increase of peak flow runoff by the project, the detention basin will be designed to be 6,000 square feet in size, at 5 feet deep and with a 21-inch outflow pipe. Alternatives to the detention basin to meet the needs of the project include improving the capacity of the downstream drainage system or over sizing and creating storage within the new and

existing drainage systems, however, the detention basin concept was determined to be the most desirable based on physical features, public safety concerns and cost and maintenance issues.

Site work for the project will involve excavation and embankment for the construction of the roadway prism and the drainage system improvements. Erosion control measures and Best Management Practices (BMPs) will be implemented during the construction period to minimize soil loss and erosion. A detailed grading and erosion control plan will be prepared in accordance with County standards. In addition, a National Pollutant Discharge Elimination System (NPDES) Permit will be obtained as necessary from the State Department of Health.

5. Electrical, Telephone and Cable Television Systems

Electrical and telephone service to the West Maui region is provided by Maui Electric Company (MECO) and Hawaiian Telcom, respectively. Cable television (CATV) service is provided by Hawaiian Cablevision.

The proposed Keawe Street extension project is not anticipated to cause an increase in demand for electrical, telephone or cable television services, as it is limited to extension of the roadway.

L. CUMULATIVE AND SECONDARY IMPACTS

The proposed project is not expected to affect population parameters or result in an increased demand for public services and facilities, nor is it anticipated to create new demands for housing or infrastructure. It is noted that should the extension of Keawe Street proceed, there will be more traffic generated on the existing portion of the street which currently runs through the Lahaina light industrial subdivision. The connection to the Lahaina Bypass will likely increase the marketability of land in the light industrial area, and may encourage development of existing vacant light industrial lots, however, the full potential of the Lahaina Bypass connection may not be realized until the full Lahaina Bypass is completed.

Additionally, as a result of the increased traffic through the area, noise may increase and air quality may decrease due to vehicle exhaust. It is noted however, that the nearest existing residence or business is located approximately 500 feet away from the proposed Keawe Street extension. At the same time, traffic volumes along the Lahainaluna Road residential

corridor will decrease, thereby, reducing vehicle congestion and related impact conditions along this roadway. During the short term, the project will benefit the local economy, either directly and/or indirectly, through the payment of wages, salaries, benefits, and taxes for employees involved in construction and construction-related jobs, as well as support businesses and services. In the long term, the proposed improvements will benefit the public by enhancing roadway system operations and efficiency in the area.

IV. RELATIONSHIP TO LAND USE PLANS, POLICIES AND CONTROLS

IV. RELATIONSHIP TO LAND USE PLANS, POLICIES AND CONTROLS

A. STATE LAND USE DISTRICTS

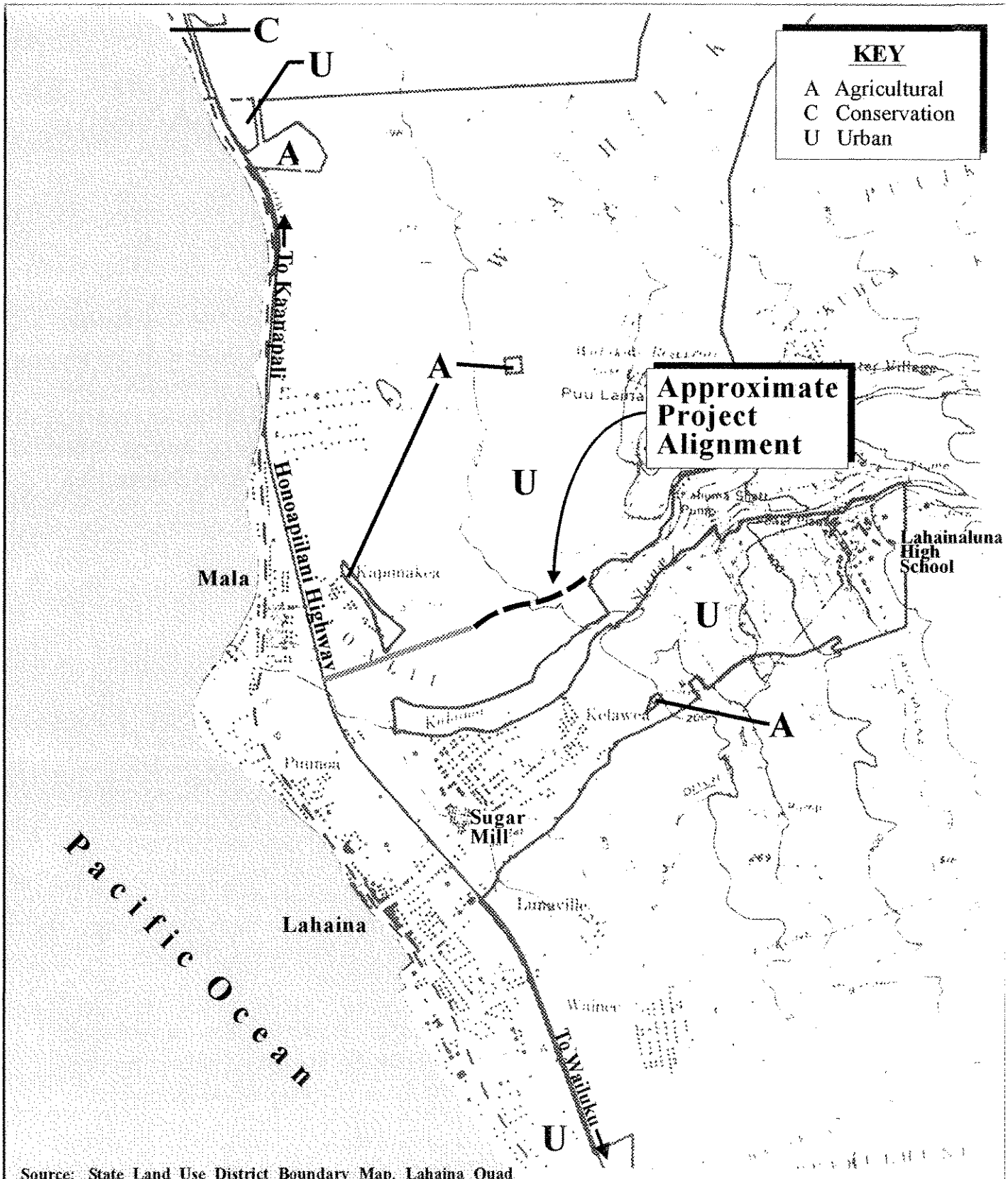
Chapter 205, Hawaii Revised Statutes (HRS), relating to the Land Use Commission, establishes the four (4) major land use districts in which all lands in the State are placed. These districts are designated "Urban", "Rural", "Agriculture" and "Conservation". The proposed roadway extension will be developed within existing and designated roadway rights-of-way and is permitted within the Urban, Agricultural and Rural Districts. The proposed action will involve lands within the State Urban and Agricultural Districts. See **Figure 7**.

B. MAUI COUNTY GENERAL PLAN

The purpose of the General Plan shall be to:

> *... indicate desired population and physical development patterns for each island 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.*

The Maui County General Plan developed five (5) major themes that focus on the overall goals of the plan. These themes were devised to reflect the "big picture" outlook the Maui County General Plan proscribes to. Of the five (5) themes, the proposed project responds to the following:



Source: State Land Use District Boundary Map, Lahaina Quad

Figure 7 Proposed Keawe Street Extension

State Land Use District Classifications

0 1000 Feet
500 2000

Prepared for: County of Maui, Dept. of Public Works and Environmental Management

MUNEKIYO & HIRAGA, INC.

* * *

Theme Number 2

Prepare a directed and managed growth plan

Amendments to the General Plan will preserve a desired quality of life where areas of urban settlement must be managed and directed within a framework that consistently and concurrently balances growth demands against human service needs and physical infrastructure supply.

* * *

The proposed action is in keeping with the following General Plan objectives relating to transportation.

TRANSPORTATION

Objective:

To develop a program for anticipating and enlarging the local street and highway systems in a timely response for planned growth.

Policy:

- Ensure that transportation facilities are anticipated and programmed for construction in order to support planned growth.

C. WEST MAUI COMMUNITY PLAN

Within the County of Maui, there are nine (9) community plan regions. From a General Plan implementation standpoint, each region is governed by a community plan which sets forth desired land use patterns, as well as goals, objectives, policies and implementing actions for a number of functional areas including infrastructure-related parameters. The nine (9) regions are: Molokai, Lanai, West Maui, Wailuku-Kahului, Kihei-Makena, Makawao-Pukalani-Kula, Paia-Haiku, Hana and Kahoolawe. The project corridor traverses a portion of the West Maui Community Plan region. See **Figure 8**.

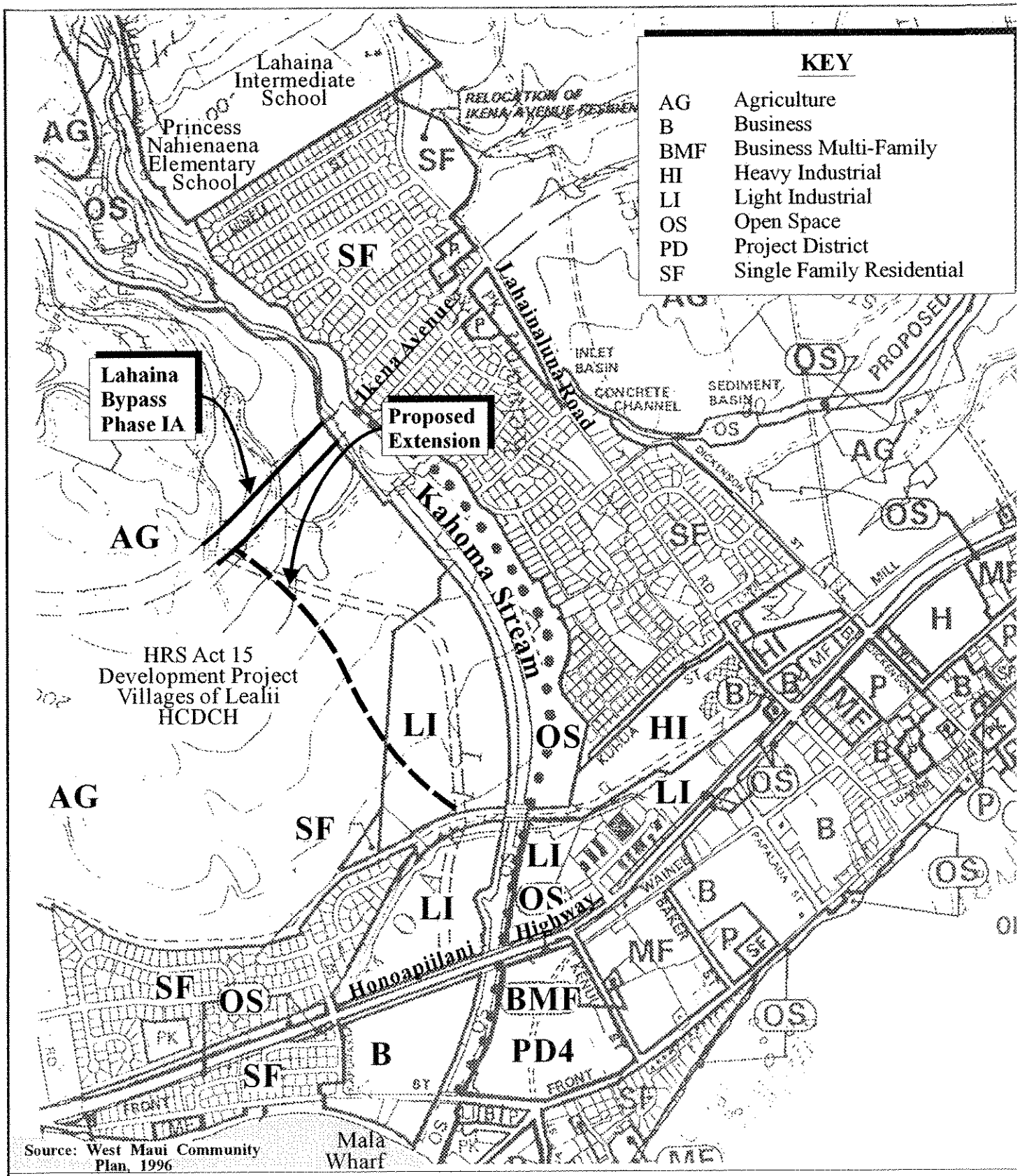


Figure 8 Proposed Keawe Street Extension

West Maui Community Plan Land Use Designations

Prepared for: County of Maui, Dept. of Public Works and Environmental Management

MUNEKIYO & HIRAGA, INC.

From a community plan land use standpoint, the proposed roadway extension is permitted. More importantly, support for the project can be found in the West Maui Community Plan.

The proposed action is consistent with the following West Maui Community Plan goal, objective and policy regarding infrastructure.

Goal:

Timely and environmentally sound planning, development, and maintenance of infrastructure systems which serve to protect and preserve the safety and health of the region's residents, commuters, and visitors through the provision of clean water, effective waste disposal, and efficient transportation systems which meet the needs of the community.

Objective and Policy:

Support construction of the proposed Lahaina Bypass Road in such a way as to promote safe, efficient travel across the region without encouraging further urbanization or impeding agricultural operations.

D. COUNTY ZONING

Permitted uses and performance standards are set forth by Title 19 of the Maui County Code relating to zoning. Roadway systems such as the proposed roadway extension are considered an incidental use which is permitted in each of the County zoning districts. Inasmuch as the proposed alignment falls within existing and designated State and County rights-of-way, there are no specific zoning standards or requirements which would require discretionary review from the Maui Planning Commission or the Maui County Council.

E. COASTAL ZONE MANAGEMENT OBJECTIVES AND POLICIES

The Hawaii Coastal Zone Management Program (HCZMP), as formalized in Chapter 205A, HRS, establishes objectives and policies for the preservation, protection, and restoration of natural resources within Hawaii's coastal zone.

As previously noted, the area around the project's western terminus lies within the limits of the Special Management Area (SMA) for the island of Maui. As the mauka border of the SMA in this area is not precisely defined, consultation with the Maui County Planning Department has been undertaken to identify its exact extent. A Special Management Area Assessment application was prepared and filed with the Department of Planning for the

construction of a left-hand turn lane at the existing intersection of Keawe Street with Honoapiilani Highway. The Planning Department responded that no SMA application was needed as the proposed intersection improvements were considered, *"Repair or Maintenance of roads and highways within existing right-of-ways..."* and thus, not considered a "Development" under the SMA rules. See Appendix "D".

As set forth by Chapter 205A, HRS, this section addresses the project's relationship to applicable coastal zone management considerations.

(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 roadway extension will be placed within existing and designated rights-of-way. The construction and long-term operation of this roadway is not anticipated to affect existing coastal or inland recreational resources.

(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: As previously noted, an archaeological assessment report was completed for the project. The subsurface testing for the project area yielded negative results for historic properties. The study recommended that if minor grubbing and grading (less than 2.0 feet) was done for the project, no archaeological monitoring would be warranted during construction. However, the study advised that monitoring be done for deeper excavations, such as for the drainage basin.

As previously noted, the State Historic Preservation Division (SHPD) approved the

archaeological inventory survey and noted that "no historic properties would be affected" by the proposed project. However, SHPD's comment letter stated, *"...in the event that historic sites including human skeletal remains, are identified during routine construction activities, all work needs to cease in the immediate vicinity of the find, the find needs to be protected from additional disturbance and the State Historic Preservation Division, Maui Section needs to be contacted immediately..."* The applicant will conform with this request by the SHPD. Refer to Section IX of this report for the SHPD comment letter.

(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 action involves the extension of a roadway within existing and designated roadway rights-of-way. In the context of adjacent surrounding uses, the proposed action is not anticipated to impact coastal scenic and open space resources nor will it adversely affect public views to and along the shoreline.

(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 subject action is not expected to adversely impact coastal ecosystems. Site work and construction activities will utilize appropriate Best Management Practices and mitigative measures to ensure that coastal ecosystems are not degraded during development.

(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 have a beneficial short-term impact on the economy during construction by providing construction-related employment. In the long term, the completed project will enhance the existing Lahaina roadway system by providing an alternative reliever route for Lahainaluna Road destinations. The proposed action is not in conflict with objectives and policies for economic uses.

(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 falls within Zone C, areas of minimal flooding. Appropriate erosion control measures will be incorporated during the construction period to minimize soil loss and erosion. As necessary, temporary drainage improvements will be utilized during construction activities. Interim and long-term drainage improvements will be coordinated with applicable regulatory agencies and land owners. These improvements will be designed to County standards to ensure that there are no adverse drainage impacts to adjoining and downstream properties. The proposed roadway extension will also facilitate evacuations during tsunamis.

(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: In compliance with requirements of Chapter 343, Hawaii Revised Statutes, this Environmental Assessment has been prepared to facilitate public understanding and input for the project.

Applicable State and County requirements will be adhered to in the design and construction of the proposed roadway extension.

(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 previously noted, public awareness of the project is being promoted through the Environmental Assessment process. The proposed project is not contrary to the objective of public awareness, education, and participation. A community meeting for the project was held on January 25, 2006.

(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 subject action will be implemented within existing and designated roadway rights-of-way. Consequently, the project is not anticipated to adversely impact beach resources.

(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 proposed project is not anticipated to adversely affect marine and coastal resources.

V. ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED AND IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

V. ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED AND IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

During the short term, the proposed project will result in unavoidable construction-related impacts which include noise-generated impacts occurring from the construction of the proposed roadway extension. In addition, there may be temporary air quality impacts associated with dust generated from site work and exhaust emissions discharged by construction equipment.

The proposed project is not anticipated to create any significant, long-term adverse environmental effects.

The proposed action will not result in the irreversible and irretrievable commitment of natural and man-made resources as existing and designated rights-of-way are proposed to be used for the proposed roadway extension. The lands underlying these rights-of-way have been utilized and committed for roadway purposes. No adverse impacts are anticipated as a result of this commitment.

VI. ANTICIPATED DETERMINATION AND FINDINGS AND REASONS SUPPORTING THE DETERMINATION

VI. ANTICIPATED DETERMINATION AND FINDINGS AND REASONS SUPPORTING THE DETERMINATION

Various alternative roadway alignments including an extension of Dickenson Street, an extension of Kuhua Street in the area above the sugar mill, and the construction of a one lane, contra-flow roadway along the southern part of Kahoma Stream were examined to ensure that all feasible options were not overlooked. The identification of an appropriate alignment involved an analysis of Federal funding and project cost considerations, construction efficiency, operational objectives, and maintenance accessibility, design integration with existing and planned roadway facilities, as well as linear and spatial relationships and adjacencies. Although there may be other alignments and methodologies which could be examined, the proposed alternative best addresses the project's development and operational criteria.

The "Significance Criteria", Section 12 of the Administrative Rules, Title 11, Chapter 200, "Environmental Impact Statement Rules", were reviewed and analyzed to determine whether the proposed project will have significant impacts to the environment. The following criteria and preliminary analysis are provided.

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

   The proposed action is not anticipated to adversely impact known habitats of rare, threatened or endangered species of flora, fauna or avifauna that are located along the project's alignment.

   The proposed action will utilize existing and designated roadway rights-of-way. As previously noted, an archaeological assessment report was completed for the project. The results of the subsurface testing yielded negative results for the area. The SHPD accepted the report and noted that the *"development of the project areas will have 'no effect' on significant historic sites"*.

   The proposed project will not affect cultural resources, practices and beliefs, including access and gathering rights.

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

The proposed action is not expected to curtail the range of beneficial uses of the environment. The proposed roadway extension will be a vital component of the roadway system infrastructure. No adverse physical environmental impacts associated with the proposed action are anticipated. Accordingly, the beneficial range of uses of the environment would not be curtailed.

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's Environmental Policy and Guidelines are set forth in Chapter 344, Hawaii Revised Statutes (HRS). The proposed action is in consonance with the policies and guidelines of Chapter 344, HRS.

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

The proposed action will have a direct beneficial effect on the local economy during the construction phase. In the long term, the proposed action will improve roadway system operations in the Lahaina area for residents, visitors, and businesses.

5. **Substantially affects public health.**

The proposed roadway extension will improve traffic circulation in the Lahaina area. No adverse impacts to the public's health and welfare are anticipated as a result of the proposed project.

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

No population changes are anticipated as a result of the proposed action.

In addition, the proposed action is not anticipated to adversely impact existing water, drainage, wastewater, and transportation systems. The design and implementation of the project will be coordinated with the appropriate governmental agencies. The proposed action is not expected to significantly impact public services such as fire, police, and emergency medical services, nor is it anticipated to adversely affect

educational, recreational, and solid waste facilities and services.

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

During its construction phase, there will be short-term air quality and noise impacts as a result of the project. In the long term, there will be no effects upon air quality and ambient noise levels. The proposed project is not anticipated to affect scenic and open space resources along its alignment.

No substantial degradation of environmental quality resulting from the project is anticipated.

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

The roadway system which will ultimately be developed in connection with the Lahaina Bypass Highway includes several connector roads, including a Keawe Street Connector. The Final Supplemental Environmental Impact Statement for the Lahaina Bypass Highway was accepted by the Governor of the State of Hawaii. Engineering design for Phase IA of the Lahaina Bypass Highway began in 2007, with construction to immediately follow.

In light of existing traffic conditions, the applicant is proposing to extend Keawe Street in order to improve traffic circulation in Lahaina by facilitating access to the schools and residences along the mauka section of Lahainaluna Road, as well as provide an alternate travel route for emergencies. With the development of the Lahaina Bypass Highway, the east-west segment of the Keawe Street Extension would function as a connector road linking the Lahaina Bypass Highway with Honoapiilani Highway.

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 all work will be conducted within existing and designated roadway rights-of-way.

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, will be implemented, as necessary, to minimize wind-blown emissions. Noise impacts will occur primarily from construction-related activities. Construction activities will be limited to daylight working hours. Water quality is not expected to be affected.

In the long term, the project is not anticipated to have a significant impact on air, noise, and water quality.

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 lands underlying the project alignment are situated beyond the limits of flooding and tsunami inundation. The soils underlying the project's alignment are not especially erosion-prone. There are no known geologically hazardous lands, estuaries, or coastal waters within or adjacent to the project's alignment.

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

The proposed action will not affect scenic corridors nor will it adversely impact scenic coastal and open space resources as the proposed roadway extension will be installed within existing and designated rights-of-way.

13. **Requires substantial energy consumption.**

The proposed project will involve the short-term commitment of fuel for equipment, vehicles, and machinery during construction activities. However, this use is not anticipated to result in a substantial consumption of energy resources.

Based on the foregoing findings, it is anticipated that the proposed action will not result in any significant adverse impacts.

VII. LIST OF PERMITS AND APPROVALS

VII. LIST OF PERMITS AND APPROVALS

The following permits and approvals will be required prior to the implementation of the project.

State of Hawai`i

1. Community Noise Permit
2. Work-to-Perform in the State Highway Right-of-Way
3. NPDES Permit (to be determined in coordination with the State Department of Health)

County of Maui

1. Work-to-Perform on County Highways
2. Grading/Grubbing Permit

VIII. AGENCIES AND ORGANIZATIONS CONSULTED DURING THE PREPARATION OF THE DRAFT ENVIRONMENTAL ASSESSMENT; LETTERS RECEIVED AND RESPONSES TO SUBSTANTIVE COMMENTS

VIII. AGENCIES AND ORGANIZATIONS CONSULTED DURING THE PREPARATION OF THE DRAFT ENVIRONMENTAL ASSESSMENT; LETTERS RECEIVED AND RESPONSES TO SUBSTANTIVE COMMENTS

The following agencies and organizations were consulted during the preparation of the Draft Environmental Assessment. Agency comments and responses to substantive comments are also included in this section.

1. Ranae Ganske-Cerizo, Acting District Conservationist
Natural Resources Conservation Service
U.S. Department of Agriculture
210 Imi Kala Street, Suite 209
Wailuku, Hawaii 96793-2100

2. George Young
Chief, Regulatory Branch
U. S. Department of the Army
U. S. Army Engineer District, Honolulu
Building 230
Fort Shafter, Hawaii 96858-5440

3. Robert P. Smith
Pacific Islands Manager
U. S. Fish and Wildlife Service
300 Ala Moana Blvd.,
Room 3-122, Box 50088
Honolulu, Hawaii 96813

4. Kai Nani Kraut
Federal Highways Administration
300 Ala Moana Blvd., Room 3202
Honolulu, Hawaii 96850

5. Mary Lou Kobayashi,
Planning Program Administrator
State of Hawaii
Office of Planning
P. O. Box 2359
Honolulu, Hawaii 96804

6. Patricia Hamamoto, Superintendent
State of Hawaii
Department of Education
P. O. Box 2360
Honolulu, Hawaii 96804

7. Denis Lau, Chief
Clean Water Branch
State of Hawaii
Department of Health
919 Ala Moana Blvd., Room 300
Honolulu, Hawaii 96814

8. Herbert Matsubayashi
District Environmental Health Program Chief
State of Hawaii
Department of Health
54 High Street
Wailuku, Hawaii 96793

9. Peter Young
State of Hawaii
Department of Land and Natural Resources
P. O. Box 621
Honolulu, Hawaii 96809

10. Melanie Chinen, Administrator
State of Hawaii
Department of Land and Natural Resources
State Historic Preservation Division
601 Kamokila Blvd., Room 555
Kapolei, Hawaii 96707

11. Rodney Haraga, Director
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813
cc: Ferdinand Cajigal

12. Clyde Namu`o, Administrator
Office of Hawaiian Affairs
711 Kapiolani Boulevard, Suite 500
Honolulu, Hawaii 96813

13. Micah Kane, Chairman
Department of Hawaiian Home Lands
P. O. Box 1879
Honolulu, Hawaii 96805

14. Stephanie Aveiro, Executive Director
Housing and Community Development Corporation of Hawaii
677 Queen Street, Suite 300
Honolulu, Hawaii 96813

15. Carl Kaupalolo, Chief
County of Maui
Department of Fire and Public Safety
200 Dairy Road
Kahului, Hawaii 96732

16. Alice Lee, Director
County of Maui
Department of Housing and Human Concerns
200 South High Street
Wailuku, Hawaii 96793

17. Michael W. Foley, Director
County of Maui
Department of Planning
250 South High Street
Wailuku, Hawaii 96793

18. Glenn Correa, Director
County of Maui
Department of Parks and Recreation
700 Hali`a Nakoa Street, Unit 2
Wailuku, Hawaii 96793

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

20. George Tengan, Director
County of Maui
Department of Water Supply
200 South High Street
Wailuku, Hawaii 96793

21. **Maui Electric Company, Ltd.**
P.O. Box 398
Kahului, Hawaii 96732

22. **Hawaiian Telcom**
60 Church Street
Wailuku, Hawaii 96793

23. **Hawaiian Cablevision**
910 Honoapiilani Highway, Suite 6
Lahaina, Hawaii 96761

24. Joseph Pluta
West Maui Taxpayers Association
P. O. Box 10338
Lahaina, Hawaii 96761

25. George Freeland
Lahaina Restoration Foundation
120 Dickenson Street
Lahaina, Hawaii 96761

26. Theo Morrison
Lahaina Town Action Committee
648 Wharf Street, Suite 102
Lahaina, Hawaii 96761

27. Akoni Akana
Friends of Moku`ula
505 Front Street, Suite 234
Lahaina, Hawaii 96761

28. Ed Lindsey
Maui Cultural Lands
c/o 1087-A Pookela Road
Makawao, Hawaii 96768

29. Patty Nishiyama
Na Kupuna O Maui
320 Kaeo Place
Lahaina, Hawaii 96761

30. **Betsill Brothers Construction, Inc.**
635 Kenolio Road
Kihei, Hawaii 96753

31. Jack Kean
Lahaina Business Park
P. O. Box 1449
Kihei, Hawaii 96753

32. Peter McKenney
West Maui Heritage Foundation
P. O. Box 519
Lahaina, Hawaii 96761

33. Lani Correa, Executive Director
Maui Hotel Association
1727 Wili Pa Loop
Wailuku, Hawaii 96793

34. Steve Lovelette
Kaanapali Development Corp.
10 Hoohui Road, Suite 305
Lahaina, Hawaii 96761

35. Senator Rosalyn Baker
Hawaii State Capitol, Room 220
415 South Beretania Street
Honolulu, Hawaii 96813

36. Representative Kam Tanaka
Hawaii State Capitol, Room 319
415 South Beretania Street
Honolulu, Hawaii 96813

37. Councilmember JoAnne Johnson
Maui County Council
200 South High Street
Wailuku, Hawaii 96793

38. May Fujiwara
Lahaina-Honolua Senior Citizens Club
P. O. Box 1086
Lahaina, Hawaii 96761

39. Stacie Thorlakson, President
Maui Chamber of Commerce
250 Alamaha Street, Suite N16A
Kahului, Hawaii 96732

DEC 27 2004

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

REPLY TO
ATTENTION OF

December 22, 2004

Regulatory Branch

Ms. Karlynn Kawahara
Project Manager
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, HI 96793

Dear Ms. Kawahara:

This responds to your request for written comments for a draft Environmental Assessment (dEA) which will address activities and impacts of the proposed 2,500 lineal feet extension of Keawe Street located on portions of a parcel identified as TMK: (2) 4-5-21: 3 and 22, Lahaina, Maui.

The dEA should indicate whether waters of the United States, as typically represented by perennial or intermittent streams and wetlands, are in, or adjacent to, or absent from, the proposed project area. The dEA should state in appropriate sections whether there is the potential for waters of the U.S. to be impacted by construction of project structures and associated ground disturbing activities. Upon our receipt of the dEA, we will provide a determination whether a Department of Army (DA) permit for Section 404 activities of the Clean Water Act may, or may not be, required for the proposed Keawe Street Extension project.

Thank you for your consideration of potential impacts to the aquatic environment of the Lahaina watershed. Please contact Mr. Farley Watanabe of my staff at 438-7701, or facsimile 438-4060, if you have any questions or need additional information. Please refer to File Number **POH-2004-1142** in any future correspondence with us.

Sincerely,

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

MUNEKIYO & HIRAGA, INC.

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

February 1, 2005

Mr. George P. Young, P.E.
Chief, Regulatory Branch
Department of the Army
U. S. Army Engineer District, Honolulu
Building 230
Fort Shafter, Hawaii 96858-5440

SUBJECT: Early Consultation Request for County of Maui's Proposed Keawe Street Extension, Lahaina, Maui, Hawaii - File No. POH-2004-1142

Dear Mr. Young:

We are in receipt of your letter dated December 22, 2004, with your comments on the subject project. On behalf of our client, County of Maui, Department of Public Works and Environmental Management, we would like to offer the following response.

The Draft Environmental Assessment (DEA)for the project will include a description of the surrounding area and note whether or not there are streams of any nature or wetlands in the project area. Further, we will provide review within the DEA as to whether or not there is a potential for waters of the U.S. to be affected by the construction of the project. We look forward to working with you on this project in the future.

Should you have any further questions, please feel free to call me at (808) 244-2015.

Very truly yours,

Karlynn Kawahara, Planner

KK:yp
cc: Milton Arakawa and Joe Krueger, Department of Public Works and Environmental Management
Scott Kunioka, Shimabukuro, Endo & Yoshizaki, Inc.
sey/keawest/army.res

DEC 27 2004

LINDA LINGLE
GOVERNOR
STATE OF HAWAII

MICAH A. KANE
CHAIRMAN
HAWAIIAN HOMES COMMISSION

BEN HENDERSON
DEPUTY TO THE CHAIRMAN

KAULANA H. PARK
EXECUTIVE ASSISTANT

STATE OF HAWAII

DEPARTMENT OF HAWAIIAN HOME LANDS

P.O. BOX 1879

HONOLULU, HAWAII 96805

December 22, 2004

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

Dear Ms. Kawahara:

Thank you for the opportunity to review the early consultation summary on the proposed Keawe Street extension project in Lahaina, Maui, in preparation of a draft environmental assessment report. The Department of Hawaiian Home Lands has no comments to offer.

Should you have any questions, please call the Planning Office at (808) 586-3836.

Aloha and mahalo,

for Micah A. Kane, Chairman
Hawaiian Homes Commission

DEC 28 2004

LINDA LINGLE
VERNOR 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

12055PKP.04

December 22, 2004

Ms. Karlynn Kawahara
Planner
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Ms. Kawahara:

Subject: Early Consultation Request for Preparation of a Draft Environmental Assessment, Keawe Street Extension - Lahaina, Maui, Hawaii

The Department of Health (DOH), Clean Water Branch (CWB), has reviewed the subject document and offers the following comments:

1. The Army Corps of Engineers should be contacted at (808) 438-9258 to identify whether a Federal license or permit (including a Department of Army permit) is required for this project. Pursuant to Section 401(a)(1) of the Federal Water Pollution Control Act (commonly known as the "Clean Water Act"), a Section 401 Water Quality Certification is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters..."

2. A National Pollutant Discharge Elimination System (NPDES) general permit coverage is required for the following activities:

   a. Storm water associated with industrial activities, as defined in Title 40, Code of Federal Regulations, Sections 122.26(b)(14)(i) through 122.26(b)(14)(ix) and 122.26(b)(14)(xi).

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

   c. Discharges of treated effluent from leaking underground storage tank remedial activities.

   d. Discharges of once through cooling water less than one (1) million gallons per day.

e. Discharges of hydrotesting water.

f. Discharges of construction dewatering effluent.

g. Discharges of treated effluent from petroleum bulk stations and terminals.

h. Discharges of treated effluent from well drilling activities.

i. Discharges of treated effluent from recycled water distribution systems.

j. Discharges of storm water from a small municipal separate storm sewer system.

k. Discharges of circulation water from decorative ponds or tanks.

The CWB requires that a Notice of Intent (NOI) to be covered by an NPDES general permit for any of the above activities be submitted at least 30 days before the commencement of the respective 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/index.html

3. The applicant may be required to apply for an individual NPDES permit if there is any type of activity in which wastewater is discharged from the project into State waters and/or coverage of the discharge(s) under the NPDES general permit(s) is not permissible (i.e. NPDES general permits do not cover discharges into Class 1 or Class AA State waters). An application for the NPDES permit is to be submitted at least 180 days before the commencement of the respective activities. The NPDES application forms may also be picked up at our office or downloaded from our website at:
http://www.hawaii.gov/health/environmental/water/cleanwater/index.html

4. Hawaii Administrative Rules, Section 11-55-38, also requires the applicant to either submit a copy of the new NOI or NPDES permit application to the State Department of Land and Natural Resources, State Historic Preservation Division (SHPD), or demonstrate to the satisfaction of the DOH that the project, activity, or site covered by the NOI or application has been or is being reviewed by SHPD.

If you have any questions, please contact Ms. Kris Poentis of the Engineering Section, CWB, at (808) 586-4309.

Sincerely,

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

KP:bt

MUNEKIYO & HIRAGA, INC.

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

February 1, 2005

Mr. Denis Lau, P.E., Chief
Clean Water Branch
Department of Health
P. O. Box 3378
Honolulu, Hawaii 96801-3378

SUBJECT: Early Consultation Request for County of Maui's Proposed Keawe Street Extension, Lahaina, Maui, Hawaii

Dear Mr. Lau:

Thank you for your letter dated December 22, 2004, providing us with your comments on the subject project. Our client, the County of Maui, Department of Public Works and Environmental Management (DPWEM), has been in contact with the Army Corps of Engineers for early consultation on the project.

Secondly, DPWEM will work with the contractor, once selected, to insure that all applicable permits are in place before the commencement of any construction activities.

Third, an early consultation request was submitted to the Department of Land and Natural Resources, State Historic Preservation Division and we are awaiting their early consultation response on the project.

Should you have any questions, please feel free to contact me at (808) 244-2015.

Very truly yours,

Karlynn Kawahara, Planner

KK:yp
cc: Milton Arakawa and Joe Krueger, Department of Public Works and Environmental Management
Scott Kunioka, Shimabukuro, Endo & Yoshizaki, Inc.
sey/keawest/cwbdoh.res

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

DEC 30 2004

HOUSE OF REPRESENTATIVES

STATE OF HAWAII
STATE CAPITOL
HONOLULU, HAWAII 96813

December 27, 2004

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

Dear Ms. Kawahara:

I hope this letter finds you in high spirits. Thank you for your letter regarding preparation of a Draft Environmental Assessment-Keawe Street Extension-Lahaina, Maui, Hawaii.
In view of the proposal project to construct a roadway extension and related improvements to Keawe Street in Lahaina, I believe that DPWEM is on the right track.

The Lahaina By Pass will meet the Keawe extension and give a tremendous fixture to the traffic woes that has been encountered for many years at Lahainaluna Road going to the three schools of the Department of Education and to our communities.

Looking at the proposed Figure 1 and 2 project site maps, the project looks very good for the future betterment of controlling traffic in our communities. I say that we waited 27 years for this and it is a terrific project for the people of West Maui. I hope the Flood Control is supportive of this project.

Mahalo,

Kam Tanaka

Kam Tanaka
State Representative
District 10

Representative Kameo Tanaka
State Capitol, Room 319 ♦ Honolulu, HI 96813
Phone: (808) 586-6160 ♦ Fax: (808) 586-6161 ♦ E-mail: reptanaka@capitol.hawaii.gov

DEC 30 2004

LINDA LINGLE
VERNOR 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

December 29, 2004

Ms. Karlynn Kawahara
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawai`i 96793

Dear Ms. Kawahara:

Subject: **Keawe Street Extension**
TMK: (2) 4-5-21:003 & 022 por.

Thank you for the opportunity to participate in the early consultation process for the environmental assessment. The following comments are offered:

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.

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

Sincerely,

Herbert S. Matsubayashi
District Environmental Health Program Chief

MUNEKIYO & HIRAGA, INC.

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

February 1, 2005

Mr. Herbert Matsubayashi
District Environmental Health Program Chief
Maui District Health Office
54 High Street
Wailuku, Hawaii 96793

SUBJECT: Early Consultation Request for County of Maui's Proposed Keawe Street Extension, Lahaina, Maui, Hawaii

Dear Mr. Matsubayashi:

Thank you for your letter dated December 29, 2004, providing us with your comments on the proposed project.

Our client, County of Maui, Department of Public Works and Environmental Management, will work with the contractor to insure that all permits, including a noise permit, are approved prior to the start of construction.

Should you have any questions, please feel free to contact me at 244-2015.

Very truly yours,

Karlynn Kawahara, Planner

KK:yp
cc: Milton Arakawa and Joe Krueger, Department of Public Works and Environmental Management
Scott Kunioka, Shimabukuro, Endo & Yoshizaki, Inc.
sey/keawest/mauidoh.res

JAN 0 5 2005

[redacted]
LINDA LINGLE
GOVERNOR

PATRICIA HAMAMOTO
SUPERINTENDENT

STATE OF HAWAI'I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI'I 96804

OFFICE OF THE SUPERINTENDENT

December 30, 2004

Ms. Karlynn Kawahara, Planner
Munekiyo & Hiraga Inc.
305 High Street, Suite 104
Wailuku, Hawai`i 96793

Dear Ms. Kawahara:

Subject: Early Consultation on the Extension of Keawe Street, Lahaina, Maui

The Department of Education (DOE) is responding to your request for early consultation comments on the proposed extension of Keawe Street from the Lahaina Business Park to the site of the future Lahaina Bypass Highway.

The DOE requests that the Draft Environmental Assessment (DEA) being prepared for the street extension include a thorough discussion about the amount of pedestrian and bicycle traffic anticipated on the Keawe Street extension and the segment of the Bypass Highway between Keawe and Lahainaluna Road. If the street extension is being proposed to reduce traffic congestion caused by the three schools at the mauka end of Lahainaluna Road, it could be beneficial to determine how traffic could be improved by making safe routes for students to walk and bike to school. If student use of the street extension is planned, then the DOE would recommend sidewalks.

The DOE also requests that the DEA include assurances that the principals of all three schools off Lahainaluna Road be kept fully informed in advance of inconveniences such as blasting, earth moving, street closures and other traffic detours, and interruption of utility services.

If you should have any questions, please call Rae M. Loui, Assistant Superintendent of the Office of Business Services, at 586-3444 or Heidi Meeker of the Facilities and Support Services Branch at 733-4862.

Very truly yours,

Patricia Hamamoto
Superintendent

PH:hy

c: Rae M. Loui, OBS
Ron Okamura, CAS, Hana/Lahainaluna/Lanai/Molokai Complex Area

MUNEKIYO & HIRAGA, INC.

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

February 1, 2005

Patricia Hamamoto, Superintendent
State of Hawaii
Department of Education
P. O. Box 2360
Honolulu, Hawaii 96804

SUBJECT: Early Consultation Request for County of Maui's Proposed Keawe Street Extension, Lahaina, Maui, Hawaii

Dear Ms. Hamamoto:

Thank you for your comments on the subject project, dated December 30, 2004. On behalf of our client, the County of Maui, Department of Public Works and Environmental Management (DPWEM), we would like to offer the following responses to your concerns.

1. Your comments with regards to the amount of anticipated pedestrian and bicycle traffic anticipated for the Keawe Street extension and the Lahaina Bypass Highway between Lahainaluna Road and Keawe Street will be forwarded to the traffic engineer for review and consideration in the Traffic Impact Assessment Report for the project. The safety of students traveling to the three (3) area schools is a concern; pedestrian safety measures for the Keawe Street extension project will be considered. Student use of the Keawe Street extension is not anticipated at this time as the roadway runs through a light-industrial area.

2. The DPWEM will keep the principals of the three (3) area schools informed about the estimated construction schedule for the project. Advance notice will be provided, as much as possible, about any inconveniences such as blasting, street closures or interruptions to utility service.

Should you have any further questions, please feel free to contact me at (808) 244-2015.

Very truly yours,

Karlynn Kawahara, Planner

KK:yp
cc: Milton Arakawa and Joe Krueger, Department of Public Works and Environmental Management
Scott Kunioka, Shimabukuro, Endo & Yoshizaki, Inc.
sey/keawest/doe.res

JAN 1 1 2

LINDA LINGLE
GOVERNOR

RODNEY K. HARAGA
DIRECTOR

Deputy Directors
BRUCE Y. MATSUI
BARRY FUKUNAGA
BRIAN H. SEKIGUCHI

IN REPLY REFER TO:

STP 8.1532

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

January 3, 2005

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

Dear Ms. Kawahara:

Subject: Keawe Street Extension
Draft Environmental Assessment/Early Consultation
TMK: 2-4-5-21: 003 and 022

Thank you for your transmittal requesting our review of the subject application.

The proposed project is being implemented by County of Maui, Department of Public Works and Environmental Management in coordination with our Highways Division. We are in full support of the project.

Thank you for the opportunity to provide comments.

Very truly yours,

Bill Mat

for RODNEY K. HARAGA
Director of Transportation

JAN 2 1 2005

LINDA LINGLE
GOVERNOR OF HAWAII

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

YVONNE Y. IZU
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
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

January 18, 2005
LD-NAV

KEAWEEXTENSION.RCM

Munekiyo and Hiraga, Inc.
Karlynn Kawahara, Project Manager
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Ms. Kawahara:

Subject: Pre-Assessment Consultation for Proposed Keawe Street Extension
Lahaina, Hawaii

Thank you for the opportunity to review and comment on the subject matter.

The Department of Land and Natural Resources' (DLNR) Land Division distributed a copy of your letter and maps dated December 15, 2004 pertaining to the subject matter to the following DLNR Divisions for their review and comment:

- Division of Forestry and Wildlife
- Engineering Division
- Commission on Water Resource Management
- Office of Conservation and Coastal Lands
- Land-Maui District Land Office
- Land-Planning and Development

Enclosed please find a copy of the Engineering Division and Maui District Land Office comments.

Based on the attached responses the Department of Land and Natural Resources has no other comment to offer on the subject matter. If you have any questions, please feel free to contact Nicholas A. Vaccaro of the Land Division Support Services Branch at 1-808-587-0384.

Very truly yours,

DIERDRE S. MAMIYA
Administrator

C: MDLO

LINDA LINGLE
GOVERNOR OF HAWAII

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DAN DAVIDSON
DEPUTY DIRECTOR - LAND

YVONNE Y. IZU
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
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

December 20, 2004
MUNEKIYO/HIRAGA

LD-NAV
KEAWEEXTENSION.CMT
Suspense Date: 12/29/04

RECEIVED
LAND DIVISION
2004 DEC 21 P 2:42

MEMORANDUM:

TO:
XXX Division of Forestry and Wildlife
XXX Engineering Division
✓XXX Land-Maui District Land Office
XXX Land-Planning and Development
XXX Office of Conservation and Coastal Lands
XXX Commission on Water Resource Management

FROM: Dierdre S. Mamiya, Administrator
Land Division

SUBJECT: Pre-Assessment Consultation for Proposed Keawe Street Extension - Lahaina, Hawaii

Please review the attached letter dated December 15, 2004 and maps (Proposed project summary) pertaining to the subject matter and submit your comment (if any) on Division letterhead signed and dated by the suspense date.

Should you have any questions, please contact Nicholas A. Vaccaro at 587-0384. If this office does not receive your comments by the suspense date, we will assume there are no comments.

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

Division: LAND
Signed: Cecil Santos

Date: 12/21/04
Print Name: CECIL SANTOS

5879

MUNEKIYO HIRAGA, INC.

RECEIVED

'04 DEC 16 A8:06

PW

December 15, 2004

Peter Young, Chairperson
State of Hawaii
Department of Land and Natural Resources
P. O. Box 621
Honolulu, Hawaii 96809

RECEIVED
2004 DEC 17 P 3:35
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

SUBJECT: Early Consultation Request for Preparation of a Draft Environmental Assessment, Keawe Street Extension - Lahaina, Maui, Hawaii

Dear Mr. Young:

The County of Maui, Department of Public Works and Environmental Management (DPWEM) proposes to construct a roadway extension and related improvements to Keawe Street in Lahaina. The scope of the project includes the construction of approximately 2,500 lineal feet of roadway, consisting of two (2), 12-foot travel lanes with 6-foot paved shoulders. A project summary is also included for your review and information.

As Federal and County funds will be used for this action, the DPWEM will be preparing a Draft Environmental Assessment (DEA) in accordance with Chapter 343, Hawaii Revised Statutes (HRS) and the National Environmental Policy Act.

In preparation for the DEA, we are requesting early consultation comments on behalf of the DPWEM. Please address written comments to our office at the address below by January 5, 2005.

Munekiyo & Hiraga, Inc.
Attention: Karlynn Kawahara
305 High Street, Suite 104
Wailuku, Hawaii 96793

LINDA LINGLE
GOVERNOR OF HAWAII

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DAN DAVIDSON
DEPUTY DIRECTOR - LAND

YVONNE Y. IZU
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
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

SANTOS

December 21, 2004

Subject: Pre-Assessment Consultation, Keawe Street Extension, Lahaina, Maui.

The site of the Keawe Street Extension, identified as portions of Tax Map Key 4-5-21:03,22 is over State Land managed by the Land Division and require a land disposition to the County of Maui.

#1418

LINDA LINGLE
GOVERNOR OF HAWAII

RECEIVED
LAND DIVISION
2005 JAN -3 P 3:57

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

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DAN DAVIDSON
DEPUTY DIRECTOR - LAND

YVONNE Y. IZU
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

December 20, 2004
MUNEKIYO/HIRAGA

LD-NAV
KEAWEEXTENSION.CMT
Suspense Date: 12/29/04

MEMORANDUM:

TO: √XXX Division of Forestry and Wildlife
XXX Engineering Division
XXX Land-Maui District Land Office
XXX Land-Planning and Development
XXX Office of Conservation and Coastal Lands
XXX Commission on Water Resource Management

FROM: Dierdre S. Mamiya, Administrator
Land Division

SUBJECT: Pre-Assessment Consultation for Proposed Keawe Street Extension - Lahaina, Hawaii

Please review the attached letter dated December 15, 2004 and maps (Proposed project summary) pertaining to the subject matter and submit your comment (if any) on Division letterhead signed and dated by the suspense date.

Should you have any questions, please contact Nicholas A. Vaccaro at 587-0384. If this office does not receive your comments by the suspense date, we will assume there are no comments.

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

Division: _____ Signed: Paul J. Conry

Date: DEC 21 2004 Print Name: PAUL J. CONRY, ADMINISTRATOR
DIVISION OF FORESTRY AND WILDLIFE

597

MUNEKIYO HIRAGA, INC.

RECEIVED
'04 DEC 16 A8:06

PY

December 15, 2004

Peter Young, Chairperson
State of Hawaii
Department of Land and Natural Resources
P. O. Box 621
Honolulu, Hawaii 96809

RECEIVED
2004 DEC 17 D 3:33
OFFICE OF CONSERVATION & COASTAL LANDS

SUBJECT: Early Consultation Request for Preparation of a Draft Environmental Assessment, Keawe Street Extension - Lahaina, Maui, Hawaii

Dear Mr. Young:

The County of Maui, Department of Public Works and Environmental Management (DPWEM) proposes to construct a roadway extension and related improvements to Keawe Street in Lahaina. The scope of the project includes the construction of approximately 2,500 lineal feet of roadway, consisting of two (2), 12-foot travel lanes with 6-foot paved shoulders. A project summary is also included for your review and information.

As Federal and County funds will be used for this action, the DPWEM will be preparing a Draft Environmental Assessment (DEA) in accordance with Chapter 343, Hawaii Revised Statutes (HRS) and the National Environmental Policy Act.

In preparation for the DEA, we are requesting early consultation comments on behalf of the DPWEM. Please address written comments to our office at the address below by January 5, 2005.

RECEIVED
'04 DEC 20 P4:25
FORESTRY & WILDLIFE
STATE OF HAWAII

Munekiyo & Hiraga, Inc.
Attention: Karlynn Kawahara
305 High Street, Suite 104
Wailuku, Hawaii 96793

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LDNAV

Ref.: KEAWEEXTENSION.CMT
MAUI.386

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 Zone C. The National Flood Insurance Program (NFIP) does not have any regulations for development within 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 Sumimoto at (808) 523-4254 or Mr. Mario Siu Li at (808) 523-4247 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 project water demands and infrastructure required to meet water demands. Please note that the implementation of any State-sponsored projects requiring water service from the Honolulu Board of Water Supply system must first obtain water allocation credits from the Engineering Division before it can receive a building permit and/or water meter.

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

( ) Additional Comments:_____

_____

( ) Other: _____

_____

Should you have any questions, please call Mr. Andrew Monden of the Planning Branch at 587-0229.

Signed: Andrew M. Monden
For ERIC T. HIRANO, CHIEF ENGINEER

Date: 12/30/04

LINDA LINGLE
GOVERNOR OF HAWAII

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DAN DAVIDSON
DEPUTY DIRECTOR - LAND

YVONNE Y. IZU
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
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

December 20, 2004
MUNEKIYO/HIRAGA

LD-NAV
KEAWEEXTENSION.CMT
Suspense Date: 12/29/04

'04 DEC 21 AM08:01 ENGINEERING

MEMORANDUM:

TO:
XXX Division of Forestry and Wildlife
✓XXX Engineering Division
XXX Land-Maui District Land Office
XXX Land-Planning and Development
XXX Office of Conservation and Coastal Lands
XXX Commission on Water Resource Management

FROM: Dierdre S. Mamiya, Administrator
Land Division

SUBJECT: Pre-Assessment Consultation for Proposed Keawe Street Extension - Lahaina, Hawaii

Please review the attached letter dated December 15, 2004 and maps (Proposed project summary) pertaining to the subject matter and submit your comment (if any) on Division letterhead signed and dated by the suspense date.

Should you have any questions, please contact Nicholas A. Vaccaro at 587-0384. If this office does not receive your comments by the suspense date, we will assume there are no comments.

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

Division: Engineering
Signed: Andrew M. Monden

Date: 12/30/04
Print Name: Andrew M. Monden

E0759

MUNEKIYO HIRAGA, INC.

RECEIVED

'04 DEC 16 A8:06

PY

December 15, 2004

& NA...

2004 DEC 17 P 3:34

RECEIVED

Peter Young, Chairperson
State of Hawaii
Department of Land and Natural Resources
P. O. Box 621
Honolulu, Hawaii 96809

SUBJECT: Early Consultation Request for Preparation of a Draft Environmental Assessment, Keawe Street Extension - Lahaina, Maui, Hawaii

Dear Mr. Young:

The County of Maui, Department of Public Works and Environmental Management (DPWEM) proposes to construct a roadway extension and related improvements to Keawe Street in Lahaina. The scope of the project includes the construction of approximately 2,500 lineal feet of roadway, consisting of two (2), 12-foot travel lanes with 6-foot paved shoulders. A project summary is also included for your review and information.

As Federal and County funds will be used for this action, the DPWEM will be preparing a Draft Environmental Assessment (DEA) in accordance with Chapter 343, Hawaii Revised Statutes (HRS) and the National Environmental Policy Act.

In preparation for the DEA, we are requesting early consultation comments on behalf of the DPWEM. Please address written comments to our office at the address below by January 5, 2005.

Munekiyo & Hiraga, Inc.
Attention: Karlynn Kawahara
305 High Street, Suite 104
Wailuku, Hawaii 96793

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

#1375

LINDA LINGLE
GOVERNOR OF HAWAII

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DAN DAVIDSON
DEPUTY DIRECTOR - LAND

YVONNE Y. IZU
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
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

December 7, 2004
LD/NAV
MUNEKIYO&HIRAGA

MAUIACADEMYDEA.CMT
Suspense Date: 12/16/04

MEMORANDUM:

TO: ✓ *XXX Division of Forestry and Wildlife
*XXX Engineering Division
*XXX Land-Maui District Land Office
*XXX Land-Planning and Development
*XXX Office of Conservation and Coastal Lands
*XXX Commission on Water Resource Management

FROM: Dierdre S. Mamiya, Administrator
Land Division

RECEIVED
LAND DIVISION
2004 DEC 13 A 11:00

SUBJECT: Draft Environmental Assessment for Proposed Maui Preparatory Academy
Applicant: Maui Land and Pineapple Company, Inc.
Location: Napili, Maui, Hawaii
Consultant: Munekiyo & Hiraga, Inc. (808-244-2015)
TMK: 2nd/ 4-3-001: Portion of 001
Authority: County of Maui Department of Planning

Please review the DEA pertaining to the subject matter and submit your comment (if any) on Division letterhead signed and dated by the suspense date.

***Note: One copy of the DEA is available for your review in the Land Division, Room 220.**

Should you have any questions, please contact Nicholas A. Vaccaro at ext.: 7-0384. If this office does not receive your comments by the suspense date, we will assume there are no comments.

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

Division: _____ Signed: Paul J. Conry

Date: DEC - 8 2004 Print Name PAUL J. CONRY, ADMINISTRATOR
DIVISION OF FORESTRY AND WILDLIFE

FEB 11 2005

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

HRD04/1672

February 8, 2005

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

Re: Request for Early Consultation, Preparation of Draft Environmental Assessment, Keawe Street Extension, Lahaina, Island of Maui

Dear Ms. Kawahara:

The Office of Hawaiian Affairs (OHA) is in receipt of your request for review and comment regarding the County of Maui's proposal to extend Keawe Street located in the Pu'unoa area of Lahaina on the Island of Maui.

After reviewing the submitted information, OHA would recommend that an archaeological investigation of the proposed road alignment occur in the form of an inventory survey. Lahaina and the makai portions of the Kahoma Stream area have been known to yield substantial cultural deposits, including unmarked native Hawaiian burial sites.

An archaeological reconnaissance of the surface area of the proposed road extension would be advisable, and depending upon the assessment, testing of any surface features may be warranted.

If you have any questions or concerns, please contact Kai Markell, Policy Advocate, at 594-1945 or kaim@oha.org. Once again, thank you for your patience during our review and assessment of this important matter.

'O wau iho nō,

Clyde W. Nāmu'o
Administrator

MUNEKIYO & HIRAGA, INC.

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

April 14, 2005

Clyde W. Namu`o, Administrator
State of Hawaii
Office of Hawaiian Affairs
711 Kapi`olani Boulevard, Suite 500
Honolulu, Hawaii 96813

SUBJECT: Early Consultation Request for the Proposed Keawe Street Extension, Lahaina, Maui, Hawaii

Dear Mr. Namu`o:

Thank you for your comment letter dated February 8, 2005 regarding the above-mentioned project. On behalf of our client, the Department of Public Works and Environmental Management, we would like to offer the following response.

An archaeological inventory survey has been conducted for the proposed Keawe Street extension alignment. A copy of the survey report will be included in the Draft Environmental Assessment for your review and information.

Should you have any further questions regarding this matter, please do not hesitate to call me at (808)244-2015.

Very truly yours,

Karlynn Kawahara, Planner

KK:lfm
cc: Cary Yamashita and Joe Krueger, Department of Public Works and Environmental Management
Scott Kunioka, Shimabukuro, Endo & Yoshizaki, Inc.
KaiNani Kraut, Federal Highways Administration
sey\keaweSt\OHA.res

DEC 2? 2004

DEPARTMENT OF
HOUSING AND HUMAN CONCERNS
COUNTY OF MAUI

ALAN M. ARAKAWA
Mayor

ALICE L. LEE
Director

HERMAN T. ANDAYA
Deputy Director

200 SOUTH HIGH STREET • WAILUKU, HAWAII 96793 • PHONE (808) 270-7805 • FAX (808) 270-7165

December 17, 2004

Ms. Karlynn Kawahara, Planner
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Ms. Kawahara:

SUBJECT: EARLY CONSULTATION REQUEST FOR PREPARATION OF A DRAFT ENVIRONMENTAL ASSESSMENT, KEAWE STREET EXTENSION-LAHAINA, MAUI, HAWAII

We have reviewed your December 15, 2004 letter and enclosures and would like to state our support of the proposed project. This project, together with the construction of Phase IA of the Lahaina Bypass Highway, will greatly alleviate the severe traffic congestion at the Honoapiilani Highway and Lahainaluna Road intersection.

Thank you for the opportunity to comment.

Very truly yours,

Alice L. Lee

ALICE L. LEE
Director

ETO:hs

c: Housing Administrator

JAN 0 3 2005

POLICE DEPARTMENT
COUNTY OF MAUI

ALAN M. ARAKAWA
MAYOR

OUR REFERENCE
YOUR REFERENCE

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

THOMAS M. PHILLIPS
CHIEF OF POLICE

KEKUHAUPIO R. AKANA
DEPUTY CHIEF OF POLIC

December 23, 2004

Ms. Karlynn Kawahara
Plannner
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, HI 96793

Dear Ms. Kawahara:

SUBJECT: Early Consultation Request for Preparation of a Draft Environmental Assessment, Keawe Street Extension – Lahaina, Hawaii

Thank you for your letter of December 15, 2004, requesting comments on the above subject.

We have reviewed the information submitted for this project and have enclosed a copy of our comments. As always, thank you for giving us the opportunity to comment on this project. We hope you and your staff have a safe and happy holiday season.

Very truly yours,

Assistant Chief Sydney Kikuchi
for: Thomas M. Phillips
Chief of Police

c: Michael Foley, Planning Department

Enclosure

COPY

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

VIA : **CHANNELS** 12/22/04

FROM : **CHARLES M. HIRATA, CAPTAIN, LAHAINA PATROL**

SUBJECT : **EARLY CONSULTATION REQUEST, KEAWE STREET EXTENSION**

Sir,

We reviewed this early consultation for the Keawe Street Extension. The purpose of this project is to extend Keawe Street to the first phase of the Lahaina Bypass. Once completed, this project will take a substantial amount of pressure off of Lahainaluna Road, especially on school days during the morning and afternoon commute times.

The infrastructure for Keawe Street is already in place with a traffic light at the intersection of Keawe Street and Honoapiilani Highway. Although not addressed in this consultation request is the design of Keawe Street where it meets the bypass. I recommend that this intersection be designed with sufficient turn lanes.

I recommend that this project proceed as quickly as possible to mitigate traffic congestion in Lahaina Town.

Respectfully submitted,

Captain Charles M. HIRATA E-4855
Lahaina Patrol
December 21, 2004 (11:26am)

MUNEKIYO & HIRAGA, INC.

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

February 1, 2005

Thomas Phillips, Chief
Maui Police Department
55 Mahalani Street
Wailuku, Hawaii 96793

SUBJECT: Early Consultation Request for County of Maui's Proposed Keawe Street Extension from, Lahaina, Maui, Hawaii

Dear Chief Phillips:

We are in receipt of your letter dated December 23, 2004 with your comments on the subject project. On behalf of our client, County of Maui, Department of Public Works and Environmental Management, we would like to offer the following response.

We note your comments with regards to the design of the intersection of the Keawe Street extension with the proposed Lahaina Bypass Highway. Your comments have been forwarded to the civil engineer for review and inclusion in the plans, if possible. Additionally, a copy of the Traffic Impact Analysis Report for the project will be included in the Draft Environmental Assessment.

Should you have any further questions, please feel free to call me at 244-2015.

Very truly yours,

Karlynn Kawahara, Planner

KK:yp
cc: Milton Arakawa and Joe Krueger, Department of Public Works and Environmental Management
Scott Kunioka, Shimabukuro, Endo & Yoshizaki, Inc.
sey/keawest/mpd.res

JAN 0 5 2005

ALAN M. ARAKAWA
MAYOR

GEORGE Y. TENGAN
DIRECTOR
JEFFREY T. PEARSON,
P.E.

DEPARTMENT OF WATER SUPPLY
COUNTY OF MAUI

P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109
Telephone (808) 270-7816 • Fax (808) 270-7833

December 27, 2004

Ms. Karlynn Kawahara, Planner
Munekiyo & Hiraga, Inc.
305 High Street Suite 104
Wailuku HI 96793

Subject: Early Consultation Request for the Preparation of an Draft Environmental Assessment for Keawe Street Extension - Lahaina, Maui, Hawaii

Dear Ms. Kawahara:

Thank you for the opportunity to provide comments on the preparation of this Draft Environmental Assessment (EA). The Department of Water Supply provides the following information:

Source Availability and Consumption
The project area is served by the Lahaina System. The main sources of water for this system are wells withdrawing from the Launipoko aquifer and surface water from the Honolua Ditch. The EA should address any anticipated water use for irrigation and short-term use for construction purposes.

System Infrastructure
There are no Department water lines in the vicinity of the project site. A section of the fire protection map is enclosed for your reference. However, construction plans need to be reviewed by the Department of Water Supply.

Pollution Prevention
The project overlies the Launipoko aquifer and is within 1,500 ft of Kahoma Stream. The Department of Water Supply strives to protect the integrity of surface and groundwater resources by encouraging the applicant to adopt best management practices (BMPs) designed to minimize infiltration and runoff from all construction and vehicle operations. We have attached sample BMPs for principle operations for reference. Additional information can be obtained from the State Department of Health.

Conservation
We recommend that the following water conservation measures be included in the EA and implemented in project design and construction:
Use Non-potable Water: We encourage the applicant to pursue using brackish or reclaimed water for landscaping irrigation and for construction purposes. Reclaimed water is readily available for trucking at the Lahaina Sewage Treatment Plant.
Use Climate-adapted Plants: The project is located in the "Maui County Planting Plan" - Plant Zone 3. Native plants adapted to the area conserve water and protect the watershed from degradation due to invasive alien species. Please refer to the attached brochure: "Saving Water In The Yard - What and How to Plant In Your

Area" for roadside landscaping.
Prevent Over-Watering By Automated Systems: Provide rain-sensors on all automated irrigation controllers in landscaped areas. Check and reset controllers at least once a month to reflect the monthly changes in evapo-transpiration rates at the site. As an alternative, provide the more automated, soil-moisture sensors on controllers.

Should you have any questions, please contact our Water Resources and Planning Division at 270-7199.

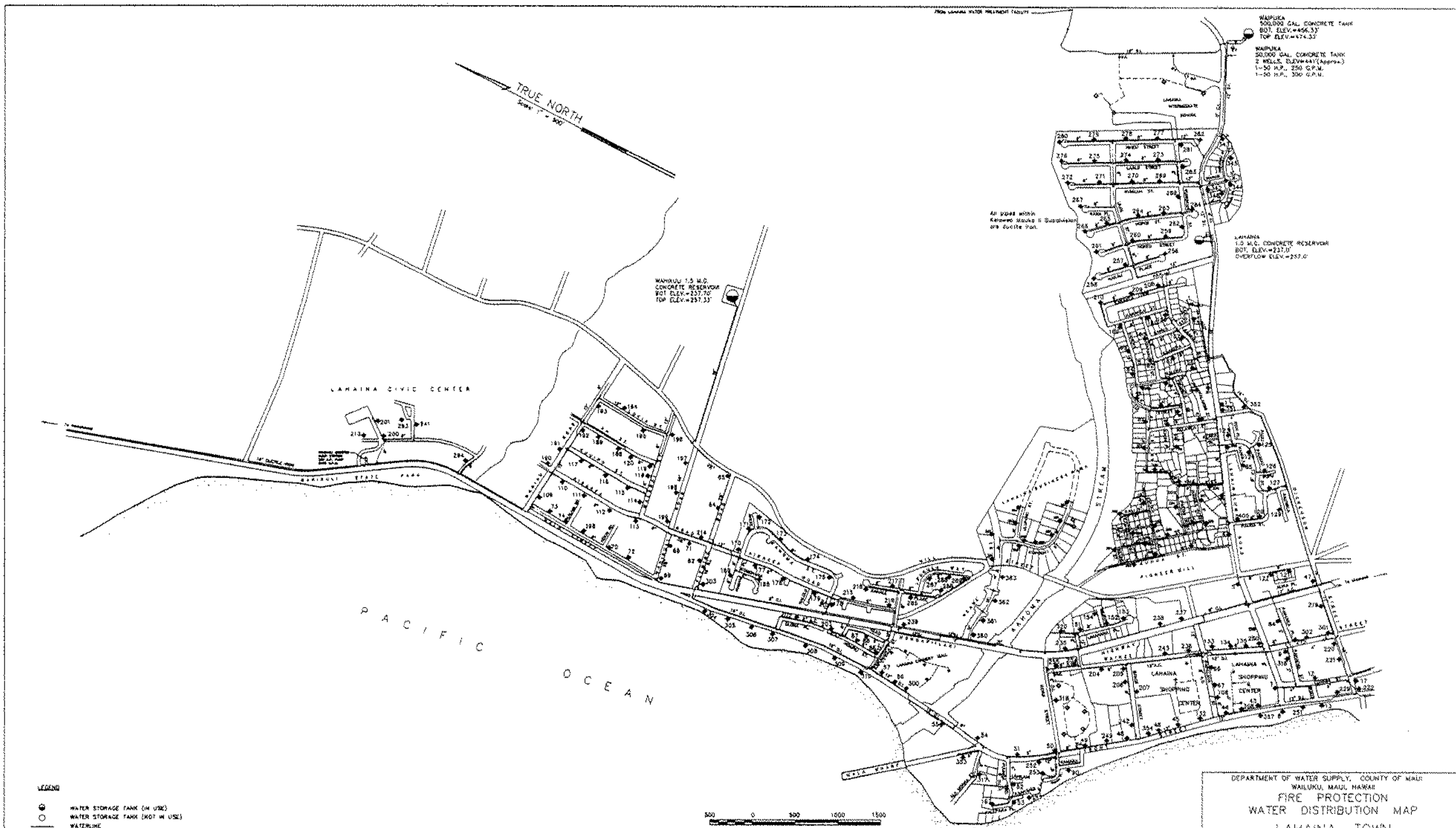
Sincerely,

George Y. Tengan
Director
emb

c: engineering division
applicant, with attachments:

Section of Fire Protection Map
Maui County Planting Plan - Saving Water in the Yard-What and How to Plant in your Area
Selected BMP's from "Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters"-EPA

C:\WPdocs\EAs EISs\Keawe Street ext DEA early consult.wpd



LEGEND

- WATER STORAGE TANK (IN USE)
- WATER STORAGE TANK (NOT IN USE)
- WATERLINE
- VALVE
- FIRE HYDRANTS MAINTAINED BY D.W.S.
- PRIVATE FIRE HYDRANTS MAINTAINED BY OTHERS
- STANDPIPES MAINTAINED BY D.W.S.
- PRIVATE WATERLINE
- PRESSURE REDUCING VALVE (P.R.V.)
- PUMP

YEAR	1986	1987	1988	1989	1990					
HYDRANT	251	253	254	265	282					
STANDPIPE	36	35	35	29	29					

DEPARTMENT OF WATER SUPPLY, COUNTY OF MAUI
WAILUKU, MAUI, HAWAII

FIRE PROTECTION WATER DISTRIBUTION MAP

LAHAINA TOWN

LAHAINA SYSTEM

Drawn By: R.K.T. Scale: 1"=500'
Date: Feb. 28, 2000
Approved By: ______________________
Director, Department of Water Supply

United States
Environmental Protection
Agency

Office of Water
Washington, DC 20460

840-B-92-002
January 1993

EPA

Guidance Specifying Management Measures For Sources Of Nonpoint Pollution In Coastal Waters

Issued Under the Authority of
Section 6217(g) of the Coastal Zone Act
Reauthorization Amendments of 1990

VII. ROADS, HIGHWAYS, AND BRIDGES

NOTE: Management Measures II.A and II.B of this chapter also apply to planning, siting, and developing roads and highways.[6]

A. Management Measure for Planning, Siting, and Developing Roads and Highways

Plan, site, and develop roads and highways to:

(1) Protect areas that provide important water quality benefits or are particularly susceptible to erosion or sediment loss;

(2) Limit land disturbance such as clearing and grading and cut and fill to reduce erosion and sediment loss; and

(3) Limit disturbance of natural drainage features and vegetation.

1. Applicability

This measure is intended to be applied by States to site development and land disturbing activities for new, relocated, and reconstructed (widened) roads (including residential streets) and highways in order to reduce the generation of nonpoint source pollutants and to mitigate the impacts of urban runoff and associated pollutants from such activities. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this management measure and will have some flexibility in doing so. The application of management measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce.

2. Description

The best time to address control of NPS pollution from roads and highways is during the initial planning and design phase. New roads and highways should be located with consideration of natural drainage patterns and planned to avoid encroachment on surface waters and wet areas. Where this is not possible, appropriate controls will be needed to minimize the impacts of NPS runoff on surface waters.

This management measure emphasizes the importance of planning to identify potential NPS problems early in the design process. This process involves a detailed analysis of environmental features most associated with NPS pollution, erosion and sediment problems such as topography, drainage patterns, soils, climate, existing land use, estimated traffic volume, and sensitive land areas. Highway locations selected, planned, and designed with consideration of these features will greatly minimize erosion and sedimentation and prevent NPS pollutants from entering watercourses during and after construction. An important consideration in planning is the distance between

[6] Management measure II.A applies only to runoff that emanates from the road, highway, and bridge right-of-way. This management measure does not apply to runoff and total suspended solid loadings from upland areas outside the road, highway, or bridge project.

a highway and a watercourse that is needed to buffer the runoff flow and prevent potential contaminants from entering surface waters. Other design elements such as project alignment, gradient, cross section, and the number of stream crossings also must be taken into account to achieve successful control of erosion and nonpoint sources of pollution. (Refer to Chapter 3 of this guidance for details on road designs for different terrains.)

The following case study illustrates some of the problems and associated costs that may occur due to poor road construction and design. These issues should be addressed in the planning and design phase.

CASE STUDY - ANNAPOLIS, MARYLAND

Poor road siting and design resulted in concentrated runoff flows and heavy erosion that threatened several house foundations adjacent to the road. Sediment-laden runoff was also discharged into Herring Bay. To protect the Chesapeake Bay and the nearby houses, the county corrected the problem by installing diversions, a curb-and-drain urban runoff conveyance, and a rock wall filtration system, at a total cost of $100,000 (Munsey, 1992).

3. Management Measure Selection

This management measure was selected because it follows the approach to highway development recommended by the American Association of State Highway and Transportation Officials (AASHTO), Federal Highway Administration (FHWA) guidance, and highway location and design guidelines used by the States of Virginia, Maryland, Washington, and others.

Additionally, AASHTO has location and design guidelines (AASHTO, 1990, 1991) available for State highway agency use that describe the considerations necessary to control erosion and highway-related pollutants. Federal Highway Administration policy (FHWA, 1991) requires that Federal-aid highway projects and highways constructed under direct supervision of the FHWA be located, designed, constructed, and operated according to standards that will minimize erosion and sediment damage to the highway and adjacent properties and abate pollution of surface water and ground-water resources.

4. Practices

As discussed more fully at the beginning of this chapter and in Chapter 1, the following practices are described for illustrative purposes only. State programs need not require implementation of these practices. However, as a practical matter, EPA anticipates that the management measure set forth above generally will be implemented by applying one or more management practices appropriate to the source, location, and climate. The practices set forth below have been found by EPA to be representative of the types of practices that can be applied successfully to achieve the management measure described above.

a. *Consider type and location of permanent erosion and sediment controls (e.g., vegetated filter strips, grassed swales, pond systems, infiltration systems, constructed urban runoff wetlands, and energy dissipators and velocity controls) during the planning phase of roads, highway, and bridges. (AASHTO, 1991; Hartigan et al., 1989)*

b. *All wetlands that are within the highway corridor and that cannot be avoided should be mitigated. These actions will be subject to Federal Clean Water Act section 404 requirements and State regulations.*

c. *Assess and establish adequate setback distances near wetlands, waterbodies, and riparian areas to ensure protection from encroachment in the vicinity of these areas.*

Setback distances should be determined on a site-specific basis since several variables may be involved such as topography, soils, floodplains, cut-and-fill slopes, and design geometry. In level or gently sloping terrain, a general rule of thumb is to establish a setback of 50 to 100 feet from the edge of the wetland or riparian area and the right-of-way. In areas of steeply sloping terrain (20 percent or greater), setbacks of 100 feet or more are recommended. Right-of-way setbacks from major waterbodies (oceans, lakes, estuaries, rivers) should be in excess of 100 to 1000 feet.

d. *Avoid locations requiring excessive cut and fill. (AASHTO, 1991)*

e. *Avoid locations subject to subsidence, sink holes, landslides, rock outcroppings, and highly erodible soils. (AASHTO, 1991; TRB, Campbell, 1988)*

f. *Size rights-of-way to include space for siting runoff pollution control structures as appropriate. (AASHTO, 1991; Hartigan, et al., 1989)*

Erosion and sediment control structures (extended detention dry ponds, permanent sediment traps, catchment basins, etc.) should be planned and located during the design phase and included as part of the design specifications to ensure that such structures, where needed, are provided within the highway right-of-way.

g. *Plan residential roads and streets in accordance with local subdivision regulations, zoning ordinances, and other local site planning requirements (International City Managers Association, Model Zoning/Subdivision Codes). Residential road and street pavements should be designed with minimum widths.*

Local roads and streets should have right-of-way widths of 36 to 50 feet, with lane widths of 10 to 12 feet. Minimum pavement widths for residential streets where street parking is permitted range from 24 to 28 feet between curbs. In large-lot subdivisions (1 acre or more), grassed drainage swales can be used in lieu of curbs and gutters and the width of paved road surface can be between 18 and 20 feet.

h. *Select the most economic and environmentally sound route location. (FHWA, 1991)*

i. *Use appropriate computer models and methods to determine urban runoff impacts with all proposed route corridors. (Driscoll, 1990)*

Computer models to determine urban runoff from streets and highways include TR-55 (Soil Conservation Service model for controlling peak runoff); the P-8 model to determine storage capacity (Palmstrom and Walker); the FHWA highway runoff model (Driscoll et al., 1990); and others (e.g., SWMM, EPA's stormwater management model; HSP continuous simulation model by Hydrocomp, Inc.).

j. *Comply with National Environmental Policy Act requirements including other State and local requirements. (FHWA, T6640.8A)*

k. *Coordinate the design of pollution controls with appropriate State and Federal environmental agencies. (Maryland DOE, 1983)*

l. Develop local official mapping to show location of proposed highway corridors.

Official mapping can be used to reserve land areas needed for public facilities such as roads, highways, bridges, and urban runoff treatment devices. Areas that require protection, such as those which are sensitive to disturbance or development-related nonpoint source pollution, can be reserved by planning and mapping necessary infrastructure for location in suitable areas.

5. Effectiveness Information and Cost Information

The most economical time to consider the type and location of erosion, sediment, and NPS pollution control is early in the planning and design phase of roads and highways. It is much more costly to correct polluted runoff problems after a road or highway has already been built. The most effective and often the most economical control is to design roads and highways as close to existing grade as possible to minimize the area that must be cut or filled and to avoid locations that encroach upon adjacent watercourses and wet areas. However, some portions of roads and highways cannot always be located where NPS pollution does not pose a threat to surface waters. In these cases, the impact from potential pollutant loadings should be mitigated. Interactive computer models designed to run on a PC are available (e.g., FHWA's model, Driscoll et al., 1990) and can be used to examine and project the runoff impacts of a proposed road or highway design on surface waters. Where controls are determined to be needed, several cost-effective management practices, such as vegetated filter strips, grassed swales, and pond systems, can be considered and used to treat the polluted runoff. These mitigating practices are described in detail in the discussion on urban developments (Management Measure IV.A).

B. Management Measure for Bridges

Site, design, and maintain bridge structures so that sensitive and valuable aquatic ecosystems and areas providing important water quality benefits are protected from adverse effects.

1. Applicability

This management measure is intended to be applied by States to new, relocated, and rehabilitated bridge structures in order to control erosion, streambed scouring, and surface runoff from such activities. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this management measure and will have some flexibility in doing so. The application of management measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce.

2. Description

This measure requires that NPS runoff impacts on surface waters from bridge decks be assessed and that appropriate management and treatment be employed to protect critical habitats, wetlands, fisheries, shellfish beds, and domestic water supplies. The siting of bridges should be a coordinated effort among the States, the FHWA, the U.S. Coast Guard, and the Army Corps of Engineers. Locating bridges in coastal areas can cause significant erosion and sedimentation, resulting in the loss of wetlands and riparian areas. Additionally, since bridge pavements are extensions of the connecting highway, runoff waters from bridge decks also deliver loadings of heavy metals, hydrocarbons, toxic substances, and deicing chemicals to surface waters as a result of discharge through scupper drains with no overland buffering. Bridge maintenance can also contribute heavy loads of lead, rust particles, paint, abrasive, solvents, and cleaners into surface waters. Protection against possible pollutant overloads can be afforded by minimizing the use of scuppers on bridges traversing very sensitive waters and conveying deck drainage to land for treatment. Whenever practical, bridge structures should be located to avoid crossing over sensitive fisheries and shellfish-harvesting areas to prevent washing polluted runoff through scuppers into the waters below. Also, bridge design should account for potential scour and erosion, which may affect shellfish beds and bottom sediments.

3. Management Measure Selection

This management measure was selected because of its documented effectiveness and to protect against potential pollution impacts from siting bridges over sensitive waters and tributaries in the coastal zone. There are several examples of siting bridges to protect sensitive areas. The Isle of Palms Bridge near Charleston, South Carolina, was designed without scupper drains to protect a local fishery from polluted runoff by preventing direct discharge into the waters below. In another example, the Louisiana Department of Transportation and Development specified stringent requirements before allowing the construction of a bridge to protect destruction of fragile wetlands near New Orleans. A similar requirement was specified for bridge construction in the Tampa Bay area in Florida (ENR, 1991).

4. Practices

As discussed more fully at the beginning of this chapter and in Chapter 1, the following practices are described for illustrative purposes only. State programs need not require implementation of these practices. However, as a practical matter, EPA anticipates that the management measure set forth above generally will be implemented by applying one or more management practices appropriate to the source, location, and climate. The practices set forth below have been found by EPA to be representative of the types of practices that can be applied successfully to achieve the management measure described above.

Additional erosion and sediment control management practices are listed in the construction section for urban sources of pollution (Management Measure IV.A).

a. Coordinate design with FHWA, USCG, COE, and other State and Federal agencies as appropriate.

b. Review National Environmental Policy Act requirements to ensure that environmental concerns are met (FHWA, T6640.8A and 23 CFR 771).

c. Avoid highway locations requiring numerous river crossings. (AASHTO, 1991)

d. Direct pollutant loadings away from bridge decks by diverting runoff waters to land for treatment.

Bridge decks should be designed to keep runoff velocities low and control pollutant loadings. Runoff waters should be conveyed away from contact with the watercourse and directed to a stable storm drainage, wetland, or detention pond. Conveyance systems should be designed to withstand the velocities of projected peak discharge.

e. Restrict the use of scupper drains on bridges less than 400 feet in length and on bridges crossing very sensitive ecosystems.

Scupper drains allow direct discharge of runoff into surface waters below the bridge deck. Such discharges can be of concern where the waterbody is highly susceptible to degradation or is an outstanding resource such as a spawning area or shellfish bed. Other sensitive waters include water supply sources, recreational waters, and irrigation systems. Care should be taken to protect these areas from contaminated runoff.

f. Site and design new bridges to avoid sensitive ecosystems.

Pristine waters and sensitive ecosystems should be protected from degradation as much as possible. Bridge structures should be located in alternative areas where only minimal environmental damage would result.

g. On bridges with scupper drains, provide equivalent urban runoff treatment in terms of pollutant load reduction elsewhere on the project to compensate for the loading discharged off the bridge.

5. Effectiveness Information and Cost Information

Effectively controlling NPS pollutants such as road contaminants, fugitive dirt, and debris and preventing accidental spills from entering surface waters via bridge decks are necessary to protect wetlands and other sensitive ecosystems. Therefore, management practices such as minimizing the use of scupper drains and diverting runoff waters to land for treatment in detention ponds and infiltration systems are known to be effective in mitigating pollutant loadings. Tables 4-7 and 4-8 in Section II provide cost and effectiveness data for ponds, constructed wetlands, and filtration devices.

C. Management Measure for Construction Projects

(1) Reduce erosion and, to the extent practicable, retain sediment onsite during and after construction and

(2) Prior to land disturbance, prepare and implement an approved erosion control plan or similar administrative document that contains erosion and sediment control provisions.

1. Applicability

This management measure is intended to be applied by States to new, replaced, restored, and rehabilitated road, highway, and bridge construction projects in order to control erosion and offsite movement of sediment from such project sites. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this management measure and will have some flexibility in doing so. The application of management measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce.

2. Description

Erosion and sedimentation from construction of roads, highways, and bridges, and from unstabilized cut-and-fill areas, can significantly impact surface waters and wetlands with silt and other pollutants including heavy metals, hydrocarbons, and toxic substances. Erosion and sediment control plans are effective in describing procedures for mitigating erosion problems at construction sites before any land-disturbing activity begins. Additional relevant practices are described in Management Measures III.A and III.B of this chapter.

Bridge construction projects include grade separations (bridges over roads) and waterbody crossings. Erosion problems at grade separations result from water running off the bridge deck and runoff waters flowing onto the bridge deck during construction. Controlling this runoff can prevent erosion of slope fills and the undermining failure of the concrete slab at the bridge approach. Bridge construction over waterbodies requires careful planning to limit the disturbance of streambanks. Soil materials excavated for footings in or near the water should be removed and relocated to prevent the material from being washed back into the waterbody. Protective berms, diversion ditches, and silt fences parallel to the waterway can be effective in preventing sediment from reaching the waterbody.

Wetland areas will need special consideration if affected by highway construction, particularly in areas where construction involves adding fill, dredging, or installing pilings. Highway development is most disruptive in wetlands since it may cause increased sediment loss, alteration of surface drainage patterns, changes in the subsurface water table, and loss of wetland habitat. Highway structures should not restrict tidal flows into salt marshes and other coastal wetland areas because this might allow the intrusion of freshwater plants and reduce the growth of salt-tolerant species. To safeguard these fragile areas, the best practice is to locate roads and highways with sufficient setback distances between the highway right-of-way and any wetlands or riparian areas. Bridge construction also can impact water circulation and quality in wetland areas, making special techniques necessary to accommodate construction. The following case study provides an example of a construction project where special considerations were given to wetlands.

CASE STUDY - BRIDGING WETLANDS IN LOUISIANA

To provide protection for an environmentally critical wetland outside New Orleans, the Louisiana Department of Transportation and Development (DOTD) required a special construction technique to build almost 2 miles of twin elevated structures for the Interstate 310 link between I-10 and U.S. Route 90. A technique known as "end-on" construction was devised to work from the decks of the structures, building each section of the bridge from the top of the last completed section and using heavy cranes to push each section forward one bay at a time. The cranes were also used to position steel platforms, drive in support pilings, and lay deck slabs, alternating this procedure between each bay. Without this technique, the Louisiana DOTD would not have been permitted to build this structure. The twin 9,200-foot bridges took 485 days to complete at a cost of $25.3 million (*Engineering News Record*, 1991).

3. Management Measure Selection

This management measure was selected because it supports FHWA's erosion and sediment control policy for all highway and bridge construction projects and is the administrative policy of several State highway departments and local governmental agencies involved in land development activity. Examples of erosion and sediment controls and NPS pollutant control practices are described in AASHTO guidelines and in several State erosion control manuals (AASHTO, 1991; North Carolina DOT, 1991; Washington State DOT, 1988). A detailed discussion of cost-effective management practices is available in the urban development section (Section II) of this chapter. These example practices are also effective for highway construction projects.

4. Practices

As discussed more fully at the beginning of this chapter and in Chapter 1, the following practices are described for illustrative purposes only. State programs need not require implementation of these practices. However, as a practical matter, EPA anticipates that the management measure set forth above generally will be implemented by applying one or more management practices appropriate to the source, location, and climate. The practices set forth below have been found by EPA to be representative of the types of practices that can be applied successfully to achieve the management measure described above.

Additional erosion and sediment control management practices are listed in the construction section (Section III) of this chapter.

a. *Write erosion and sediment control requirements into plans, specifications, and estimates for Federal aid construction projects for highways and bridges (FHWA, 1991) and develop erosion control plans for earth-disturbing activities.*

Erosion and sediment control decisions made during the planning and location phase should be written into the contract, plans, specifications, and special provisions provided to the construction contractor. This approach can establish contractor responsibility to carry out the explicit contract plan recommendations for the project and the erosion control practices needed.

b. *Coordinate erosion and sediment controls with FHWA, AASHTO, and State guidelines.*

Coordination and scheduling of the project work with State and local authorities are major considerations in controlling anticipated erosion and sediment problems. In addition, the contractor should submit a general work schedule and plan that indicates planned implementation of temporary and permanent erosion control practices, including shutdown procedures for winter and other work interruptions. The plan also should include proposed methods of control on restoring borrow pits and the disposal of waste and hazardous materials.

■ *c. Install permanent erosion and sediment control structures at the earliest practicable time in the construction phase.*

Permanent or temporary soil stabilization practices should be applied to cleared areas within 15 days after final grade is reached on any portion of the site. Soil stabilization should also be applied within 15 days to denuded areas that may not be at final grade but will remain exposed to rain for 30 days or more. Soil stabilization practices protect soil from the erosive forces of raindrop impact and flowing water. Temporary erosion control practices usually include seeding, mulching, establishing general vegetation, and early application of a gravel base on areas to be paved. Permanent soil stabilization practices include vegetation, filter strips, and structural devices.

Sediment basins and traps, perimeter dikes, sediment barriers, and other practices intended to trap sediment on site should be constructed as a first step in grading and should be functional before upslope land disturbance takes place. Structural practices such as earthen dams, dikes, and diversions should be seeded and mulched within 15 days of installation.

■ *d. Coordinate temporary erosion and sediment control structures with permanent practices.*

All temporary erosion and sediment controls should be removed and disposed of within 30 days after final site stabilization is achieved or after the temporary practices are no longer needed. Trapped sediment and other disturbed soil areas resulting from the disposition of temporary controls should be permanently stabilized to prevent further erosion and sedimentation (AASHTO, 1991).

■ *e. Wash all vehicles prior to leaving the construction site to remove mud and other deposits. Vehicles entering or leaving the site with trash or other loose materials should be covered to prevent transport of dust, dirt, and debris. Install and maintain mud and silt traps.*

■ *f. Mitigate wetland areas destroyed during construction.*

Marshes and some types of wetlands can often be developed in areas where fill material was extracted or in ponds designed for sediment control during construction. Vegetated strips of native marsh grasses established along highway embankments near wetlands or riparian areas can be effective to protect these areas from erosion and sedimentation (FHWA, 1991).

■ *g. Minimize the area that is cleared for construction.*

■ *h. Construct cut-and-fill slopes in a manner that will minimize erosion.*

Cut-and-fill slopes should be constructed in a manner that will minimize erosion by taking into consideration the length and steepness of slopes, soil types, upslope drainage areas, and ground-water conditions. Suggested recommendations are as follows: reduce the length of long steep slopes by adding diversions or terraces; prevent concentrated runoff from flowing down cut-and-fill slopes by containing these flows within flumes or slope drain structures; and create roughened soil surfaces on cut-and-fill slopes to slow runoff flows. Wherever a slope face crosses a water seepage plane, thereby endangering the stability of the slope, adequate subsurface drainage should be provided.

■ *i. Minimize runoff entering and leaving the site through perimeter and onsite sediment controls.*

■ *j. Inspect and maintain erosion and sediment control practices (both on-site and perimeter) until disturbed areas are permanently stabilized.*

- k. *Divert and convey offsite runoff around disturbed soils and steep slopes to stable areas in order to prevent transport of pollutants off site.*

- l. *After construction, remove temporary control structures and restore the affected area. Dispose of sediments in accordance with State and Federal regulations.*

- m. *All storm drain inlets that are made operable during construction should be protected so that sediment-laden water will not enter the conveyance system without first being filtered or otherwise treated to remove sediment.*

5. Effectiveness Information and Cost Information

The detailed cost and effectiveness information presented under the construction measure for urban development is also applicable to road, highway, and bridge construction. See Tables 4-15 and 4-16 in Section III.

D. Management Measure for Construction Site Chemical Control

(1) Limit the application, generation, and migration of toxic substances;

(2) Ensure the proper storage and disposal of toxic materials; and

(3) Apply nutrients at rates necessary to establish and maintain vegetation without causing significant nutrient runoff to surface water.

1. Applicability

This management measure is intended to be applied by States to new, resurfaced, restored, and rehabilitated road, highway, and bridge construction projects in order to reduce toxic and nutrient loadings from such project sites. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this management measure and will have some flexibility in doing so. The application of management measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce.

2. Description

The objective of this measure is to guard against toxic spills and hazardous loadings at construction sites from equipment and fuel storage sites. Toxic substances tend to bind to fine soil particles; however, by controlling sediment mobilization, it is possible to limit the loadings of these pollutants. Also, some substances such as fuels and solvents are hazardous and excess applications or spills during construction can pose significant environmental impacts. Proper management and control of toxic substances and hazardous materials should be the adopted procedure for all construction projects and should be established by erosion and sediment control plans. Additional relevant practices are described in Management Measure III.B of this chapter.

3. Management Measure Selection

This management measure was selected because of existing practices that have been shown to be effective in mitigating construction-generated NPS pollution at highway project sites and equipment storage yards. In addition, maintenance areas containing road salt storage, fertilizers and pesticides, snowplows and trucks, and tractor mowers have the potential to contribute NPS pollutants to adjacent watercourses if not properly managed (AASHTO, 1988, 1991a). This measure is intended to safeguard surface waters and ground water from toxic and hazardous pollutants generated at construction sites. Examples of effective implementation of this measure are presented in the section on construction in urban areas. Several State environmental agencies are using this approach to regulate toxic and hazardous pollutants (Florida DER, 1988; Puget Sound Basin, 1991).

4. Practices

As discussed more fully at the beginning of this chapter and in Chapter 1, the following practices are described for illustrative purposes only. State programs need not require implementation of these practices. However, as a practical matter, EPA anticipates that the management measure set forth above generally will be implemented by applying one or more management practices appropriate to the source, location, and climate. The practices set forth below have been found by EPA to be representative of the types of practices that can be applied successfully to achieve the management measure described above.

The practices that are applicable to this management measure are described in Section III.B.

5. Effectiveness Information and Cost Information

The detailed cost and effectiveness data presented in the Section III.A of this chapter describing NPS controls for construction projects in urban development areas are also applicable to highway construction projects.

E. Management Measure for Operation and Maintenance

Incorporate pollution prevention procedures into the operation and maintenance of roads, highways, and bridges to reduce pollutant loadings to surface waters.

1. Applicability

This management measure is intended to be applied by States to existing, restored, and rehabilitated roads, highways, and bridges. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this management measures and will have some flexibility in doing so. The application of measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce.

2. Description

Substantial amounts of eroded material and other pollutants can be generated by operation and maintenance procedures for roads, highways, and bridges, and from sparsely vegetated areas, cracked pavements, potholes, and poorly operating urban runoff control structures. This measure is intended to ensure that pollutant loadings from roads, highways, and bridges are minimized by the development and implementation of a program and associated practices to ensure that sediment and toxic substance loadings from operation and maintenance activities do not impair coastal surface waters. The program to be developed, using the practices described in this management measure, should consist of and identify standard operating procedures for nutrient and pesticide management, road salt use minimization, and maintenance guidelines (e.g., capture and contain paint chips and other particulates from bridge maintenance operations, resurfacing, and pothole repairs).

3. Management Measure Selection

This management measure for operation and maintenance was selected because (1) it is recommended by FHWA as a cost-effective practice (FHWA, 1991); (2) it is protective of the human environment (Puget Sound Water Quality Authority, 1989); (3) it is effective in controlling erosion by revegetating bare slopes (AASHTO, 1991b); (4) it is helpful in minimizing polluted runoff from road pavements (Transportation Research Board, 1991); and (5) both Federal (Richardson, 1974) and State highway agencies (Minnesota Pollution Control Agency, 1989; Pitt, 1973) advocate highway maintenance as an effective practice for minimizing pollutant loadings.

Maintenance of erosion and sediment control practices is of critical importance. Both temporary and permanent controls require frequent and periodic cleanout of accumulated sediment. Any trapping or filtering device, such as silt fences, sediment basins, buffers, inlets, and check dams, should be checked and cleaned out when approximately 50 percent of their capacity is reached, as determined by the erodible nature of the soil, flow velocity, and quantity of runoff. Seasonal and climatic differences may require more frequent cleanout of these structures. The sediments removed from these control devices should be deposited in permanently stabilized areas to prevent further erosion and sediment from reaching drainages and receiving streams. After periods of use, control devices may require replacement of deteriorated materials such as straw bales and silt fence fabrics, or restoration and reconstruction of sediment basins and riprap installations.

Permanent erosion controls such as vegetated filter strips, grassed swales, and velocity dissipators should be inspected periodically to determine their integrity and continued effectiveness. Continual deterioration or damage to these controls may indicate a need for better design or construction.

4. Practices

As discussed more fully at the beginning of this chapter and in Chapter 1, the following practices are described for illustrative purposes only. State programs need not require implementation of these practices. However, as a practical matter, EPA anticipates that the management measure set forth above generally will be implemented by applying one or more management practices appropriate to the source, location, and climate. The practices set forth below have been found by EPA to be representative of the types of practices that can be applied successfully apply to achieve the management measure described above.

- *a. Seed and fertilize, seed and mulch, and/or sod damaged vegetated areas and slopes.*

- *b. Establish pesticide/herbicide use and nutrient management programs.*

Refer to the Management Measure for Construction Site Chemical Control in this chapter.

- *c. Restrict herbicide and pesticide use in highway rights-of-way to applicators certified under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) to ensure safe and effective application.*

- *d. The use of chemicals such as soil stabilizers, dust palliatives, sterilants, and growth inhibitors should be limited to the best estimate of optimum application rates. All feasible measures should be taken to avoid excess application and consequent intrusion of such chemicals into surface runoff.*

- *e. Sweep, vacuum, and wash residential/urban streets and parking lots.*

- *f. Collect and remove road debris.*

- *g. Cover salt storage piles and other deicing materials to reduce contamination of surface waters. Locate them outside the 100-year floodplain.*

- *h. Regulate the application of deicing salts to prevent oversalting of pavement.*

- *i. Use specially equipped salt application trucks.*

- *j. Use alternative deicing materials, such as sand or salt substitutes, where sensitive ecosystems should be protected.*

- *k. Prevent dumping of accumulated snow into surface waters.*

- *l. Maintain retaining walls and pavements to minimize cracks and leakage.*

- *m. Repair potholes.*

- *n. Encourage litter and debris control management.*

o. *Develop an inspection program to ensure that general maintenance is performed on urban runoff and NPS pollution control facilities.*

To be effective, erosion and sediment control devices and practices must receive thorough and periodic inspection checks. The following is a suggested checklist for the inspection of erosion and sediment controls (AASHTO Operating Subcommittee on Design, 1990):

- Clean out sediment basins and traps; ensure that structures are stable.
- Inspect silt fences and replace deteriorated fabrics and wire connections; properly dispose of deteriorated materials.
- Renew riprapped areas and reapply supplemental rock as necessary.
- Repair/replace check dams and brush barriers; replace or stabilize straw bales as needed.
- Regrade and shape berms and drainage ditches to ensure that runoff is properly channeled.
- Apply seed and mulch where bare spots appear, and replace matting material if deteriorated.
- Ensure that culverts and inlets are protected from siltation.
- Inspect all permanent erosion and sediment controls on a scheduled, programmed basis.

p. *Ensure that energy dissipators and velocity controls to minimize runoff velocity and erosion are maintained.*

q. *Dispose of accumulated sediment collected from urban runoff management and pollution control facilities, and any wastes generated during maintenance operations, in accordance with appropriate local, State, and Federal regulations.*

r. *Use techniques such as suspended tarps, vacuums, or booms to reduce, to the extent practicable, the delivery to surface waters of pollutants used or generated during bridge maintenance (e.g., paint, solvents, scrapings).*

s. *Develop education programs to promote the practices listed above.*

5. Effectiveness Information and Cost Information

Preventive maintenance is a time-proven, cost-effective management approach. Operation schedules and maintenance procedures to restore vegetation, proper management of salt and fertilizer application, regular cleaning of urban runoff structures, and frequent sweeping and vacuuming of urban streets have effective results in pollution control. Litter control, clean-up, and fix-up practices are a low-cost means for eliminating causes of pollution, as is the proper handling of fertilizers, pesticides, and other toxic materials including deicing salts and abrasives. Table 4-30 presents summary information on the cost and effectiveness of operation and maintenance practices for roads, highways, and bridges. Many States and communities are already implementing several of these practices within their budget limitations. As shown in Table 4-30, the use of road salt alternatives such as calcium magnesium acetate (CMA) can be very costly. Some researchers have indicated, however, that reductions in corrosion of infrastructure, damage to roadside vegetation, and the quantity of material that needs to be applied may offset the higher cost of CMA. Use of road salt minimization practices such as salt storage protection and special salt spreading equipment reduces the amount of salt that a State or community must purchase. Consequently, implementation of these practices can pay for itself through savings in salt purchasing costs. Similar programs such as nutrient and pesticide management can also lead to decreased expenditures for materials.

CMA Eligible for Matching Funds

Calcium magnesium acetate (CMA) is now eligible for Federal matching funds under the Bridge Program of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. The Act provides 80 percent funding for use of CMA on salt-sensitive bridges in order to protect against corrosion and to extend their useful life. CMA can also be used to protect vegetation from salt damage in environmentally sensitive areas.

Table 4-30. Effectiveness and Cost Summary for Roads, Highways, and Bridges Operation and Maintenance Management Practices

Management Practice	% Removal TSS	TP	TN	COD	Pb	Zn	Cost
MAINTAIN VEGETATION							
For Sediment Control							Natural succession allowed to occur -
Average:	90	NA	NA	NA	NA	NA	Avg: $100/ac/year
Reported Range:	50-100	NA	NA	NA	NA	NA	Reported Range: $50-$200/ac/year
Probable Range:	80-100	-	-	-	-	-	
For Pollutant Removal							Natural succession not allowed to occur -
Average:	60	40	40	50	50	50	Avg: $800/ac/year
Reported Range	0-100	0-100	0-70	20-80	0-100	50-60	Reported Range: $700-$900/ac/year
Probable Range:	0-100	0-100	0-100	0-100	0-100	0-100	
PESTICIDE/HERBICIDE USE MANAGEMENT							Generally accepted as an economical program to control excessive use
Average:	NA						
Reported Range:	NA						
Probable Range:							
STREET SWEEPING							
Smooth Street, Frequent Cleaning (One or More Passes Per Week)							Avg: $20/curb mile Reported Range: $10-$30/curb mile
Average:	20	NA	NA	5	25	NA	
Reported Range:	20	NA	NA	0-10	5-35	NA	
Probable Range:	20-50	-	-	0-10	20-50	10-30	
Infrequent Cleaning (One Pass Per Month or Less)							
Average:	NA	NA	NA	NA	5	NA	
Reported Range:	NA	NA	NA	NA	0-10	NA	
Probable Range:	0-20	-	-	-	0-20	0-10	
LITTER CONTROL							
Average:	NA						Generally accepted as an economical approach to control excessive use
Reported Range:	NA						
Probable Range:							

Table 4-30. (Continued)

Management Practice	% Removal TSS	TP	TN	COD	Pb	Zn	Cost
GENERAL MAINTENANCE (e.g., pothole and roadside repairs)							Generally accepted as an economical preventive maintenance program by local and State agencies
Average:	NA						
Reported Range:	NA						
Probable Range:							
PROTECTION OF SALT PILES							For salt storage building - Ave: $30/ton salt Reported Range: $10-$70/ton salt
Average:	NA						
Reported Range:	NA						
Probable Range:	90-100[a]						
MINIMIZATION OF APPLICATION OF DEICING SALTS							Generally accepted as an economical preventive maintenance program by local and State agencies
Average:	NA						
Reported Range:	NA						
Probable Range:	Deicing salts that are not applied to roads will not enter runoff[a]						
SPECIALLY EQUIPPED SALT APPLICATION TRUCKS							For spread rate control on truck - Ave: $6,000/truck Reported Range: $6,000/truck
Average:	NA						
Reported Range:	NA						
Probable Range:	Deicing salts that are not applied to roads will not enter runoff[a]						
USE OF ALTERNATIVE DEICING MATERIALS							CMA - Ave: $650/ton Reported Range: $650/ton (note: cost of salt $30/ton)
Average:	NA						
Reported Range:	NA						
Probable Range:	Deicing salts that are not applied to roads will not enter runoff[a]						
CONTAIN POLLUTANTS GENERATED DURING BRIDGE MAINTENANCE							Varies with method of containment use
Average:	NA						
Reported Range:	NA						
Probable Range:	50-100[b]						

NA = Not applicable.
[a]Measured as reduction in salt.
[b]Measured as reduction of all pollutants.

F. Management Measure for Road, Highway, and Bridge Runoff Systems

Develop and implement runoff management systems for existing roads, highways, and bridges to reduce runoff pollutant concentrations and volumes entering surface waters.

(1) Identify priority and watershed pollutant reduction opportunities (e.g., improvements to existing urban runoff control structures; and

(2) Establish schedules for implementing appropriate controls.

1. Applicability

This management measure is intended to be applied by States to existing, resurfaced, restored, and rehabilitated roads, highways, and bridges that contribute to adverse effects in surface waters. Under the Coastal Zone Act Reauthorization Amendments of 1990, States are subject to a number of requirements as they develop coastal NPS programs in conformity with this management measure and will have some flexibility in doing so. The application of management measures by States is described more fully in *Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance*, published jointly by the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce.

2. Description

This measure requires that operation and maintenance systems include the development of retrofit projects, where needed, to collect NPS pollutant loadings from existing, reconstructed, and rehabilitated roads, highways, and bridges. Poorly designed or maintained roads and bridges can generate significant erosion and pollution loads containing heavy metals, hydrocarbons, sediment, and debris that run off into and threaten the quality of surface waters and their tributaries. In areas where such adverse impacts to surface waters can be attributed to adjacent roads or bridges, retrofit management projects to protect these waters may be needed (e.g., installation of structural or nonstructural pollution controls). Retrofit projects can be located in existing rights-of-way, within interchange loops, or on adjacent land areas. Areas with severe erosion and pollution runoff problems may require relocation or reconstruction to mitigate these impacts.

Runoff management systems are a combination of nonstructural and structural practices selected to reduce nonpoint source loadings from roads, highways, and bridges. These systems are expected to include structural improvements to existing runoff control structures for water quality purposes; construction of new runoff control devices, where necessary to protect water quality; and scheduled operation and maintenance activities for these runoff control practices. Typical runoff controls for roads, highways, and bridges include vegetated filter strips, grassed swales, detention basins, constructed wetlands, and infiltration trenches.

3. Management Measure Selection

This management measure was selected because of the demonstrated effectiveness of retrofit systems for existing roads and highways that were constructed with inadequate nonpoint source pollution controls or without such controls. Structural practices for mitigating polluted runoff from existing highways are described in the literature (Silverman, 1988).

4. Practices

As discussed more fully at the beginning of this chapter and in Chapter 1, the following practices are described for illustrative purposes only. State programs need not require implementation of these practices. However, as a practical matter, EPA anticipates that the management measure set forth above generally will be implemented by applying one or more management practices appropriate to the source, location, and climate. The practices set forth below have been found by EPA to be representative of the types of practices that can be applied successfully to achieve the management measure described above.

- *a. Locate runoff treatment facilities within existing rights-of-way or in medians and interchange loops.*
- *b. Develop multiple-use treatment facilities on adjacent lands (e.g., parks and golf courses).*
- *c. Acquire additional land for locating treatment facilities.*
- *d. Use underground storage where no alternative is available.*
- *e. Maximize the length and width of vegetated filter strips to slow the travel time of sheet flow and increase the infiltration rate of urban runoff.*

5. Effectiveness Information and Cost Information

Cost and effectiveness data for structural urban runoff management and pollution control facilities are outlined in Tables 4-15 and 4-16 in Section III and discussed in Section IV of this chapter and are applicable to determine the cost and effectiveness of retrofit projects. Retrofit projects can often be more costly to construct because of the need to locate the required structures within existing space or the need to locate the structures within adjacent property that requires purchase. However, the use of multiple-use facilities on adjacent lands, such as diverting runoff waters to parkland or golf courses, can offset this cost. Nonstructural practices described in the urban section also can be effective in achieving source control. As with other sections of this document, the costs of loss of habitat, fisheries, and recreational areas must be weighed against the cost of retrofitting control structures within existing rights-of-way.

6. Pollutants of Concern

Table 4-31 lists the pollutants commonly found in urban runoff from roads, highways, and bridges and their sources. The disposition and subsequent magnitude of pollutants found in highway runoff are site-specific and are affected by traffic volume, road or highway design, surrounding land use, climate, and accidental spills.

The FHWA conducted an extensive field monitoring and laboratory analysis program to determine the pollutant concentration in highway runoff from 31 sites in 11 States (Driscoll et al., 1990). The event mean concentrations (EMCs) developed in the study for a number of pollutants are presented in Table 4-32. The study also indicated that for highways discharging into lakes, the pollutants of major concern are phosphorus and heavy metals. For highways discharging into streams, the pollutants of major concern are heavy metals—cadmium, copper, lead, and zinc.

Table 4-31. Highway Runoff Constituents and Their Primary Sources

Constituents	Primary Sources
Particulates	Pavement wear, vehicles, atmosphere, maintenance
Nitrogen, Phosphorus	Atmosphere, roadside fertilizer application
Lead	Leaded gasoline (auto exhaust), tire wear (lead oxide filler material, lubricating oil and grease, bearing wear)
Zinc	Tire wear (filler material), motor oil (stabilizing additive), grease
Iron	Auto body rust, steel highway structures (guard rails, bridges, etc.), moving engine parts
Copper	Metal plating, bearing and bushing wear, moving engine parts, brake lining wear, fungicides and insecticides
Cadmium	Tire wear (filler material), insecticide application
Chromium	Metal plating, moving engine parts, break lining wear
Nickel	Diesel fuel and gasoline (exhaust), lubricating oil, metal plating, bushing wear, brake lining wear, asphalt paving
Manganese	Moving engine parts
Cyanide	Anticake compound (ferric ferrocyanide, sodium ferrocyanide, yellow prussiate of soda) used to keep deicing salt granular
Sodium, Calcium, Chloride	Deicing salts
Sulphate	Roadway beds, fuel, deicing salts
Petroleum	Spills, leaks or blow-by of motor lubricants, antifreeze and hydraulic fluids, asphalt surface leachate

In colder regions where deicing agents are used, deicing chemicals and abrasives are the largest source of pollutants during winter months. Deicing salt (primarily sodium chloride, NaCl) is the most commonly used deicing agent. Potential pollutants from deicing salt include sodium chloride, ferric ferrocyanide (used to keep the salt in granular form), and sulfates such as gypsum. Table 4-33 summarizes potential environmental impacts caused by road salt. Other chemicals used as a salt substitute include calcium magnesium acetate (CMA) and, less frequently, urea and glycol compounds. Researchers have differing opinions on the environmental impacts of CMA compared to those of road salt (Chevron Chemical Company, 1991; Salt Institute, undated; Transportation Research Board, 1991).

Table 4-32. Pollutant Concentrations in Highway Runoff (Driscoll et al., 1990)

Pollutant	Event Mean Concentration for Highways With Fewer Than 30,000 Vehicles/Day[a] (mg/L)	Event Mean Concentration for Highways With More Than 30,000 Vehicles/Day[a] (mg/L)
Total Suspended Solids	41	142
Volatile Suspended Solids	12	39
Total Organic Carbon	8	25
Chemical Oxygen Demand	49	114
Nitrite and Nitrate	0.46	0.76
Total Kjeldahl Nitrogen	0.87	1.83
Phosphate Phosphorus	0.16	0.40
Copper	0.022	0.054
Lead	0.080	0.400
Zinc	0.080	0.329

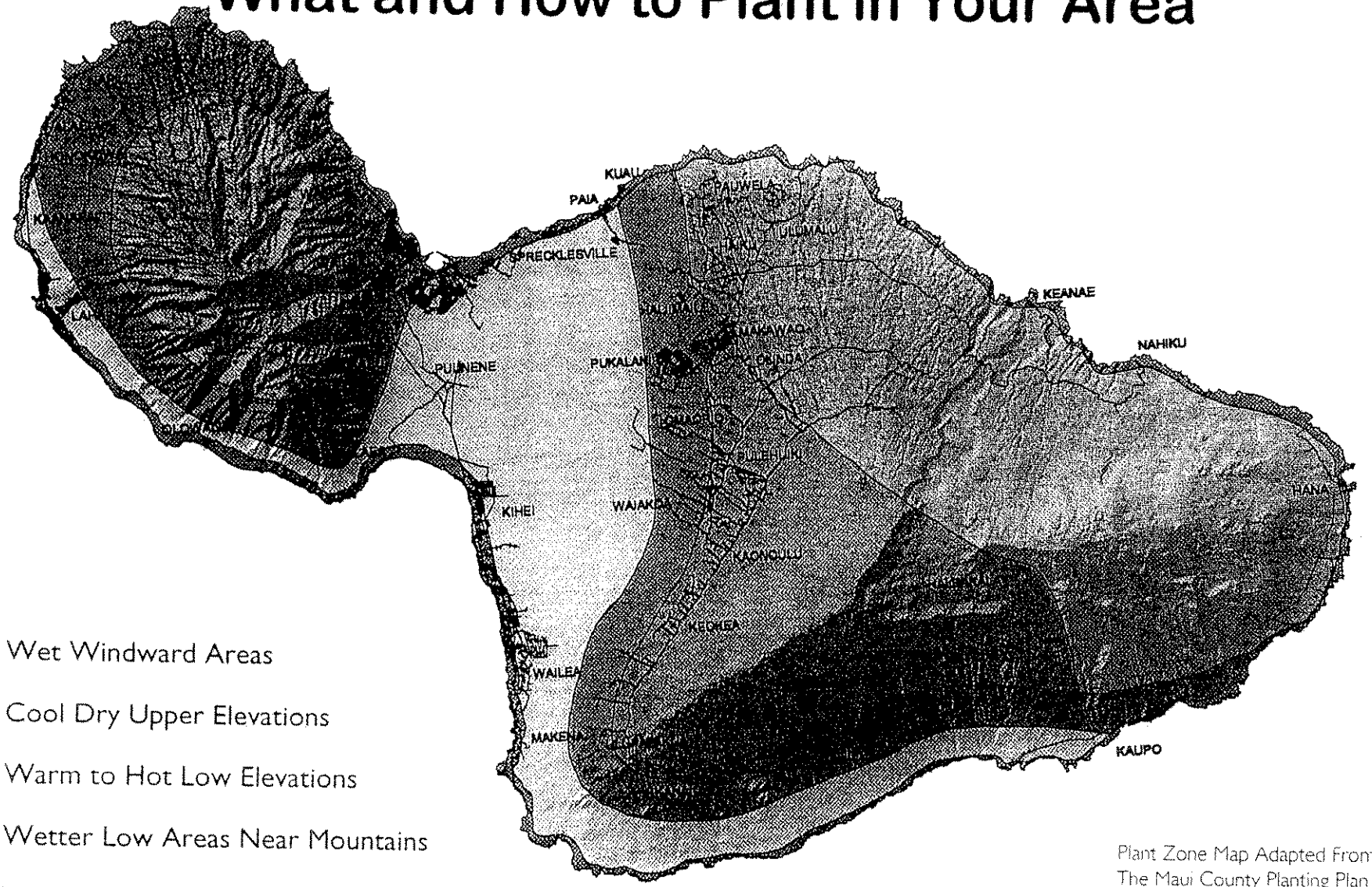
[a]Event mean concentrations are for the 50% median site.

Table 4-33. Potential Environmental Impacts of Road Salts

Environmental Resource	Potential Environmental Impact of Road Salt (NaCl)
Soils	May accumulate in soil. Breaks down soil structure, increases erosion. Causes soil compaction that results in decreased permeability.
Vegetation	Osmotic stress and soil compaction harm root systems. Spray causes foliage dehydration damage. Many plant species are salt-sensitive.
Ground Water	Mobile Na and Cl ions readily reach ground water. Increases NaCl concentration in well water, as well as alkalinity and hardness.
Surface Water	Causes density stratification in ponds and lakes that can prevent reoxygenation. Increases runoff of heavy metals and nutrients through increased erosion.
Aquatic Life	Monovalent Na and Cl ions stress osmotic balances. Toxic levels: Na - 500 ppm for stickleback; Cl - 400 ppm for trout.
Human/Mammalian	Sodium is linked to heart disease and hypertension. Chlorine causes unpleasant taste in drinking water. Mild skin and eye irritant. Acute oral LD_{50} in rats is approximately 3,000 mg/kg (slightly toxic).

Saving Water in The Yard

What and How to Plant in Your Area



1 Wet Windward Areas

Cool Dry Upper Elevations

3 Warm to Hot Low Elevations

Wetter Low Areas Near Mountains

Windward Coastal Salt Spray Zones

Plant Zone Map Adapted From
The Maui County Planting Plan

Tips From The Maui County Department of Water Supply

By Water All Things Find Life

Zone-specific Native and Polynesian plants for Maui County

Zone 1

TYPE: **F** Fern **G** Grass **Gr** Ground Cover **Sh** Shrub **P** Palm **S** Sedge **Tr** Tree **V** Vine

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
F	Psilotum nudum	moa, moa kula	1'	1'	sea to 3,000'	Dry to Wet
F	Sadleria cyatheoides	'ama'u, ama'uma'u				
Gr - Sh	Lipochaeta succulenta	nehe	2'	5'	sea to 1,000'	Dry to Wet
P	Cocos nucifera	coconut, niu	100'	30'	sea to 1,000'	Dry to Wet
P	Pritchardia arecina	lo'ulu, hawane	40'	10'	1,000' to 3,000'	Dry to Wet
P	Pritchardia forbesiana	lo'ulu	15'			
P	Pritchardia hillebrandii	lo'ulu, fan palm	25'	15'	sea to 1,000'	Dry to Wet
S	Mariscus javanicus	marsh cypress, 'ahu'awa	0.5'	0.5'	sea to 1,000'	Dry to Medium
Sh	Bidens hillebrandiana ssp. hillebrandiana	ko'oko'olau	1'	2'	sea to 1,000'	Dry to Wet
Sh	Cordyline fruticosa	ti, ki	6			
Sh	Hedyotis spp.	au, pilo	3'	2'	1,000' to 3,000'	Dry to Wet
Sh - Tr	Broussonetia papyrifera	wauke, paper mulberry	8'	6'	sea to 1,000'	Dry to Medium
Tr	Acacia koa	koa	50' - 100'	40' - 80'	1,500' to 4,000'	Dry to Medium
Tr	Aleurites moluccana	candlenut, kukui	50'	50'	sea to 3,000'	Medium to Wet
Tr	Calophyllum inophyllum	kamani, alexandrian laurel	60'	40'	sea to 3,000'	Medium to Wet
Tr	Charpentiera obovata		15'			
Tr	Cordia subcordata	kou	30'	25'	sea to 1,000'	Dry to Wet
Tr	Hibiscus furcellatus	'akiohala, hau-hele	8'			
Tr	Metrosideros polymorpha var. macrophylla	ohi'a lehua	25'	25'	sea to 1,000'	Dry to Wet
Tr	Morinda citrifolia	indian mulberry, noni	20'	15'	sea to 1,000'	Dry to Wet
Tr	Pandanus tectorius	hala, puhala (HALELIST)	35'	25'	sea to 1,000'	Dry to Wet
V	Alyxia oliviformis	maile	Vine		sea to 6,000'	Medium to Wet

Zone-specific Native and Polynesian plants for Maui County

Zone 2

TYPE: **F** Fern **G** Grass **Gr** Ground Cover **Sh** Shrub **P** Palm **S** Sedge **Tr** Tree **V** Vine

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
F	Psilotum nudum	moa, moa kula	1'	1'	sea to 3,000'	Dry to Wet
F	Sadleria cyatheoides	'ama'u, ama'uma'u				
G	Eragrostis monticola	kalamalo	1'	2'	sea to 3,000'	Dry to Medium
Gr	Ipomoea tuboides	Hawaiian moon flower, 'uala	1'	10'	sea to 3,000'	Dry to Medium
Gr	Peperomia leptostachya	'ala'ala-wai-nui	1'	1'	sea to 3,000'	Dry to Medium
Gr	Plumbago zeylanica	'ilie'e	1'			
Gr - Sh	Hibiscus calyphyllus	ma'o hau hele, Rock's hibiscus	3'	2'	sea to 3,000'	Dry to Medium
Gr - Sh	Lipochaeta rockii	nehe	2'	2'	sea to 3,000'	Dry to Medium
Sh	Argemone glauca var. decipiens	pua kala	3'	2'	sea to 3,000'	Dry to Medium
Sh	Artemisia mauiensis var. diffusa	Maui wormwood, 'ahinahina	2'	3'	1,000' to higher	Dry to Medium
Sh	Chenopodium oahuense	'aheahea, 'aweoweo	6'		sea to higher	Dry to Medium
Sh	Dianella sandwicensis	'uki	2'	2'	1,000' to higher	Dry to Medium
Sh	Lipochaeta lavarum	nehe	3'	3'	sea to 3,000'	Dry to Medium
Sh	Osteomeles anthyllidifolia	'ulei, eluehe	4'	6'	sea to 3,000'	Dry to Medium
Sh	Senna gaudichaudii	kolomana	5'	5'	sea to 3,000'	Dry to Medium
Sh	Styphelia tamelameiae	pukiawe	6'	6'	1,000' to higher	Dry to Medium
Sh	Vitex rotundifolia	pohinahina	3'	4'	sea to 1,000'	Dry to Medium
Sh - Tr	Myoporum sandwicense	naio, false sandalwood	10'	10'	sea to higher	Dry to Medium
Sh - Tr	Nototrichium sandwicense	kulu'i	8'	8'	sea to 3,000'	Dry to Medium
Sh-Tr	Dodonaea viscosa	'a'ali'i	6'	8'	sea to higher	Dry to Medium
Tr	Acacia koa	koa	50' - 100'	40' - 80'	1,500' to 4,000'	Dry to Medium
Tr	Charpentiera obovata		15'			
Tr	Erythrina sandwicensis	wiliwili	20'	20'	sea to 1,000'	Dry
Tr	Metrosideros polymorpha var. macrophylla	ohi'a lehua	25'	25'	sea to 1,000'	Dry to Wet

Zone-specific Native and Polynesian plants for Maui County

Zone 2

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
Tr	Nestegis sandwicensis	olopua	15'	15'	1,000' to 3,000'	Dry to Medium
Tr	Pleomele auwahiensis	halapepe	20'			
Tr	Rauvolfia sandwicensis	hao	20'	15'	sea to 3,000'	Dry to Medium
Tr	Santalum ellipticum	coastal sandalwood, 'ili-ahi	8'	8'	sea to 3,000'	Dry to Medium
Tr	Sophora chrysophylla	mamane	15'	15'	1,000' to 3,000'	Medium
V	Alyxia oliviformis	maile	Vine		sea to 6,000'	Medium to Wet

Zone-specific Native and Polynesian plants for Maui County

Zone 3

TYPE: **F** Fern **G** Grass **Gr** Ground Cover **Sh** Shrub **P** Palm **S** Sedge **Tr** Tree **V** Vine

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
F	Psilotum nudum	moa, moa kula	1'	1'	sea to 3,000'	Dry to Wet
G	Colubrina asiatica	'anapanapa	3'	10'	sea to 1,000'	Dry to Wet
G	Eragrostis monticola	kalamalo	1'	2'	sea to 3,000'	Dry to Medium
G	Eragrostis variabilis	'emo-loa	1'	2'	sea to 3,000'	Dry to Medium
G	Fimbristylis cymosa ssp. spathacea	mau'u'aki'aki fimbristylis	0.5'	1'	sea to 1,000'	Dry to Medium
Gr	Boerhavia repens	alena	0.5'	4'	sea to 1,000'	Dry to Medium
Gr	Chamaesyce celastroides var. laehiensis	'akoko	2'	3'	sea to 1,000'	Dry to Medium
Gr	Cressa truxillensis	cressa	0.5'	1'	sea to 1,000'	Dry to Medium
Gr	Heliotropium anomalum var. argenteum	hinahina ku kahakai	1'	2'	sea to 1,000'	Dry to Medium
Gr	Ipomoea tuboides	Hawaiian moon flower, 'uala	1'	10'	sea to 3,000'	Dry to Medium
Gr	Jacquemontia ovalifolia ssp. sandwicensis	pa'u o hi'iaka	0.5'	6'	sea to 1,000'	Dry to Medium
Gr	Lipochaeta integrifolia	nehe	1'	5'	sea to 1,00'	Dry to Medium
Gr	Peperomia leptostachya	'ala'ala-wai-nui	1'	1'	sea to 3,000'	Dry to Medium
Gr	Plumbago zeylanica	'ilie'e	1'			
Gr	Sesuvium portulacastrum	'akulikuli, sea-purslane	0.5'	2'	sea to 1,000'	Dry to Wet
Gr	Sida fallax	'ilima	0.5'	3'	sea to 1,000'	Dry to Medium
Gr	Tephrosia purpurea var. purpurea	'auhuhu	2'	2'	sea to 1,000'	Dry to Medium
Gr - Sh	Hibiscus calyphyllus	ma'o hau hele, Rock's hibiscus	3'	2'	sea to 3,000'	Dry to Medium
Gr - Sh	Lipochaeta rockii	nehe	2'	2'	sea to 3,000'	Dry to Medium
Gr - Sh	Lipochaeta succulenta	nehe	2'	5'	sea to 1,000'	Dry to Wet
Gr - Sh	Lycium sandwicense	'ohelo-kai, 'ae'ae	2'	2'	sea to 1,000'	Dry to Medium
P	Cocos nucifera	coconut, niu	100'	30'	sea to 1,000'	Dry to Wet
P	Pritchardia hillebrandii	lo'ulu, fan palm	25'	15'	sea to 1,000'	Dry to Wet
S	Mariscus javanicus	marsh cypress, 'ahu'awa	0.5'	0.5'	sea to 1,000'	Dry to Medium

Zone-specific Native and Polynesian plants for Maui County

Zone 3

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
Sh	Argemone glauca var. deciplens	pua kala	3'	2'	sea to 3,000'	Dry to Medium
Sh	Bidens mauiensis	ko'oko'olau	1'	3'	sea to 1,000'	Dry to Medium
Sh	Bidens menziesii ssp. menziesii	ko'oko'olau	1'	3'		
Sh	Bidens micrantha ssp. micrantha	ko'oko'olau	1'	3'		
Sh	Chenopodium oahuense	'aheahea, 'aweoweo	6'		sea to higher	Dry to Medium
Sh	Dianella sandwicensis	'uki	2'	2'	1,000' to higher	Dry to Medium
Sh	Gossypium tomentosum	mao, Hawaiian cotton	5'	8'	sea to 1,000'	Dry to Medium
Sh	Hedyotis spp.	au, pilo	3'	2'	1,000' to 3,000'	Dry to Wet
Sh	Lipochaeta lavarum	nehe	3'	3'	sea to 3,000'	Dry to Medium
Sh	Osteomeles anthyllidifolia	'ulei, eluehe	4'	6'	sea to 3,000'	Dry to Medium
Sh	Scaevola sericea	naupaka, naupaka-kahakai	6'	8'	sea to 1,000'	Dry to Medium
Sh	Senna gaudichaudii	kolomana	5'	5'	sea to 3,000'	Dry to Medium
Sh	Solanum nelsonii	'akia, beach solanum	3'	3'	sea to 1,00'	Dry to Medium
Sh	Styphelia tameiameiae	pukiawe	6'	6'	1,000' to higher	Dry to Medium
Sh	Vitex rotundifolia	pohinahina	3'	4'	sea to 1,000'	Dry to Medium
Sh	Wikstroemia uva-ursi kauaiensis kauaiensis	'akia, Molokai osmanthus				
Sh - Tr	Broussonetia papyrifera	wauke, paper mulberry	8'	6'	sea to 1,000'	Dry to Medium
Sh - Tr	Myoporum sandwicense	naio, false sandalwood	10'	10'	sea to higher	Dry to Medium
Sh - Tr	Nototrichium sandwicense	kulu'i	8'	8'	sea to 3,000'	Dry to Medium
Sh-Tr	Dodonaea viscosa	'a'ali'i	6'	8'	sea to higher	Dry to Medium
Tr	Aleurites moluccana	candlenut, kukui	50'	50'	sea to 3,000'	Medium to Wet
Tr	Calophyllum inophyllum	kamani, alexandrian laurel	60'	40'	sea to 3,000'	Medium to Wet
Tr	Canthium odoratum	Alahe'e, 'ohe'e, walahe'e	12'	8'	sea to 3,000'	Dry to Medium
Tr	Cordia subcordata	kou	30'	25'	sea to 1,000'	Dry to Wet
Tr	Diospyros sandwicensis	lama	12'	15'	sea to 3,000'	Dry to Medium
Tr	Erythrina sandwicensis	wiliwili	20'	20'	sea to 1,000'	Dry
Tr	Metrosideros polymorpha var. macrophylla	ohi'a lehua	25'	25'	sea to 1,000'	Dry to Wet

Zone-specific Native and Polynesian plants for Maui County

Zone 3

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
Tr	Morinda citrifolia	indian mulberry, noni	20'	15'	sea to 1,000'	Dry to Wet
Tr	Nesoluma polynesicum	keahi	15'	15'	sea to 3,00'	Dry
Tr	Nestegis sandwicensis	olopua	15'	15'	1,000' to 3,000'	Dry to Medium
Tr	Pandanus tectorius	hala, puhala (HALELIST)	35'	25'	sea to 1,000'	Dry to Wet
Tr	Pleomele auwahiensis	halapepe	20'			
Tr	Rauvolfia sandwicensis	hao	20'	15'	sea to 3,000'	Dry to Medium
Tr	Reynoldsia sandwicensis	'ohe makai	20'	20'	1,000' to 3,000'	Dry
Tr	Santalum ellipticum	coastal sandalwood, 'ili-ahi	8'	8'	sea to 3,000'	Dry to Medium
Tr	Thespesia populnea	milo	30'	30'	sea to 3,000'	Dry to Wet

Zone-specific Native and Polynesian plants for Maui County

Zone 4

TYPE: F Fern G Grass Gr Ground Cover Sh Shrub P Palm S Sedge Tr Tree V Vine

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
F	Psilotum nudum	moa, moa kula	1'	1'	sea to 3,000'	Dry to Wet
F	Sadleria cyatheoides	'ama'u, ama'uma'u				
G	Colubrina asiatica	'anapanapa	3'	10'	sea to 1,000'	Dry to Wet
G	Eragrostis monticola	kalamalo	1'	2'	sea to 3,000'	Dry to Medium
G	Eragrostis variabilis	'emo-loa	1'	2'	sea to 3,000'	Dry to Medium
G	Fimbristylis cymosa ssp. spathacea	mau'u'aki'aki fimbristylis	0.5'	1'	sea to 1,000'	Dry to Medium
Gr	Chamaesyce celastroides var. laehiensis	'akoko	2'	3'	sea to 1,000'	Dry to Medium
Gr	Ipomoea tuboides	Hawaiian moon flower, 'uala	1'	10'	sea to 3,000'	Dry to Medium
Gr	Jacquemontia ovalifolia ssp. sandwicensis	pa'u o hi'iaka	0.5'	6'	sea to 1,000'	Dry to Medium
Gr	Lipochaeta integrifolia	nehe	1'	5'	sea to 1,00'	Dry to Medium
Gr	Peperomia leptostachya	'ala'ala-wai-nui	1'	1'	sea to 3,000'	Dry to Medium
Gr	Plumbago zeylanica	'ilie'e	1'			
Gr	Sida fallax	'ilima	0.5'	3'	sea to 1,000'	Dry to Medium
Gr	Tephrosia purpurea var. purpurea	'auhuhu	2'	2'	sea to 1,000'	Dry to Medium
Gr - Sh	Hibiscus calyphyllus	ma'o hau hele, Rock's hibiscus	3'	2'	sea to 3,000'	Dry to Medium
Gr - Sh	Lipochaeta rockii	nehe	2'	2'	sea to 3,000'	Dry to Medium
Gr - Sh	Lipochaeta succulenta	nehe	2'	5'	sea to 1,000'	Dry to Wet
P	Cocos nucifera	coconut, niu	100'	30'	sea to 1,000'	Dry to Wet
P	Pritchardia arecina	lo'ulu, hawane	40'	10'	1,000' to 3,000'	Dry to Wet
P	Pritchardia forbesiana	lo'ulu	15'			
P	Pritchardia hillebrandii	lo'ulu, fan palm	25'	15'	sea to 1,000'	Dry to Wet
S	Mariscus javanicus	marsh cypress, 'ahu'awa	0.5'	0.5'	sea to 1,000'	Dry to Medium
Sh	Argemone glauca var. decipiens	pua kala	3'	2'	sea to 3,000'	Dry to Medium
Sh	Artemisia australis	'ahinahina	2'	3'	sea to 3,000'	Dry to Medium

Zone-specific Native and Polynesian plants for Maui County

Zone 4

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
Sh	Artemisia mauiensis var. diffusa	Maui wormwood, 'ahinahina	2'	3'	1,000' to higher	Dry to Medium
Sh	Bidens hillebrandiana ssp. hillebrandiana	ko'oko'olau	1'	2'	sea to 1,000'	Dry to Wet
Sh	Bidens menziesii ssp. menziesii	ko'oko'olau	1'	3'		
Sh	Bidens micrantha ssp. micrantha	ko'oko'olau	1'	3'		
Sh	Cordyline fruticosa	ti, ki	6			
Sh	Dianella sandwicensis	'uki	2'	2'	1,000' to higher	Dry to Medium
Sh	Lipochaeta lavarum	nehe	3'	3'	sea to 3,000'	Dry to Medium
Sh	Osteomeles anthyllidifolia	'ulei, eluehe	4'	6'	sea to 3,000'	Dry to Medium
Sh	Scaevola sericea	naupaka, naupaka-kahakai	6'	8'	sea to 1,000'	Dry to Medium
Sh	Solanum nelsonii	'akia, beach solanum	3'	3'	sea to 1,00'	Dry to Medium
Sh	Styphelia tamelameiae	pukiawe	6'	6'	1,000' to higher	Dry to Medium
Sh	Vitex rotundifolia	pohinahina	3'	4'	sea to 1,000'	Dry to Medium
Sh	Wikstroemia uva-ursi kauaiensis kauaiensis	'akia, Molokai osmanthus				
Sh - Tr	Broussonetia papyrifera	wauke, paper mulberry	8'	6'	sea to 1,000'	Dry to Medium
Sh - Tr	Myoporum sandwicense	naio, false sandalwood	10'	10'	sea to higher	Dry to Medium
Sh - Tr	Nototrichium sandwicense	kulu'i	8'	8'	sea to 3,000'	Dry to Medium
Sh-Tr	Dodonaea viscosa	'a'ali'i	6'	8'	sea to higher	Dry to Medium
Tr	Acacia koa	koa	50' - 100'	40' - 80'	1,500' to 4,000'	Dry to Medium
Tr	Aleurites moluccana	candlenut, kukui	50'	50'	sea to 3,000'	Medium to Wet
Tr	Calophyllum inophyllum	kamani, alexandrian laurel	60'	40'	sea to 3,000'	Medium to Wet
Tr	Canthium odoratum	Alahe'e, 'ohe'e, walahe'e	12'	8'	sea to 3,000'	Dry to Medium
Tr	Charpentiera obovata		15'			
Tr	Cordia subcordata	kou	30'	25'	sea to 1,000'	Dry to Wet
Tr	Diospyros sandwicensis	lama	12'	15'	sea to 3,000'	Dry to Medium
Tr	Hibiscus furcellatus	'akiohala, hau-hele	8'			
Tr	Metrosideros polymorpha var. macrophylla	ohi'a lehua	25'	25'	sea to 1,000'	Dry to Wet
Tr	Morinda citrifolia	indian mulberry, noni	20'	15'	sea to 1,000'	Dry to Wet

Zone-specific Native and Polynesian plants for Maui County

Zone 4

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
Tr	Nestegis sandwicensis	olopua	15'	15'	1,000' to 3,000'	Dry to Medium
Tr	Pandanus tectorius	hala, puhala (HALELIST)	35'	25'	sea to 1,000'	Dry to Wet
Tr	Pleomele auwahiensis	halapepe	20'			
Tr	Rauvolfia sandwicensis	hao	20'	15'	sea to 3,000'	Dry to Medium
Tr	Santalum ellipticum	coastal sandalwood, 'iliahi	8'	8'	sea to 3,000'	Dry to Medium
Tr	Sophora chrysophylla	mamane	15'	15'	1,000' to 3,000'	Medium
Tr	Thespesia populnea	milo	30'	30'	sea to 3,000'	Dry to Wet
V	Alyxia oliviformis	maile	Vine		sea to 6,000'	Medium to Wet

Zone-specific Native and Polynesian plants for Maui County

Zone 5

TYPE: F Fern G Grass Gr Ground Cover Sh Shrub P Palm S Sedge Tr Tree V Vine

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
G	Colubrina asiatica	'anapanapa	3'	10'	sea to 1,000'	Dry to Wet
G	Eragrostis variabilis	'emo-loa	1'	2'	sea to 3,000'	Dry to Medium
G	Fimbristylis cymosa ssp. spathacea	mau'u'aki'aki fimbristylis	0.5'	1'	sea to 1,000'	Dry to Medium
Gr	Boerhavia repens	alena	0.5'	4'	sea to 1,000'	Dry to Medium
Gr	Chamaesyce celastroides var. laehiensis	'akoko	2'	3'	sea to 1,000'	Dry to Medium
Gr	Cressa truxillensis	cressa	0.5'	1'	sea to 1,000'	Dry to Medium
Gr	Heliotropium anomalum var. argenteum	hinahina ku kahakai	1'	2'	sea to 1,000'	Dry to Medium
Gr	Jacquemontia ovalifolia ssp. sandwicensis	pa'u o hi'iaka	0.5'	6'	sea to 1,000'	Dry to Medium
Gr	Lipochaeta integrifolia	nehe	1'	5'	sea to 1,00'	Dry to Medium
Gr	Sesuvium portulacastrum	'akulikuli, sea-purslane	0.5'	2'	sea to 1,000'	Dry to Wet
Gr	Sida fallax	'ilima	0.5'	3'	sea to 1,000'	Dry to Medium
Gr	Tephrosia purpurea var. purpurea	'auhuhu	2'	2'	sea to 1,000'	Dry to Medium
Gr - Sh	Hibiscus calyphyllus	ma'o hau hele, Rock's hibiscus	3'	2'	sea to 3,000'	Dry to Medium
Gr - Sh	Lycium sandwicense	'ohelo-kai, 'ae'ae	2'	2'	sea to 1,000'	Dry to Medium
P	Cocos nucifera	coconut, niu	100'	30'	sea to 1,000'	Dry to Wet
P	Pritchardia hillebrandii	lo'ulu, fan palm	25'	15'	sea to 1,000'	Dry to Wet
S	Mariscus javanicus	marsh cypress, 'ahu'awa	0.5'	0.5'	sea to 1,000'	Dry to Medium
Sh	Argemone glauca var. decipiens	pua kala	3'	2'	sea to 3,000'	Dry to Medium
Sh	Artemisia australis	'ahinahina	2'	3'	sea to 3,000'	Dry to Medium
Sh	Bidens hillebrandiana ssp. hillebrandiana	ko'oko'olau	1'	2'	sea to 1,000'	Dry to Wet
Sh	Bidens mauiensis	ko'oko'olau	1'	3'	sea to 1,000'	Dry to Medium
Sh	Chenopodium oahuense	'aheahea, 'aweoweo	6'		sea to higher	Dry to Medium
Sh	Dianella sandwicensis	'uki	2'	2'	1,000' to higher	Dry to Medium
Sh	Gossypium tomentosum	mao, Hawaiian cotton	5'	8'	sea to 1,000'	Dry to Medium

Zone-specific Native and Polynesian plants for Maui County

Zone 5

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
Sh	Hedyotis spp.	au, pilo	3'	2'	1,000' to 3,000'	Dry to Wet
Sh	Lipochaeta lavarum	nehe	3'	3'	sea to 3,000'	Dry to Medium
Sh	Osteomeles anthyllidifolia	'ulei, eluehe	4'	6'	sea to 3,000'	Dry to Medium
Sh	Scaevola sericea	naupaka, naupaka-kahakai	6'	8'	sea to 1,000'	Dry to Medium
Sh	Senna gaudichaudii	kolomana	5'	5'	sea to 3,000'	Dry to Medium
Sh	Solanum nelsonii	'akia, beach solanum	3'	3'	sea to 1,00'	Dry to Medium
Sh	Vitex rotundifolia	pohinahina	3'	4'	sea to 1,000'	Dry to Medium
Sh	Wikstroemia uva-ursi kauaiensis kauaiensis	'akia, Molokai osmanthus				
Sh - Tr	Myoporum sandwicense	naio, false sandalwood	10'	10'	sea to higher	Dry to Medium
Sh-Tr	Dodonaea viscosa	'a'ali'i	6'	8'	sea to higher	Dry to Medium
Tr	Aleurites moluccana	candlenut, kukui	50'	50'	sea to 3,000'	Medium to Wet
Tr	Calophyllum inophyllum	kamani, alexandrian laurel	60'	40'	sea to 3,000'	Medium to Wet
Tr	Cordia subcordata	kou	30'	25'	sea to 1,000'	Dry to Wet
Tr	Hibiscus furcellatus	'akiohala, hau-hele	8'			
Tr	Morinda citrifolia	indian mulberry, noni	20'	15'	sea to 1,000'	Dry to Wet
Tr	Pandanus tectorius	hala, puhala (HALELIST)	35'	25'	sea to 1,000'	Dry to Wet
Tr	Thespesia populnea	milo	30'	30'	sea to 3,000'	Dry to Wet
V	Ipomoea pes-caprae	beach morning glory, pohuehue	1			

DO NOT PLANT THESE PLANTS !!!

Common name	Scientific name	Plant family
black wattle	Acacia mearnsii	Mimosaceae
blackberry	Rubus argutus	Rosaceae
blue gum	Eucalyptus globulus	Myrtaceae
bocconia	Bocconia frutescens	Papaveraceae
broad-leaved cordia	Cordia glabra	Boraginaceae
broomsedge, yellow bluestem	Andropogon virginicus	Poaceae
buffelgrass	Cenchrus ciliaris	Poaceae
butterfly bush, smoke bush	Buddleja madagascariensis	Buddlejaceae
cats claw, Mysore thorn, wait-a-bit	Caesalpinia decapetala	Caesalpiniaceae
common ironwood	Casuarina equisetifolia	Casuarinaceae
common velvet grass, Yorkshire fog	Holcus lanatus	Poaceae
fiddlewood	Citharexylum spinosum	Verbenaceae
fire tree, faya tree	Myrica faya	Myricaceae
glorybower	Clerodendrum laponicum	Verbenaceae
hairy cat's ear, gosmore	Hypochoeris radicata	Asteraceae
haole koa	Leucaena leucocephala	Fabaceae
ivy gourd, scarlet-fruited gourd	Coccinia grandis	Cucurbitaceae
juniper berry	Citharexylum caudatum	Verbenaceae
kahili flower	Grevillea banksii	Proteaceae
klu, popinac	Acacia farnesiana	Mimosaceae
logwood, bloodwood tree	Haematoxylon campechianum	Caesalpiniaceae
loquat	Eriobotrya japonica	Rosaceae
meadow ricegrass	Ehrharta stipoides	Poaceae
melaleuca	Melaleuca quinquenervia	Myrtaceae
miconia, velvet leaf	Miconia calvescens	Melastomataceae
narrow-leaved carpetgrass	Axonopus fissifolius	Poaceae
oleaster	Elaeagnus umbellata	Elaeagnaceae
oriental mangrove	Bruguiera gymnorrhiza	Rhizophoraceae
padang cassia	Cinnamomum burmanii	Lauraceae
palmgrass	Setaria palmifolia	Poaceae
pearl flower	Heterocentron subtriplinervium	Melastomataceae
quinine tree	Cinchona pubesens	Rubiaceae
satin leaf, caimitillo	Chrysophyllum oliviforme	Sapotaceae
silkwood, Queensland maple	Flindersia brayleyana	Rutaceae
silky oak, silver oak	Grevillea robusta	Proteaceae
strawberry guava	Psidium cattleianum	Myrtaceae
swamp oak, saltmarsh, longleaf ironwood	Casuarina glauca	Casuarinaceae
sweet vernalgrass	Anthoxanthum odoratum	Poaceae
tree of heaven	Allanthus altissima	Simaroubaceae
trumpet tree, guarumo	Cecropia obtusifolia	Cecropiaceae
white ginger	Hedychium coronarium	Zingiberaceae
white moho	Heliocarpus popayanensis	Tiliaceae
yellow ginger	Hedychium flavescens	Zingiberaceae

DO NOT PLANT THESE PLANTS !!!

Common name	Scientific name	Plant family
	Jasminum fluminense	Oleaceae
	Arthrostema ciliatum	Melastomataceae
	Dissotis rotundifolia	Melastomataceae
	Erigeron karvinskianus	Asteraceae
	Eucalyptus robusta	Myrtaceae
	Hedychium gardnerianum	Zingiberaceae
	Juncus planifolius	Juncaceae
	Lophostemon confertus	Myrtaceae
	Medinilla cumingii	Melastomataceae
	Medinilla magnifica	Melastomataceae
	Medinilla venosa	Melastomataceae
	Melastoma candidum	Melastomataceae
	Melinis minutiflora	Poaceae
	Olea europaea	
	Oxyspora paniculata	Melastomataceae
	Panicum maximum	Poaceae
	Paspalum urvillei	Poaceae
	Passiflora edulis	Passifloraceae
	Phormium tenax	Agavaceae
	Pinus taeda	Pinaceae
	Prosopis pallida	Fabaceae
	Pterolepis glomerata	Melastomataceae
	Rhodomyrtus tomentosa	Myrtaceae
	Schefflera actinophylla	Araliaceae
	Syzygium jambos	Myrtaceae
Australian blackwood	Acacia melanoxylon	Mimosaceae
Australian tree fern	Cyathea cooperi	Cyatheaceae
Australian tree fern	Sphaeropteris cooperi	Cyatheaceae
Beggar's tick, Spanish needle	Bidens pilosa	Asteraceae
California grass	Brachiaria mutica	Poaceae
Chinese banyon, Maylayan banyon	Ficus mirocarpa	Moraceae
Chinese violet	Asystasia gangetica	Acanthaceae
Christmasberry, Brazilian pepper	Schinus terebinthifolius	Anacardiaceae
Formosan koa	Acacia confusa	Mimosaceae
German ivy	Senecio mikanioides	Asteraceae
Japanese honeysuckle	Lonicera japonica	Caprifoliaceae
Koster's curse	Clidemia hirta	Melastomataceae
Lantana	Lantana camara	Verbenaceae
Mauritius hemp	Furcraea foetida	Agavaceae
Mexican ash, tropical ash	Fraxinus uhdei	Oleaceae
Mexican tulip poppy	Hunnemannia fumariifolia	Papaveraceae
Mules foot, Madagascar tree fern	Angiopteris evecta	Marattiaceae
New Zealand laurel, karakaranut	Corynocarpus laevigatus	Corynocarpaceae
New Zealand tea	Leptospermum scoparium	Myrtaceae
Pampas grass	Cortaderia jubata	Poaceae
Panama rubber tree, Mexican rubber tree	Castilloa elastica	Moraceae
Shoebutton ardisia	Ardisia elliptica	Myrsinaceae
banana poka	Passiflora mollissima	Passifloraceae

Selection

As a general rule, it is best to select the largest and healthiest specimens. However, be sure to note that they are not pot-bound. Smaller, younger plants may result in a low rate of plant survival.[1] When selecting native species, consider the site they are to be planted in, and the space that you have to plant. For example: Mountain species such as koa and maile will not grow well in hot coastal areas exposed to strong ocean breezes. Lowland and coastal species such as wiliwili and Kou require abundant sunshine and porus soil. They will not grow well with frequent cloud cover, high rainfall and heavy soil.

Consider too, the size that the species will grow to be. It is not wise to plant trees that will grow too large.[2] Overplanting tends to be a big problem in the landscape due to the underestimation of a species' height, width or spread.

A large, dense canopied tree such as the kukui is a good shade tree for a lawn. However, it's canopy size and density of shade will limit what can be planted in the surrounding area. Shade cast by a koa and ohia lehua is relatively light and will not inhibit growth beneath it.

Keep seasons in mind when you are selecting your plants. Not all plants look good year round, some plants such as ilima will look scraggly after they have flowered and formed seeds. Avoid planting large areas with only one native plant. Mixing plants which naturally grow together will ensure the garden will look good all year round.[3] Looking at natural habitats helps to show how plants grow naturally in the landscape.

When planting an area with a mixed-ecosystem, keep in mind the size and ecological requirements of each plant. Start with the hardiest and most easily grown species, but allow space for fragile ones in subsequent plantings.

Acquiring natives

Plants in their wild habitat must be protected and maintained. It is best and easiest to get your plants from nurseries (see list), or friend's gardens. Obtain proper permits from landowners and make sure you follow a few common sense rules:

- collect sparingly from each plant or area.
- some plants are on the state or Federal Endangered Species list. Make sure you get permits (see app. A,B)

---

[1] K. Nagata, P.6

[2] K. Nagata, P.9

[3] Nagata, P.9

Soil

Once you have selected your site and the plants you wish to establish there, you must look at the soil conditions on the site. Proper soil is necessary for the successful growth of most native plants, which preform poorly in hard pan, clay or adobe soils. If natives are to be planted in these types of soil, it would be wise to dig planting holes several times the size of the rootball and backfill with 50-75% compost.[4] A large planting hole ensures the development of a strong root system. The plant will have a headstart before the roots penetrate the surrounding poor soil.[5]

It is recommended that native plants not be planted in ground that is more dense than potting soil. If there is no alternative, dig a hole in a mound of soil mixed with volcanic cinder which encourages maximum root development. Fill the hole with water, if the water tends to puddle or drain too slowly, dig a deeper hole until the water does not puddle longer than 1 or 2 minutes.[6] Well-drained soil is one of the most important things when planting natives as you will see in the next section.

Irrigation

Most natives do very poorly in waterlogged conditions. Do not water if the soil is damp. Water when the soil is dry and the plants are wilting. Once established, a good soaking twice a week should suffice. Deep soaking encourages the development of stronger, and deeper root systems. This is better than frequent and shallow watering which encourage weaker, more shallow root systems.

The following is a watering schedule from Kenneth Nagata's Booklet, *How To Plant A Native Hawaiian Garden*:

WATER REQUIREMENT	WATERING FREQUENCY
Heavy	3x / week
Moderate	2x / week
Light	1x / week

Red clay soils hold more water for a longer period of time than sandy soils do. If your area is very sunny or near a beach, things will dry out faster. Even in the area of one garden, there are parts that will need more or less water. Soils can vary and amount of shade and wind differ. After plants are established (a month or two for most plants, up to a year for some trees), you can back off watering.

---

[4] Nagata, p. 6

[5] Nagata, p. 8

[6] Nagata, p. 8

Automatic sprinkler systems are expensive to install and must be checked and adjusted regularly. Above-ground systems allow you to monitor how much water is being put out, but you lose a lot due to malfunctioning of sprinkler heads and wind. The most efficient way to save water and make sure your plants get enough water, is to hand-water. This way you are getting our precious water to the right places in the right amounts.[7]

Fertilizer

An all-purpose fertilizer 10-10-10 is adequate for most species. They should be applied at planting time, 3 months later, and 6 months thereafter. Use half the dosage recommended for ornamentals and pay special attention to native ferns which are sensitive to strong fertilizers. Use of organic composts and aged animal manures is suggested instead of chemical fertilizers. In addition, use of cinders for providing trace minerals is strongly recommended.[8]

Natives are plants which were here hundreds of years before the polynesians inhabited the Hawaiian Islands. They were brought here by birds, or survived the harsh ocean conditions to float here. They are well-adapted to Hawaii's varying soil and environmental conditions. This is why they make prime specimens for a xeriscape garden. However, natives will not thrive on their own, especially under harsh conditions. On the other hand, like any other plant, if you over-water and over-fertilize them, they will die. Follow the instructions given to you by the nursery you buy the plant from, or from this booklet. Better yet, buy a book (suggested readings can be found in the bibliography in the back of this pamphlet), read it, and learn more about native plants. I guarantee that you will be pleased with the results.

---

[7] Bornhorst, p. 19-20

[8] Nagata, p. 6

Propagation

There are many ways to propagate and plant-out native Hawaiian species. One of the most thourough and helpful book is Heidi Bornhorst's book, *Growing Native Hawaiian Plants.* The easiest, and best way to obtain natives for the novice gardener is to get them from a reputable nursery (see appendix c). That way all you will have to do is know how to transplant (if necessary) and plant-out when you are ready. These are the two methods I have listed here.

Transplanting

1. Use pots that are one size bigger than the potted plant is in
2. Get your potting medium ready

Good potting medium is a ½, ½ mixture of peat moss and perlite. If the plant is from a dry or coastal area, add chunks of cinder or extra perlite. If it is a wet forest species, add more peat moss or compost. Be aware that peat moss is very acidic and certain plants react severely to acidity.

If the plant is to eventually be planted into the ground, make a mix of equal parts peat moss, perlite, and soil from the area in which the plant is to be planted. Slow-release fertilizer can be mixed into the potting medium.

3. Once pots, potting medium, fertilizer and water are ready, you can begin re-potting. Keep the plant stem at the same depth it was in the original pot. Avoid putting the plant in too large a pot, as the plant may not be able to soak up all the water in the soil and the roots may drown and rot.

Mix potting medium and add slow-release fertilizer at this time. Pre-wet the medium to keep dust down and lessen shock to the plant. Put medium in bottom of pot. Measure for the correct depth in the new pot. Make sure there is from ½ to 2 inches from the top of the pot so the plant can get adequate water. Try to stand the plant upright and center the stem in the middle of the pot.

Water the plant thoroughly after transplanting. A vitamin B-1 transplanting solution can help to lessen the transplant shock. Keep the plant in the same type of environment as it was before, sun or shade. If roots were broken, trimm off some of the leaves to compensate for the loss.[9]

Planting out

1. Plant most native Hawaiian plants in a sunny location in soil that is well-drained.
2. Make the planting hole twice as wide as the root ball or present pot, and just as deep.

If the soil is clay-like, and drains slowly, mix in some coarse red or bland cinder, coarse perlite or

---

[9] Bornhorst, p.20-21

coarse compost. Place some slow-release fertilizer at the bottom of the hole.

3. Carefully remove the plant from the container and place it in the hole. The top of the soil should be at the same level as the top of the hole, if it is too high or too low, adjust the soil level so that the plant is at the right depth.
4. Water thoroughly after you transplant.

Mulch

Most natives cannot compete with weeds, and therefore must be weeded around constantly in order to thrive. Mulch is a practical alternative, which discourages and prevents weeds from growing.

Hawaii's hot, humid climate leads to the breaking down of organic mulches. Thick organic mulches such as wood chips and leaves, may also be hiding places for pests.

Stone mulches are attractive, permanent and can help to improve soil quality. Red or black cinder, blue rock chips, smooth river rocks and coral chips are some natural choices.[10] Macadamia nut hulls are also easy to find and can make a nice mulch.[11]

Never pile up mulch right next to the stem or trunk of a plant, keep it a few inches away.

---

[10] Bornhorst, p. 24

[11] Nagata, p. 7

PLACES TO SEE NATIVES ON:

The following places propagate native Hawaiian plants from seeds and/or cuttings. Their purpose is to protect and preserve these native plants. Please contact them before going to view the sites, they can provide valuable information and referral to other sources.

Maui:

1. Hoolawa Farms, P.O. Box 731, Haiku, Hawaii, 96708	572-4835
2. The Hawaiian Collection, 1127 Manu St., Kula, Hawaii, 96790	878-1701
3. Kula Botanical Gardens, RR 4, Box 228, Kula, Hawaii, 96790	878-1715
4. Maui Botanical Gardens, Kanaloa Avenue across from stadium	243-7337
5. Kula Forest Reserve, access road at the end of Waipouli Rd. Call the Maui District Forester	984-8100
6. Wailea Point, Private Condominium residence, 4000 Wailea Alanui, public access points at Four Seasons Resort or Polo Beach	875-9557
7. Kahanu Gardens, National Tropical Botanical Garden, Alau Pl, Hana, Hawaii, 96713	248-8912
9. Kahului Library Courtyard, 20 School Street, Kahului, Hawaii	873-3097

ZONES

The Maui County Planting Plan has compiled a system of 5 zones of plant growth for Maui County. The descriptions of zones and maps for these zones are as follows:

Zone 1:

Wet areas on the windward side of the island. More than 40 inches of rain per year. Higher than 3,000 feet.

Zone 2:

Cool, dry areas in higher elevations (above 1,000 feet). 20 to 40 inches of rain per year.

Zone 3:

Low, drier areas, warm to hot. Less than 20 inches of rain per year. Sea level to 1,000 feet.

Zone 4:

Lower elevations which are wetter due to proximity of mountains. 1,000 to 3,000 feet.

Zone 5:

Salt spray zones in coastal areas on the windward side.

These zones are to be used as a general guide to planting for Maui County. In addition to looking at the maps, read the descriptions of the zones and decide which zone best fits your area. Plants can be listed in more than one zone and can be planted in a variety of conditions. For best results, take notes on the rainfall, wind, sun and salt conditions of your site. Use the zones as a general guide for selection and read about the plants to decide which best fits your needs as far as care and or function.

PLACES TO BUY NATIVES ON:

Maui:

1. **Hoolawa Farms** — 575-5099
   P O Box 731
   Haiku HI 96708
   The largest and best collection of natives in the state. They will deliver, but it's worth the drive to go and see!
   Will propagate upon request

2. **Kula True Value Nursery** — 878-2551
   Many natives in stock
   Get most of their plants from Hoolawa Farms
   They take special requests

3. **Kihei Garden and Landscape** — 244-3804

4. **Kihana Nursery, Kihei** — 879-1165

5. **The Hawaiian Collection** — 878-1701
   Specialize in Sandalwood propagation
   Will propagate special requests

MUNEKIYO & HIRAGA, INC.

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

February 1, 2005

George Tengan, Director
Department of Water Supply
200 South High Street
Wailuku, Hawaii 96793

SUBJECT: Early Consultation Request for County of Maui's Proposed Keawe Street Extension, Lahaina, Maui, Hawaii

Dear Mr. Tengan:

Thank you for your letter dated December 27, 2004, providing us with your comments on the subject project. On behalf of our client, the County of Maui, Department of Public Works and Environmental Management (DPWEM), we would like to offer the following responses to your comments.

1. The Draft Environmental Assessment (DEA) will address anticipated water use, if any, for landscape irrigation, as well as short-term use for construction.

2. The civil engineering consultant will contact your engineering division for review of the project's construction plans.

3. DPWEM will work with its civil engineering consultant to develop Best Management Practices (BMPs) for the construction of the project.

4. We note your comments with regards to landscaping and irrigation, and will implement water conservation measures, if possible. Additionally, DPWEM will consider the use of reclaimed water for construction purposes.

Should you have any questions, please feel free to contact me at 244-2015.

Very truly yours,

Karlynn Kawahara, Planner

KK:yp
cc: Milton Arakawa and Joe Krueger, Department of Public Works and Environmental Management
Scott Kunioka, Shimabukuro, Endo & Yoshizaki, Inc.
sey/keawest/doe.res

JAN 0 8 2005

ALAN M. ARAKAWA
Mayor

GLENN T. CORREA
Director

JOHN L. BUCK III
Deputy Director

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

DEPARTMENT OF PARKS & RECREATION

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

December 28, 2004

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

Dear Ms. Kawahara:

SUBJECT: KEAWE STREET EXTENSION - LAHAINA, MAUI, HAWAII

We have reviewed the Project Summary for the subject project and have no comments to the proposed action.

Thank you for the opportunity to review and comment. Should there be any questions, please contact Mr. Patrick Matsui, Chief of Parks Planning and Development, at 270-7387.

Sincerely,

GLENN T. CORREA
Director

c: Patrick Matsui, Chief of Parks Planning and Development

ALAN M. ARAKAWA
Mayor

MICHAEL W. FOLEY
Director

WAYNE A. BOTEILHO
Deputy Director

JAN 13 200

COUNTY OF MAUI
DEPARTMENT OF PLANNING

January 11, 2005

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

Dear Ms. Kawahara;

RE: Preconsultation - Draft Environmental Assessment for the Proposed Keawe Street Extension located on portions of TMK Nos. 2-4-5-021: 003 and 022, Lahaina, Island of Maui, Hawaii (LTR 2004/4601)

The Maui Planning Department (Department) received your request for preconsultation comments in preparation of an Environmental Assessment (EA) as required by Chapter 343, HRS, and the National Environmental Policy Act (NEPA). The Department's comments are as follows:

1. Are any improvements proposed for the existing portion of Keawe Street?

2. Discuss how the proposed action intends to comply with the objectives and policies of the West Maui Community Plan, specifically in establishing a regional network of bikeways and pedestrian paths.

3. Include a conceptual landscape planting plan.

4. The street lighting plan should consist of down-lit or shielded lights.

Thank you for the opportunity to comment. Should you require additional clarification, please contact Ms. Kivette A. Caigoy, Environmental Planner, at 270-7735.

Sincerely,

MICHAEL W. FOLEY
Planning Director

MWF:KAC:dm
c: Wayne Boteilho, Deputy Planning Director
Joe Alueta, Admin. Planning Officer
Colleen Suyama, Staff Planner
Kivette A. Caigoy, Environmental Planner
General File
K:\WP_DOCS\PLANNING\EA\PreConComments\2004\4601_KeaweStExt.wpd

MUNEKIYO & HIRAGA, INC.

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

February 1, 2005

Michael W. Foley, Director
Department of Planning
250 South High Street
Wailuku, Hawaii 96793

SUBJECT: Early Consultation Request for County of Maui's
Proposed Keawe Street Extension, Lahaina, Maui, Hawaii

Dear Mr. Foley:

Thank you for your letter dated January 11, 2005 regarding the subject project. On behalf of our client, the County of Maui, Department of Public Works and Environmental Management (DPWEM), we would like to offer the following responses to your comments.

1. There may be intersection improvements to the existing Keawe Street. The Draft Environmental Assessment (DEA) will include a more detailed project description.

2. The Keawe Street extension is currently being designed. Your comments have been forwarded to the civil engineering consultant and the DPWEM. Bicycle lanes and sidewalks will be considered in the design and included, if feasible.

3. At this point in time, the design calls for grassing of swales on both sides of the road. Should there be an increase in landscaping for the project, a conceptual landscaping plan will be included in the DEA.

4. Down-lit or shielded lights will be considered for the project.

Should you have any questions, please feel free to contact me at 244-2015.

Very truly yours,

Karlynn Kawahara, Planner

KK:yp
cc: Milton Arakawa and Joe Krueger, Department of Public Works and Environmental Management
Scott Kunioka, Shimabukuro, Endo & Yoshizaki, Inc.
sey\keawest\planning.res

DEC 29 2004

Verizon Hawaii Inc.

verizon

60 So. Church Street
Wailuku, HI 96793

Phone 808 242-5276

December 27, 2004

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

ATTN: Ms. Karlynn Kawahara

SUBJECT: Early Consultation Request for Preparation of a Draft Environmental Assessment, Keawe Street Extension – Lahaina, Maui, Hawaii

Dear Ms. Kawahara:

Thank you for providing Verizon Hawaii Incorporated, the opportunity to comment on the Early Consultation Request for Preparation of a Draft Environmental Assessment, Keawe Street Extension – Lahaina, Maui, Hawaii.

Verizon Hawaii has no comments on this project at this time.

If there are any questions, please call Sheri Tihada at (808) 242-5258.

Sincerely,

Lynette Yoshida
Section Manager –
Network Engineering & Planning

C: File (3045-LHNA)
S. Tihada

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

JAN 06 2005

January 4, 2005

Ms. Karlynn Kawahara
Munekiyo & Hiraga, Inc.
305 S. High Street, Suite 104
Wailuku, HI 96793

Dear Ms. Kawahara:

Subject: Early Consultation Request for Preparation of a Draft Environmental Assessment, Keawe Street Extension - Lahaina, Maui, Hawaii

Thank you for allowing us to comment on the subject project.

In reviewing the information transmitted and our records, we have no objection to the subject project. We encourage the applicant's electrical consultant to meet with us as soon as practical to verify if there any electrical requirements for the project so that service can be provided on a timely basis.

If you have any questions or concerns, please call Dan Takahata at 871-2385.

Sincerely,

Neal Shinyama

Neal Shinyama
Manager, Engineering

NS/dt:lkh

MUNEKIYO & HIRAGA, INC.

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

February 1, 2005

Mr. Neal Shinyama
Manager, Engineering
Maui Electric Company, Ltd.
P. O. Box 398
Kahului, Hawaii 96733-6898

SUBJECT: Early Consultation Request for County of Maui's Proposed Keawe Street Extension, Lahaina, Maui, Hawaii

Dear Mr. Shinyama:

Thank you for your letter dated January 4, 2005, providing us with your comments on the proposed project.

Our client, the County of Maui, Department of Public Works and Environmental Management, will have its electrical engineer contact your office to discuss electrical needs for the project.

Should you have any questions, please feel free to contact me at 244-2015.

Very truly yours,

Karlynn Kawahara, Planner

KK:yp
cc: Milton Arakawa and Joe Krueger, Department of Public Works and Environmental Management
Scott Kunioka, Shimabukuro, Endo & Yoshizaki, Inc.
sey/keawest/meco.res

Lahaina
BUSINESS PARK
A WEST MAUI VENTURE GROUP PROJECT

January 5, 2005

Munekiyo & Hiraga, Inc.
Attn: Karlynn Kawahara
305 High Street, Suite 104
Wailuku, Hawaii 96793

Re: Early Consultation Request for Preparation of Draft Environmental Assessment.
Keawe Street Extension – Lahaina, Maui, Hawaii

Dear Ms. Kawahara:

Lahaina Business Park and associated parcels of land are located adjacent to Keawe Street. It is our understanding that Phase 1 of the Lahaina Bypass (Bypass) would utilize Keawe Street to connect the Bypass to Honoapiilani Highway. We are supportive of the Bypass, but have concerns regarding the impact that Bypass traffic will have on Keawe Street and its intersection with Honoapiilani Highway.

Lahaina Business Park and its predecessors constructed and improved existing Keawe Street between Honoapiilani Highway and a point just mauka of the Lahaina & Kaanapali Railroad (L&KRR) track. The segment of Keawe Street located between Honoapiilani Highway and the L&KRR track is configured as a four-lane, divided roadway with raised, landscaped median. The outside edges of Keawe Street have curb, gutter, sidewalk, and inlets and catch basins for storm sewer. The intersection with Honoapiilani Highway is signalized, and this improvement was also implemented by Lahaina Business Park or its predecessors.

Our concern is that the added traffic contributed by Phase 1 of the Bypass may require modifications to the lane geometry at the Honoapiilani Highway/Keawe Street intersection. If modifications were required, the curb and gutters, sidewalks, storm drain inlets, and catch basins would need to be reconstructed. The existing traffic signal may also need to be modified. Other intersections along Keawe Street may need modification as well.

We are not opposed to these potential modifications. We are concerned that Lahaina Business Park or its related development would be required to implement these improvements as parcels are developed. It is our understanding that the substantial improvements already installed were designed to handle the projected build out of the Lahaina Business Park, the Hawaii Omori Mauka parcels, and other related parcels. Therefore, it is our position that any modification to the Honoapiilani Highway/Keawe Street intersection needs to be implemented as part of the Keawe Street Extension project or Lahaina Bypass – Phase 1 project.

Thank you for giving us the opportunity to comment on the proposed Keawe Street Extension project.

Sincerely,

LAHAINA BUSINESS PARK

John M. Kean

MUNEKIYO & HIRAGA, INC.

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

February 1, 2005

Mr. John M. Kean
Lahaina Business Park
P. O. Box 220
Kihei, Hawaii 96753

SUBJECT: Early Consultation Request for County of Maui's
Proposed Keawe Street Extension, Lahaina, Maui, Hawaii

Dear Mr. Kean:

Thank you for your letter dated January 5, 2005 regarding the subject project. On behalf of our client, the County of Maui, Department of Public Works and Environmental Management (DPWEM), we would like to offer the following response to your comments.

There may be improvements to the existing Keawe Street and Honoapiilani Highway intersection, as part of the proposed Keawe Street extension project. The roadway extension is currently under design. The Draft Environmental Assessment (DEA) will include a more detailed project description. We also note your description of improvements to the existing Keawe Street that Lahaina Business Park and its predecessors have completed. The DPWEM will take into consideration the existing improvements in its review of future commercial projects in the area. We would also suggest that you inform the State Department of Transportation of your concerns regarding their Lahaina Bypass Highway project.

environment
planning

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

Should you have any questions, please feel free to contact me at 244-2015.

Very truly yours,

Karlynn Kawahara, Planner

KK:yp
cc: Milton Arakawa and Joe Krueger, Department of Public Works and Environmental Management
Scott Kunioka, Shimabukuro, Endo & Yoshizaki, Inc.
sey\keawest\lahbuspark.res

IX. LETTERS RECEIVED DURING THE DRAFT ENVIRONMENTAL ASSESSMENT PUBLIC COMMENT PERIOD AND RESPONSES TO SUBSTANTIVE COMMENTS

IX. LETTERS RECEIVED DURING THE DRAFT ENVIRONMENTAL ASSESSMENT PUBLIC COMMENT PERIOD AND RESPONSES TO SUBSTANTIVE COMMENTS

A Draft Environmental Assessment for the subject project was filed and published in the Office of Environmental Quality Control's The Environmental Notice on January 8, 2006.

Comments on the Draft EA were received during the 30-day public comment period. Comments, as well as responses to substantive comments, are included in this chapter.

JAN 13 2006

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

REPLY TO
ATTENTION OF

January 12, 2006

Regulatory Branch

File No. **POH-2004-1142**

Mr. Joseph Krueger, Project Manager
Department of Public Works & Environmental Management
County of Maui
200 South High Street
Wailuku, HI 96793

Dear Mr. Krueger:

This responds to your request for written comments for the draft Environmental Assessment (dEA) which addresses activities and impacts of the proposed 2,500 lineal feet extension of Keawe Street located on portions of a parcel identified as TMK: (2) 4-5-21: 3 and 22, Lahaina, Maui.

The dEA indicates that no waters of the United States, as represented by perennial or intermittent streams, and wetlands are in, or adjacent to, the proposed project area. The dEA states in appropriate sections that there is no potential for waters of the U.S. to be impacted by construction of project structures and associated ground disturbing activities within the proposed improvement area. It is therefore determined that a Department of Army (DA) permit for Section 404 activities of the Clean Water Act will not be required for the proposed Keawe Street Extension project.

Thank you for your consideration of potential impacts to the aquatic environment of the Lahaina watershed. Please contact Mr. Farley Watanabe of my staff at 808-438-7701, or facsimile 808-438-4060, if you have any questions or need additional information. Please reference the file number above in any future correspondence regarding this project.

Sincerely,

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

Copy furnished:
Mr. Denis R. Lau, Clean Water Branch, State DOH, P.O. Box 3378, Honolulu, HI 96801
Ms. Karlynn Kawahara, Munekiyo & Hiraga, Inc., 305 High St. #104, Wailuku, HI 96793

JAN 12 2006

LINDA LINGLE
GOVERNOR
STATE OF HAWAII

MICAH A. KANE
CHAIRMAN
HAWAIIAN HOMES COMMISSION

BEN HENDERSON
DEPUTY TO THE CHAIRMAN

KAULANA H. PARK
EXECUTIVE ASSISTANT

STATE OF HAWAII

DEPARTMENT OF HAWAIIAN HOME LANDS

P.O. BOX 1879

HONOLULU, HAWAII 96805

January 11, 2006

Mr. Milton Arakawa, Director
Department of Public Works and
Environmental Management
200 South High Street
Wailuku, Hawaii 96793

Attention: Mr. Joseph Krueger

Dear Mr. Arakawa:

Thank you for the opportunity to review the draft environmental assessment report for the "Proposed Keawe Street Extension" project in Lahaina, Maui. The Department of Hawaiian Home Lands has no comments to offer.

Should you have any questions, please call the Planning Office at (808) 586-3836.

Aloha and mahalo,

for Micah A. Kane, Chairman
Hawaiian Homes Commission

c: Office of Environmental Quality Control
✓Karlynn Kawahara, Munekiyo & Hiraga, Inc.

JAN 23 2006

LINDA LINGLE
GOVERNOR

STEPHANIE AVEIRO
EXECUTIVE DIRECTOR

PAMELA Y. DODSON
EXECUTIVE ASSISTANT

STATE OF HAWAII
DEPARTMENT OF HUMAN SERVICES
HOUSING AND COMMUNITY DEVELOPMENT CORPORATION OF HAWAII
677 QUEEN STREET, SUITE 300
Honolulu, Hawaii 96813
FAX: (808) 587-0600

IN REPLY REFER TO:
06:PEO/08

January 17, 2006

County of Maui
Department of Public Works and
Environmental Management
200 South High Street
Wailuku, Hawaii 96793

Attention: Mr. Joseph Krueger, Project Manager

Dear Mr. Krueger:

Subject: Draft Environmental Assessment
Proposed Keawe Street Extension
Lahaina, Maui, Hawaii

Thank you for the opportunity to review the above subject Draft Environmental Assessment (January 2006) for the proposed Keawe Street Extension Project in Lahaina, Maui, Hawaii. The proposed project traverses the southern portion of the Villages of Leiali'i residential master planned community in Lahaina, Maui, Hawaii, at TMK (2) 4-5-21: 003 & por. 022. The Housing and Community Development Corporation of Hawaii (HCDCH) is the master developer of the Villages of Leiali'i project and fee owner of TMK parcel 003. Our comments are as follows:

1. The right-of-way of the proposed Keawe Street Extension is 60' wide. The Leiali'i Parkway within the Villages of Leiali'i is master planned to be a 4-lane, 100' wide roadway intersecting at Kapunakea Street, in accordance with the Final Supplemental Environmental Impact Statement for the Lahaina Bypass Highway. Since the proposed Keawe Street Extension replaces the master plan alignment for Leiali'i Parkway at Kapunakea Street, the proposed Keawe Street Extension should be master planned to be a 4-lane, 100' wide right-of-way roadway so that the Keawe Street Extension can accommodate a connection with the Leiali'i Parkway in the future.

2. The difference between the final elevation of the proposed project and the existing grade of adjacent properties should be minimized, where feasible, to facilitate roadway connections from the adjacent properties in the future.

3. Conveyance of the right-of-way and easements to the County of Maui for the proposed project shall be subject to the approval of the HCDCH Board of Directors.

Should there be any questions or comments regarding this matter, please contact Stan S. Fujimoto, Project Manager, at 587-0541.

Sincerely,

Stephanie Aveiro

Stephanie Aveiro
Executive Director

c: Office of Environmental Quality Control
✓ Karlynn Kawahara, Planner, Munekiyo & Hiraga, Inc.
Stan S. Fujimoto, Project Manager, HCDCH

MAY 19 2006

ALAN M. ARAKAWA
Mayor

MILTON M. ARAKAWA, A.I.C.P.
Director

MICHAEL M. MIYAMOTO
Deputy Director

Telephone: (808) 270-7745
Fax: (808) 270-7975

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
AND ENVIRONMENTAL MANAGEMENT
ENGINEERING DIVISION
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Development Services Administration

DAVID TAYLOR, P.E.
Wastewater Reclamation Division

CARY YAMASHITA, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

TRACY TAKAMINE, P.E.
Solid Waste Division

May 15, 2006

Ms. Stephanie Aveiro, Executive Director
Department of Human Services
Housing and Community Development Corporation of Hawaii
677 Queen Street, Suite 300
Honolulu, Hawaii 96813

SUBJECT: KEAWE STREET EXTENSION
JOB NO. 03-31
LAHAINA, MAUI, HAWAII

Dear Ms. Aveiro:

Thank you for your comments of March 10, 2006 concerning our preliminary map submittal for the Keawe Street Extension project. We would like to acquire title to the applicable land and easements for this project. It is our understanding that the ceded land issue has been settled, therefore, this is no longer a concern regarding acceptance by the County. Our intent is to transmit the necessary documents to the Maui County Council so they can accept conveyance of the property with the approval of HCDCH Board of Directors prior to construction.

If you have any questions, please call Joe Krueger at (808) 270-7745.

Sincerely,

MILTON M. ARAKAWA, A.I.C.P.
Director of Public Works
and Envirnmental Management

MA/JK:c(ED06-366)
S:\ENG\ALL\Joe\Letters\148-keaweHCDCH.wpd

xc: Scott Kunioka, SEY, Inc.
Karlynn Kawahara, Munekiyo & Hiraga, Inc.

JAN 23 2006

ERT BUNDA
RESIDENT
NA MERCADO KIM
CE PRESIDENT
LEEN HANABUSA
JORITY LEADER
TON HEE
JORITY FLOOR LEADER
N S. TSUTSUI
JORITY CAUCUS LEADER
HEMMINGS
NORITY LEADER
HOGUE
NORITY FLOOR LEADER
ON TRIMBLE
NORITY POLICY LEADER

T DISTRICT
RRAINE R. INOUYE
ND DISTRICT
SSELL S. KOKUBUN
D DISTRICT
UL WHALEN
TH DISTRICT
AN S. TSUTSUI
H DISTRICT
SALYN H. BAKER
H DISTRICT
KALANI ENGLISH
NTH DISTRICT
RY L. HOOSER
TH DISTRICT
M SLOM
H DISTRICT
S IHARA, JR
H DISTRICT
AN T. TANIGUCHI
ENTH DISTRICT
ROL FUKUNAGA
FTH DISTRICT
RDON TRIMBLE
TEENTH DISTRICT
ZANNE CHUN OAKLAND
TEENTH DISTRICT
INA MERCADO KIM
ENTH DISTRICT
RMAN SAKAMOTO
ENTH DISTRICT
ID Y. IGE
NTEENTH DISTRICT
N MENOR
TEENTH DISTRICT
ARENCE K. NISHIHARA
TEENTH DISTRICT
AN KANNO
NTIETH DISTRICT
L ESPERO
NTY-FIRST DISTRICT
LEEN HANABUSA
NTY-SECOND DISTRICT
BERT BUNDA
NTY-THIRD DISTRICT
AYTON HEE
NTY-FOURTH DISTRICT
B HOGUE
NTY-FIFTH DISTRICT
ED HEMMINGS
F CLERK
UL Y. KAWAGUCHI

The Senate

The Twenty-Third Legislature

of the

State of Hawaii

STATE CAPITOL

HONOLULU, HAWAII 96813

January 20, 2006

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

Dear Ms. Kawahara:

I am writing in support of the proposed Keawe Street Extension project on Lahaina, Maui as outlined in the Draft Environmental Assessment prepared by Munekiyo & Hiraga, Inc. dated January 5, 2006. Easing traffic congestion is a top priority for Lahaina residents, workers, and visitors. This important connector road in conjunction with the state Department of Transportation's bypass project will definitely improve traffic circulation in this area.

Traffic volumes along the Lahainaluna Road residential corridor will decrease thereby reducing vehicle congestion and related impact conditions along the roadway and Honoapiilani Highway. This project is long overdue.

As a longtime resident of Lahaina and the Senator for the West side, I look forward to seeing our residents reap the benefits of this much-needed and long-awaited improvement.

Best regards,

Rosalyn H. Baker
SENATOR
5th District – South and West Maui

JAN 26 2006

LINDA LINGLE
GOVERNOR OF HAWAII

CHIYOME L. FUKINO, M.
DIRECTOR OF HEALTH

LORRIN W. PANG, M. D., M.
DISTRICT HEALTH OFFICE

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

January 25, 2006

Mr. Joseph Krueger
Project Manager
Department of Public Works and
Environmental Management
County of Maui
200 South High Street
Wailuku, Hawai`i 96793

Dear Mr. Krueger:

Subject: **Proposed Keawe Street Extension**
TMK: (2) 4-5-21: 003 and 022 (portions)

Thank you for the opportunity to comment on the proposed Keawe Street Extension. In a letter dated December 29, 2004, we offered comments regarding the impact of construction noise. We have no further comments at this time.

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

Sincerely,

Herbert S. Matsubayashi
District Environmental Health Program Chief

c: Karlynn Kawahara
OEQC

MUNEKIYO & HIRAGA, INC.

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

KARLYNN KAWAHARA

March 10, 2006

Herbert Matsubayashi, District Environmental
Health Program Chief
Department of Health
Maui District Health Office
54 South High Street
Wailuku, Hawaii 96793

SUBJECT: Draft Environmental Assessment for County of Maui's Proposed Keawe Street Extension; TMK 4-5-21:003 and 022(por.), Lahaina, Maui, Hawaii

Dear Mr. Matsubayashi:

Thank you for your letter dated January 25, 2006, providing us with your comments on the proposed project.

Our client, County of Maui, Department of Public Works and Environmental Management, will work with the contractor to insure that all permits, including a noise permit, are approved prior to the start of construction.

Should you have any questions, please feel free to contact me at 244-2015.

Very truly yours,

Karlynn Kawahara, Project Manager

KK:lfm
cc: Milton Arakawa and Joe Krueger, Department of Public Works and Environmental Management
Scott Kunioka, Shimabukuro, Endo & Yoshizaki, Inc
F:\DATA\SEY\KeaweSt\DOHMaui.dea.res.wpd

FEB 0 8 2006

LINDA LINGLE
GOVERNOR OF HAWAII

GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186
E-mail: oeqc@health.state.hi.us

February 6, 2006

Mr. Milton Arakawa, A.I.C.P.
Director of Public Works and Environmental Management
County of Maui
200 South High Street
Wailuku, Hawai'i 96793

Ms. Karlynn Kawahara
Munekiyo & Hiraga, Inc.
305 High Street, Suite 104
Wailuku, Hawai'i 96793

Dear Mr. Arakawa and Ms. Kawahara:

The Office of Environmental Quality Control has reviewed the draft environmental assessment for the Proposed Keawe Street Extension, Tax Map Key (2nd) 4-5-21, parcel 3 and portions of parcel 22, situated in the judicial district of Lahaina. We offer the following comments for your consideration and response.

1. ***Photographs***: Please provide photographs looking mauka and makai and including the proposed area where the extension is to be built.
2. ***Landscaping with Native and Indigenous Plants:*** Please consider landscaping with native and indigineous xerophagic (drought-tolerant) plants appropriate to the area. Please refer to the URL: http://www.state.hi.us/health/oeqc/garden/index.html for more information.

Thank you for the opportunity to comment. If there are any questions, or if you would like to discuss this matter further, please call Mr. Leslie Segundo, Environmental Health Specialist, at (808) 586-4185.

Sincerely,

for GENEVIEVE SALMONSON
Director

MUNEKIYO & HIRAGA, INC.

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

KARLYNN KAWAHARA

March 10, 2006

Genevieve Salmonson, Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

SUBJECT: Draft Environmental Assessment for County of Maui's Proposed Keawe Street Extension; TMK 4-5-21:003 and 022(por.), Lahaina, Maui, Hawaii

Dear Ms. Salmonson:

Thank you for your letter dated February 6, 2006, providing us with your comments on the subject project. On behalf of our client, the County of Maui, Department of Public Works and Environmental Management (DPWEM), we would like to offer the following responses to your comments.

1. We have attached photographs of mauka and makai views of the location where the Keawe Street extension is proposed. We will include these photographs as an exhibit to the Final Environmental Assessment (Final EA).

2. We note your comment with regards to the use of native and indigenous plans for the project's landscaping. The project is proposing grass swales, however, the DPWEM can consider the planting of native plants on the side slopes. It is noted that the adjacent properties may be developed in the future so extensive landscaping will not be planned for the project.

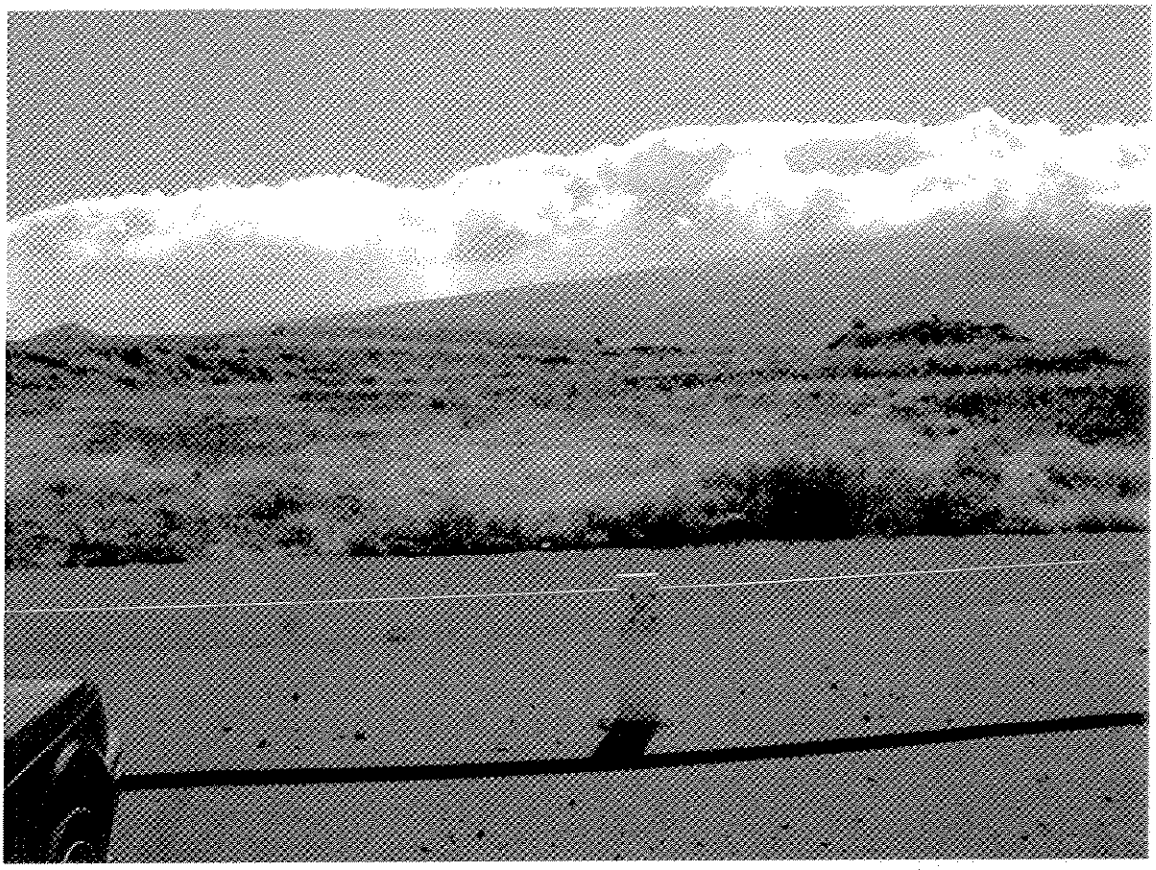
Should you have any questions, please feel free to contact me at (808)244-2015.

Very truly yours,

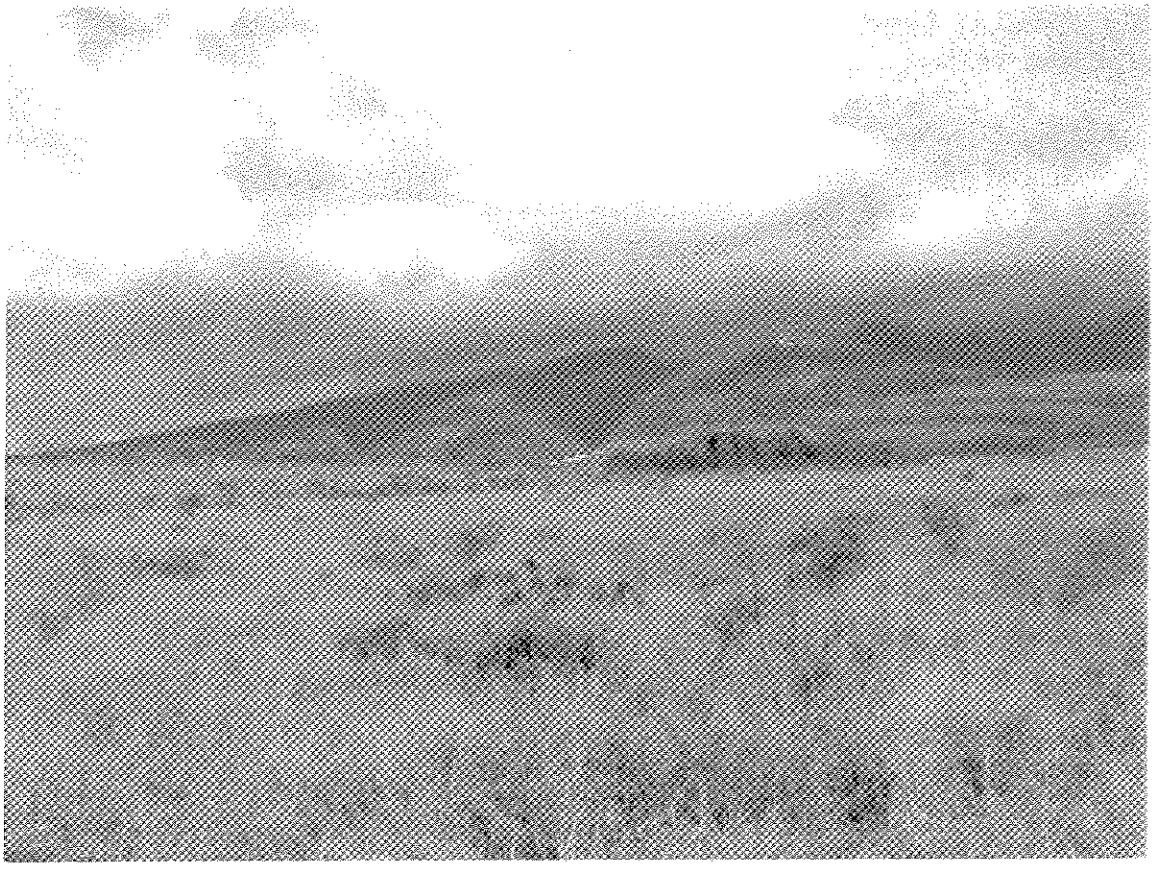
Karlynn Kawahara, Project Manager

KK:lfm
Enclosure
cc: Milton Arakawa and Joe Krueger, Department of Public Works and Environmental Management (w/ enclosure)
Scott Kunioka, Shimabukuro, Endo & Yoshizaki, Inc. (w/ enclosure)

F:\DATA\SEY\KeaweSt\OEQC.dea.res.wpd



Photograph No. 1: East view of project site. Terminus of existing Keawe Street in foreground.



Photograph No. 2: East view of proposed Keawe Street Extension corridor.

Photograph No. 3: West view of proposed Keawe Street Extension corridor.

FEB 15 2006

LINDA LINGLE
GOVERNOR

RODNEY K. HARAGA
DIRECTOR

Deputy Directors
BRUCE Y. MATSUI
BARRY FUKUNAGA
BRENNON T. MORIOKA
BRIAN H. SEKIGUCHI

IN REPLY REFER TO:

STP 8.2037

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

February 10, 2006

Mr. Joseph Krueger
Project Manager
Department of Public Works and
Environmental Management
200 South High Street
Wailuku, Hawaii 96793

Dear Mr. Krueger:

Subject: Draft Environmental Assessment
Keawe Street Extension, Lahaina, Maui

In reply to the request from the subject project's consultant for our review of the environmental assessment for the street extension, this is to advise you that our prior comments supporting the project are still applicable (see attached letter, STP 8.1532).

We look forward to having your agency and project consultant keeping our Highways Division Maui District Office updated and apprised of the progress and status of the project.

We appreciate the opportunity to provide our comments.

Very truly yours,

RODNEY K. HARAGA
Director of Transportation

Attach.

c: Munekiyo & Hiraga (K. Kawahara)

LINDA LINGLE
GOVERNOR

RODNEY K. HARAGA
DIRECTOR

Deputy Directors
BRUCE Y. MATSUI
BARRY FUKUNAGA
BRIAN H. SEKIGUCHI

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

IN REPLY REFER TO:

STP 8.1532

January 3, 2005

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

Dear Ms. Kawahara:

Subject: Keawe Street Extension
Draft Environmental Assessment/Early Consultation
TMK: 2-4-5-21: 003 and 022

Thank you for your transmittal requesting our review of the subject application.

The proposed project is being implemented by County of Maui, Department of Public Works and Environmental Management in coordination with our Highways Division. We are in full support of the project.

Thank you for the opportunity to provide comments.

Very truly yours,

RODNEY K. HARAGA
Director of Transportation

LINDA LINGLE
GOVERNOR OF HAWAII

PETER T. YOUNG
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
DEPUTY DIRECTOR - LAND

DEAN NAKANO
ACTING 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

May 22, 2006

Mr. Jeffrey Pantaleo
Archaeological Services Hawaii, LLC
1930 A Vineyard Street
Wailuku, Hawai'i 96793

LOG NO: 2006.1009
DOC NO: 0604MK32
Archaeology

Dear Mr. Pantaleo:

SUBJECT: Chapter 6E-42 Historic Preservation Review –
Archaeological Assessment Report for the Proposed Keawe Street Extension
Hanaka'o'o Ahupua'a, Lahaina District, Island of Maui
TMK (2) 4-4-008:007, 013

Thank you for the opportunity to review this report which our O'ahu staff received on July 13, 2005 (Formolo *et al.* 2005, *Archaeological Assessment Report for the Proposed Keawe Street Extension, Hanaka'o'o Ahupua'a, Lahaina District, Island of Maui, TMK 4-4-08:07, 13*...Archaeological Services Hawaii, LLC, ms).

The assessment meets our minimum requirements, as set forth in HAR 276-5 (a) and (c). The subject property consists of a corridor measuring 1200-feet long and 60 feet wide. The parcel has previously been in use for agricultural purposes.

The survey has adequately covered the project area documenting no historic properties. Subsurface testing was also negative for evidence of cultural deposits, and yielded stratigraphic evidence indicative of intensive use for commercial agriculture (recent/modern trash, black plastic, plastic drip line fragments etc.). Deposits in all of the test excavations terminated between 0.70 meters and 1.15 meters.

We believe that no further work is necessary on the subject parcel. As a contingency, in the event that historic sites including human skeletal remains, are identified during routine construction activities, all work needs to cease in the immediate vicinity of the fine, the find needs to be protected from additional disturbance, and the State Historic Preservation Office, Maui Section, needs to be contacted immediately at (808) 243-5169.

We find this report to be acceptable. The historic preservation review process is concluded. Development of the project areas will have "no effect" on significant historic sites. As always, if you disagree with our comments or have questions, please contact Dr. Melissa Kirkendall of the State Historic Preservation Division, Maui Section, at (808) 243-5169 to resolve these concerns.

Aloha,

Melanie Chinen, Administrator
State Historic Preservation Division

MK:kf

c: Bert Ratte, DPWEM, County of Maui, FAX 270-7972
Michael Foley, Director, Dept. of Planning, FAX 270-7634
Maui Cultural Res. Commission, Dept. of Planning, 250 S. High St, Wailuku, HI 96793
Jeffrey Pantaleo, Principle Investigator, ASH, LLC, FAX 837-0171

ALAN M. ARAKAWA
Mayor

GLENN T. CORREA
Director

JOHN L. BUCK III
Deputy Director

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

DEPARTMENT OF PARKS & RECREATION

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

January 11, 2006

Mr. Joseph Krueger, Project Manager
County of Maui
Department of Public Works and
Environmental Management
200 South High Street
Wailuku, Hawaii 96793

Dear Mr. Krueger:

SUBJECT: Proposed Keawe Street Extension Project, Lahaina, Maui, Hawaii

We have reviewed the Draft Environmental Assessment (EA) for the Proposed Keawe Street Extension Project and have no comments or objections to submit at this time.

Thank you for the opportunity to review and comment. Should you have any questions, please feel free to contact me or Mr. Patrick Matsui, Chief of Planning and Development, at 270-7387.

Very truly yours,

GLENN T. CORREA
Director

c: Genevieve Salmonson, Director
Office of Environmental Quality Control
Karlynn Kawahara, Planner, Munekiyo & Hiraga, Inc.
Patrick T. Matsui, Chief of Planning and Development

DEPARTMENT OF
HOUSING AND HUMAN CONCERNS
COUNTY OF MAUI

JAN 19 2006

ALAN M. ARAKAWA
Mayor

ALICE L. LEE
Director

HERMAN T. ANDAYA
Deputy Director

200 SOUTH HIGH STREET • WAILUKU, HAWAII 96793 • PHONE (808) 270-7805 • FAX (808) 270-7165

January 12, 2006

Mr. Joseph Krueger, Project Manager
Department of Public Works and
Environmental Management
County of Maui
200 South High Street
Wailuku, Hawaii 96793

Dear Mr. Krueger:

SUBJECT: PROPOSED KEAWE STREET EXTENSION, LAHAINA, MAUI [(2) 4-5-21:003 and 022 (portions)]

We have reviewed the Draft Environmental Assessment (DEA) for the subject project and do not have additional comments to offer to what was stated in my December 17, 2004 early consultation letter to Ms. Karlynn Kawahara of Munekiyo & Hiraga, Inc. (included in Part VIII of the DEA).

Thank you for the opportunity to comment. We are returning the DEA for your use.

Very truly yours,

ALICE L. LEE
Director

ETO:hs
Enclosure
c: ✓Ms. Karlynn Kawahara
Ms. Genevieve Salmonson
Mr. Edwin Okubo

COPY

POLICE DEPARTMENT

COUNTY OF MAUI

ALAN M. ARAKAWA
MAYOR

OUR REFERENCE
YOUR REFERENCE ti

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

THOMAS M. PHILLIPS
CHIEF OF POLICE

KEKUHAUPIO R. AKANA
DEPUTY CHIEF OF POLICE

January 13, 2006

Mr. Joseph Krueger, Project Manager
County of Maui
Dept. of Public Works and
Environmental Management
200 South High Street
Wailuku, HI 96793

Dear Mr. Krueger:

SUBJECT: PROPOSED KEAWE STREET EXTENSION PROJECT, LAHAINA

This is in response to your letter dated January 5, 2006, requesting comments on the above subject.

Please refer to the enclosed copy of the To/From submitted by Officer Scott Migita for our comments. Thank you for giving us the opportunity to comment on this project.

Sincerely,

Assistant Chief Sydney Kikuchi
for: THOMAS M. PHILLIPS
Chief of Police

Enclosure

COPY

TO : **THOMAS M. PHILLIPS, CHIEF OF POLICE, MAUI POLICE DEPARTMENT**

VIA : **CHANNELS** 01/13/06

FROM : **SCOTT Y. MIGITA, POLICE OFFICER III, LAHAINA BICYCLE PATROL**

SUBJECT : **DRAFT ENVIRONMENTAL ASSESSMENT: PROPOSED KEAWE STREET EXTENSION PROJECT**

Sir, this To/From is being submitted regarding a draft environmental assessment of the proposed extension of the existing Keawe Street in Lahaina which will establish the required connection between the Lahaina Bypass Highway and Honoapiilani Highway to ensure the functional operation of Phase 1A of the Lahaina Bypass Highway. This proposed extension submitted by consultant, Munekiyo & Hiraga, Inc. on behalf of the applicant, County of Maui, Department of Public Works and Environmental Management includes construction of 2,500 lineal feet of roadway with twelve foot travel lanes and six foot paved shoulders. Related improvements such as grading, drainage, utilities, and landscaping are also proposed.

A Traffic Assessment Report has been prepared for this proposed project (Appendix "B"), where on page 37, concludes that "Traffic volumes at the Honoapiilani Highway and Keawe Street intersection are anticipated to increase proportionately. With the implementation of the recommendations, traffic movements at all study intersections are expected to operate at acceptable levels of service during both peak periods (AM and PM peak hours of traffic)."

The Lahaina Bypass Highway is greatly needed and long overdue with the increase in traffic. Once complete, this Bypass should alleviate much of the traffic congestion experienced by locals and tourists traveling in and out of Lahaina.

Submitted for your information and perusal.

Concur.
1512
1/12/06 0630

Respectfully submitted,

Scott Y. MIGITA, E-1122
P.O. III, Bike Patrol Officer
01/11/2006 at 1142 hours

THIS PROJECT NEEDS TO PROCEED ASAP.

1/12/06

FEB 10 2006

ALAN M. ARAKAWA
Mayor

GEORGE Y. TENGAN
Director

ERIC H. YAMASHIGE, P.E., L
Deputy Director

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

February 7, 2006

Ms.Karlynn Kawahara, Planner
Munekiyo & Hiraga, Inc.
305 High Street Suite 104
Wailuku HI 96793

Subject: Draft Environmental Assessment for the Proposed Keawe Street Extension Project - Lahaina, Maui, Hawaii

Dear Ms. Kawahara:

Thank you for the opportunity to review this Draft Environmental Assessment. Our comment letter of December 27, 2004 is included in the project document.

DWS has no waterlines in the vicinity of the project site. The applicant did not address the source and anticipated water use for irrigation and short-term use for construction in the draft EA. Other comments we provided would still apply.

Should you have any questions, please call our Water Resources and Planning Division at 244-8550.

Sincerely,

George Y. Tengan
Director
eam

c: Engineering Division

D:\My Documents\WP\Proj Rev\Lahaina Proj\Proposed Keawe St Ext_DEA.wpd

MUNEKIYO & HIRAGA, INC.

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

KARLYNN KAWAHARA

November 21, 2006

George Tengan, Director
Department of Water Supply
200 South High Street
Wailuku, Hawaii 96793

SUBJECT: Draft Environmental Assessment for County of Maui's Proposed Keawe Street Extension, TMK 4-5-21:003 and 022 (por.),Lahaina, Maui, Hawaii

Dear Mr. Tengan:

Thank you for your letter dated February 7, 2006, providing us with your comments on the subject project. On behalf of our client, the County of Maui, Department of Public Works and Environmental Management (DPWEM), we would like to offer the following response to your comment.

We note your comment with regards to the source and anticipated water use for the project's landscaping and irrigation. DPWEM plans to utilize the existing fire hydrants in the area as a temporary water source for construction and short term irrigation use. Additionally, DPWEM will utilize reclaimed water whenever possible. No permanent irrigation system will be installed as part of the project scope.

Should you have any questions, please feel free to contact me at 244-2015.

Very truly yours,

Karlynn Kawahara
Project Manager

KK:yp
cc: Milton Arakawa and Joe Krueger, Department of Public Works and Environmental Management
Scott Kunioka, Shimabukuro, Endo & Yoshizaki, Inc.
F:\DATA\SEY\KeaweSt\dws.dea.res.wpd

NOV 0 3 2006

ALAN M. ARAKAWA
MAYOR

CARL M. KAUPALOLO
CHIEF

NEAL A. BAL
DEPUTY CHIEF

COUNTY OF MAUI
DEPARTMENT OF FIRE AND PUBLIC SAFETY

200 DAIRY ROAD
KAHULUI, MAUI, HAWAII 96732
(808) 270-7561
FAX (808) 270-7919

November 1, 2006

Mr. Joseph Krueger, Project Manager
Department of Public Works &
Environmental Management
200 South High Street
Wailuku, HI 96793

Subject: Proposed Keawe Street Extension Project, Lahaina, Maui

Dear Mr. Krueger,

My office has had the opportunity to review the proposed Keawe Street Extension Project. I would like to express our support since the roadway would allow the project to come closer to realizing the connection of the proposed bypass. Please feel free to contact Captain Val Martin of our Fire Prevention Bureau if there are any questions or concerns.

Sincerely,

for Carl M. Kaupalolo
Fire Chief

cc: Karlynn Kawahara, Munekiyo & Hiraga, Inc.

JAN 17 2006

Hawaiian Telcom

January 11, 2006

County of Maui
Dept. of Public Works and Environmental Management
200 South High Street
Wailuku, Hawaii 96793

ATTN: Mr. Joseph Krueger

SUBJECT: Draft Environmental Assessment
Proposed Keawe Street Extension – Lahaina, Maui, Hawaii

Dear Mr. Krueger:

Thank you for providing Hawaiian Telcom, the opportunity to comment on the Draft Environmental Assessment, Keawe Street Extension – Lahaina, Maui, Hawaii.

Hawaiian Telcom has no comments on this project at this time.

If there are any questions, please call Sheri Tihada at (808) 242-5258.

Sincerely,

Gordon J. Yadao
Section Manager –
Network Engineering & Planning

C: Karlynn Kawahara, Munekiyo & Hiraga, Inc.
File (3045-LHNA)
S. Tihada

Maui Electric Company, Ltd. • 210 West Kamehameha Avenue • PO Box 398 • Kahului, Maui, HI 96733-6898 • (808) 871-84

January 11, 2006

County of Maui, Department of Public Works and Environmental Management
Mr. Joseph Krueger, Project Manager
200 South High Steet
Wailuku, Hawaii 96793

Dear Mr. Krueger,

Subject: Proposed Keawe Street Extension Project -
Draft Environmental Assessment (EA)
Lahaina, Maui, Hawaii
TMK: (2) 4-5-021:003 and 022 (portions)

Thank you for allowing us to comment on the Draft EA for the subject project, which was received on January 5, 2006.

In reviewing our records and the information received, Maui Electric Company (MECO) has no objections to the proposed project. Should there be any electrical requirements for the project, we encourage the applicant's consultant to meet with us as soon as practical so that service can be provided on a timely basis.

If you have any questions or concerns, please call Ray Okazaki at 871-2340.

Sincerely,

Neal Shinyama
Manager, Engineering

NS/ro:lh

Cc: Ms. Karlynn Kawahara - Munekiyo & Hiraga, Inc.

MUNEKIYO & HIRAGA, INC.

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

KARLYNN KAWAHARA

March 10, 2006

Neal Shinyama, Manager-Engineering
Maui Electric Company, Ltd.
P.O. Box 398
Kahului, Hawaii 96733-6898

SUBJECT: Draft Environmental Assessment for County of Maui's Proposed Keawe Street Extension; TMK 4-5-21:003 and 022(por.), Lahaina, Maui, Hawaii

Dear Mr. Shinyama:

Thank you for your letter dated January 11, 2006, providing us with your comments on the proposed project.

Our client, County of Maui, Department of Public Works and Environmental Management, will have its electrical engineer contact your office to discuss electrical needs for the project.

Should you have any questions, please feel free to contact me at 244-2015.

Very truly yours,

Karlynn Kawahara, Project Manager

KK:lfm
cc: Milton Arakawa and Joe Krueger, Department of Public Works and Environmental Management
Scott Kunioka, Shimabukuro, Endo & Yoshizaki, Inc.
F:\DATA\SEY\KeaweSt\MECO.dea.res.wpd

Lahaina
BUSINESS PARK
A WEST MAUI VENTURE GROUP PROJECT

February 6, 2006

County of Maui
Department of Public Works and
Environmental Management
200 South High Street
Wailuku, Hawaii 96793
Att: Joseph Krueger, Project Manager

VIA HAND DELIVERY

Re: Comments Regarding Recommended Improvements Contained in the Draft Environmental Assessment, Keawe Street Extension – Lahaina, Maui, Hawaii, January 2006

Dear Ms. Kawahara:

Background

Lahaina Business Park and associated parcels of land are located adjacent to Keawe Street. It is our understanding that Phase 1 of the Lahaina Bypass (Bypass) would utilize Keawe Street to connect the Bypass to Honoapiilani Highway. We are supportive of the Bypass, but have concerns regarding the impact that Bypass traffic will have on Keawe Street and its intersection with Honoapiilani Highway.

Lahaina Business Park and its predecessors constructed and improved existing Keawe Street between Honoapiilani Highway and a point just mauka of the Lahaina & Kaanapali Railroad (L&KRR) track. The segment of Keawe Street located between Honoapiilani Highway and the L&KRR track is configured as a four-lane, divided roadway with raised, landscaped median. The outside edges of Keawe Street have curb, gutter, sidewalk, and inlets and catch basins for storm sewer. The intersection with Honoapiilani Highway is signalized, and this improvement was also implemented by Lahaina Business Park or its predecessors.

DEA Comments

We have reviewed the Draft Environmental Assessment (DEA) for the Keawe Street Extension, dated January 2006 and have the following comments:

- The Traffic Assessment Report, Keawe Street Extension, April 2005 contained in Appendix B of the DEA recommends the following improvements at the Honoapiilani Highway/Keawe Street intersection: provide exclusive westbound left-turn, through, and right-turn lanes on the Keawe Street approach of the intersection. We concur with this recommendation, but note that implementing this improvement will affect underground utilities in the north edge and in the median of Keawe Street. We, therefore, request that any improvement project include the appropriate reconstruction of curb and gutters, sidewalks, storm drain inlets, and catch basins. The existing traffic signal may also need to be modified and streetlights within the

median relocated. We also note that, based on traffic analyses conducted by our traffic consultant, there may be a need to include additional traffic improvements at this intersection. These could include channelization of the eastbound Lahaina Cannery Mall approach to this intersection in a manner similar to the recommended improvement to the westbound Keawe Street approach. Depending on the degree of traffic signal timing changes that are allowed by the State of Hawaii Department of Transportation (HDOT), there may be a need to also implement southbound double left-turn lanes on Honoapiilani Highway.

- The added traffic contributed by Phase 1 of the Bypass may require modifications to the lane geometry at other intersections along Keawe Street. We request that the proposed Lahaina Bypass incorporate needed improvements at the existing access points along Keawe Street and that the traffic consultant working on the Lahaina Bypass work with the traffic consultant for Lahaina Gateway to coordinate the improvements.
- We request that the required improvements be implemented as part of the Lahaina Bypass project. Lahaina Business Park or its related development would be responsible for improvements directly related to its accesses.

Thank you for giving us the opportunity to comment on the proposed Keawe Street Extension project.

Sincerely,
LAHAINA BUSINESS PARK

John M. Kean

c. ✓ Karlynn Kawahara, Munekiyo & Hiraga
Wayne Yoshioka, Parsons Brinckerhoff Quade & Douglas, Inc.
Paul Ueoka, Esq.,

MUNEKIYO & HIRAGA, INC.

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

KARLYNN KAWAHARA

March 10, 2006

Mr. John M. Kean
Lahaina Business Park
P.O. Box 220
Kihei, Hawaii 96753

SUBJECT: Draft Environmental Assessment for County of Maui's Proposed Keawe Street Extension; TMK 4-5-21:003 and 022(por.), Lahaina, Maui, Hawaii

Dear Mr. Kean:

Thank you for your letter dated February 6, 2006 regarding the subject project. On behalf of our client, the County of Maui, Department of Public Works and Environmental Management (DPWEM), we would like to offer the following responses to your comments.

1. The proposed project includes improvements to the underground utilities as well as the curbs, gutters, reconfiguration of the median strip and traffic signal modifications at the existing Keawe Street and Honoapiilani Highway intersection. We note your comment with regards to the possible implementation of the southbound double left-turn lanes on Honoapiilani Highway. Your comments have been forwarded to the project's traffic engineer for review and consideration.

2. We note your comments with regards to the additional traffic on Keawe Street with the completion of Phase I of the Lahaina Bypass. We would suggest that you inform the State Department of Transportation (DOT) of your concerns regarding their Lahaina Bypass Highway project. It is our understanding that the DOT is currently in process for Phase IA of the Lahaina Bypass. As such, this may be the appropriate time to share your concerns with them for consideration into the design of the Lahaina Bypass.

Should you have any questions, please feel free to contact me at 244-2015.

Very truly yours,

Karlynn Kawahara, Project Manager

KK:lfm
cc: Milton Arakawa and Joe Krueger, Department of Public Works and Environmental Management
Scott Kunioka, Shimabukuro, Endo & Yoshizaki, Inc.
Pete Pascua, Wilson Okamoto Corporation

F:\DATA\SEY\KeaweSt\Lahaina\BusPk.dea res.wpd

X. REFERENCES

X. REFERENCES

County of Maui, Office of Economic Development, 2004 Maui County Data Book, December 2004.

County of Maui, West Maui Community Plan, February 1996.

Federal Emergency Management Agency, Flood Insurance Rate Map Community/Panel No. 150003/0161, August 3, 1998.

Handy, E.S. Craighill, The Hawaii Planter, Honolulu: The Museum, 1940.

Handy, E.S. Craghill and Elizabeth Green Handy, Native Planters in Old Hawaii: Their Life, Love, and Environment, Honolulu: Bishop Museum Press, 1972.

Munekiyo, Arakawa & Hiraga, Inc., Final Environmental Assessment - Westside Resource Center, December 2000.

Munekiyo & Hiraga, Inc., Draft Environmental Assessment of the Proposed Dickenson Street Extension, November 2002.

Munekiyo & Hiraga, Inc., Final Environmental Assessment - Front Street Commercial Building, October 2002.

Munekiyo & Hiraga, Inc., Final Environmental Assessment - Lahaina Wastewater Pump Station Nos. 5 and 6 - Force Main Improvements, September 2002.

Pukui, Mary Kawena, et al., Place Names of Hawaii, Honolulu: University of Hawaii Press, 1974.

SMS, Maui County Community Plan Update Program: Socio-Economic Forecasts Phase I Report, Final Version (June 14, 2002).

Speakman, Commins E. Jr., Mowee: An Informal History of the Hawaiian Island, Salem: Peabody Museum of Salem, 1978.

State Department of Labor and Industrial Relations, May 2007.

University of Hawaii, Department of Geography, Atlas of Hawaii, Third Edition, 1999.

U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii, 1972.

Wilson Okamoto & Associates, Inc., County of Maui Infrastructure Assessment Update, May 2003.

APPENDIX A. ARCHAEOLOGICAL ASSESSMENT REPORT

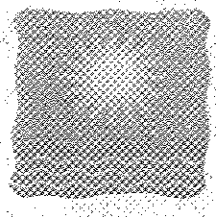
NOV 0 7 2005

ARCHAEOLOGICAL ASSESSMENT REPORT FOR THE PROPOSED KEAWE STREET EXTENSION HANAKA'O'O *AHUPUA'A*, LAHAINA DISTRICT ISLAND OF MAUI TMK 4-4-08:07, 13

FOR
Mr. Scott Kunioka of SEY

BY
Holly Formolo B.A., Lisa Rotunno-Hazuka, B.A.
and
Jeffrey Pantaleo, M.A.

JUNE 2005
Revised – October 2005



ARCHAEOLOGICAL SERVICES HAWAII, LLC
1930 Vineyard Street
Wailuku, HI 96793

EXECUTIVE SUMMARY

Archaeological Services Hawaii (ASH), LLC, of Wailuku, conducted an archaeological assessment (inventory survey level testing with negative findings) of the proposed Keawe Street Roadway extension which measures 1200 ft. long by 60 ft. wide. The project area is located within two parcels in the *ahupua'a* of Wahikuli, Lahaina District, Maui Island (TMK 4-5-21:3 & 22). The objective of the survey was to satisfy historic preservation regulatory review inventory requirements of the Department of Land and Natural Resources, State Historic Preservation Division (DLNR-SHPD), as contained within Hawaii Administrative Rules, Rules Governing Standards for Inventory Surveys and Reports, Chapter 13-276.

Fieldwork was conducted on 10 February 2005, by Ms. Holly Formolo B.A., under the direction of Ms. Lisa Rotunno-Hazuka, B.A., and overall supervision of Mr. Jeffrey Pantaleo, M.A. A total of 8 trenches were excavated with negative findings. These trenches were placed systematically along the proposed route perpendicularly to the centerline of the corridor. All trench locations were plotted on the proposed plan map by the archaeologist.

Archaeological monitoring during certain construction-related activities is recommended. The monitoring program is necessary because of the potential for remnant subsurface traditional Hawaiian cultural remains and historic features extant within the subject property.

TABLE OF CONTENTS

Page

ABSTRACT ..... **i**
TABLE OF CONTENTS ..... **ii**
LIST OF FIGURES ..... **iii**
LIST OF TABLES ..... **iii**

INTRODUCTION **1**
PROJECT AREA 1
HISTORICAL BACKGROUND 5
Land Tenure 6
PREVIOUS ARCHAEOLOGY 7
SETTLEMENT PATTERN 13
SITE EXPECTABILITY 14
METHODS 14
RESULTS OF FIELDWORK **15**
DISCUSSION **18**
RECOMMENDATIONS **19**
REFERENCES **20**

LIST OF FIGURES

Figure 1. Location of Project Area on USGS.....2
Figure 2. Location of Project Area on Tax Map Key.....3
Figure 3. Proposed Roadway Corridor Showing Backhoe Trench Locations...4
Figure 4. Location of Previous Studies Near the Project Area.....12
Figure 5. Stratigraphic Profiles of Trenches 1, 3, and 6.....18

LIST OF TABLES

Table I. Previous Archaeological Investigations.....11
Table II. Summary of Backhoe Trench Dimensions and Data.....18

INTRODUCTION

Under contract to Mr. Scott Kunioka of Shimabukuro, Endo, Yoshizaki, Inc. and per a requirement by the State Historic Preservation Division (SHPD), Archaeological Services Hawaii, LLC, has prepared this archaeological assessment (archaeological inventory survey with no findings) for the Keawe Street extension project located in Lahaina, Wahikuli *ahupua'a* District, Island of Maui TMK 4-5-21: portions of 3 and 22 (Figures 1 and 2).

The purpose of an inventory survey is to determine presence, absence and extent of surface cultural remains, and to ascertain the probability of encountering subsurface sites. A total of 8 backhoe trenches were executed along the proposed extension corridor. No surface or subsurface cultural remains were evident in any of the test trenches. The area had been previously graded for the purposes of agriculture, and these disturbances may have impacted extant cultural remains.

PROJECT AREA

The project area is an elongated portion of land within two parcels. The parcel is located in Lahaina along the lower slopes of the West Maui Mountains. It is adjacent to and *mauka* (east) of Honoapiilani Highway in the vicinity of the existing Keawe Street (TMK 4-5-10: 34) and Lahaina Cannery Mall. The proposed action for this parcel consists of extending Keawe Street further east and installing drainage utilities. The proposed Keawe Street extension corridor measures 1200 ft. long by 60 ft. wide and this roadway corridor will eventually intersect with the proposed Lahaina Bypass road (Figure 3).

The project area is open (no structures or trees) where the surface either contains thick California grasses with fallow sugarcane, or exposed areas of eroded soil and rock. Other types of vegetation noted in the parcel consist of *`uhaloa* (Waltheria), *haole koa,* lion's ear, *`ilima* (sparse), and Castor Bean (must get latin names for all). The parcel gently slopes *mauka* to *makai*, ranging in elevations from 80 to 40 ft amsl. The project area has been previously disturbed by sugar cane cultivation, and more recently impacted by clearing for a construction staging area. Several push berms, stacks of HDPE pipes and other construction materials were noted on the western portion of the project area.

Figure 1. Location of Project Area on USGS

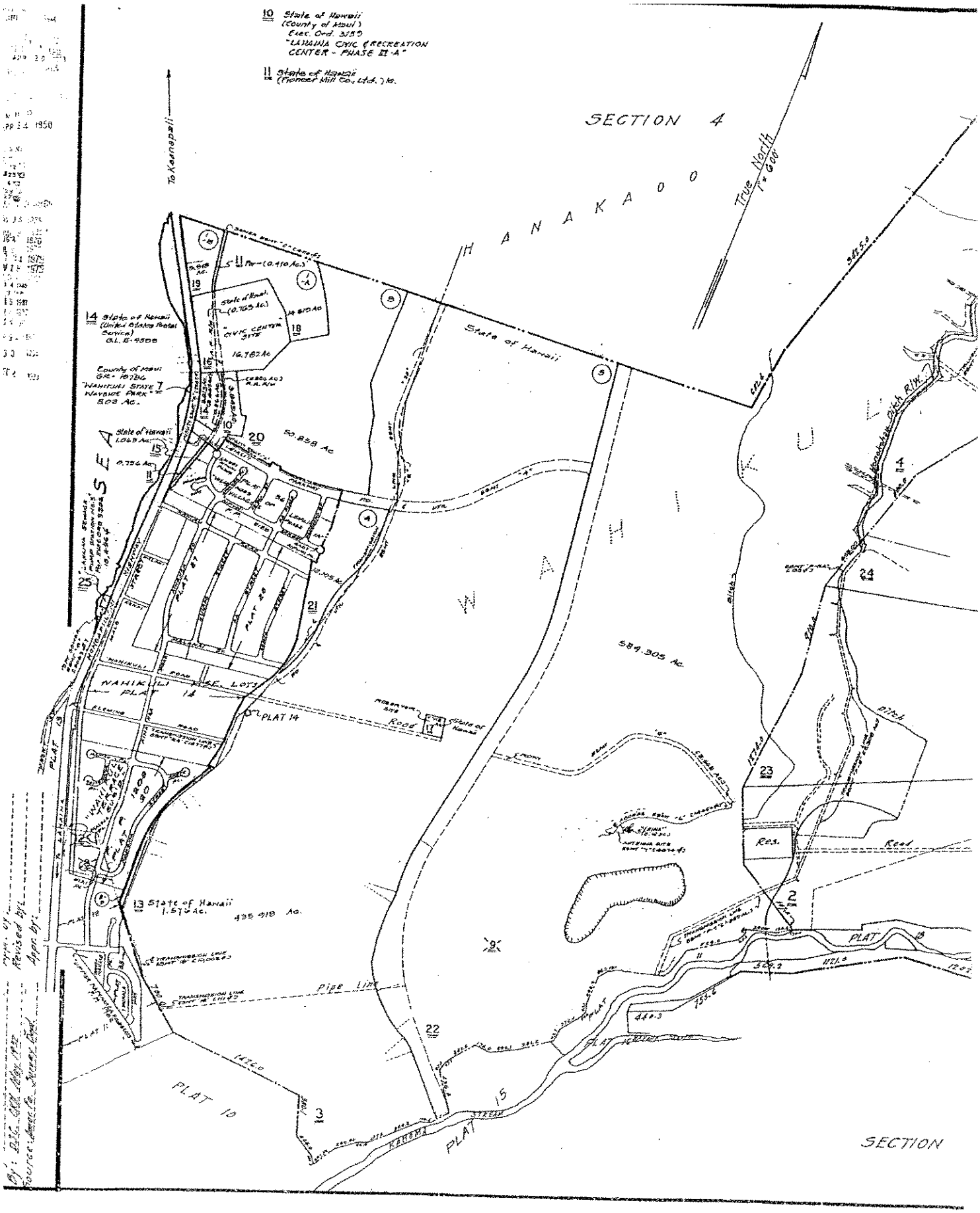


Figure 2. Location of Project Area on Tax Map Key

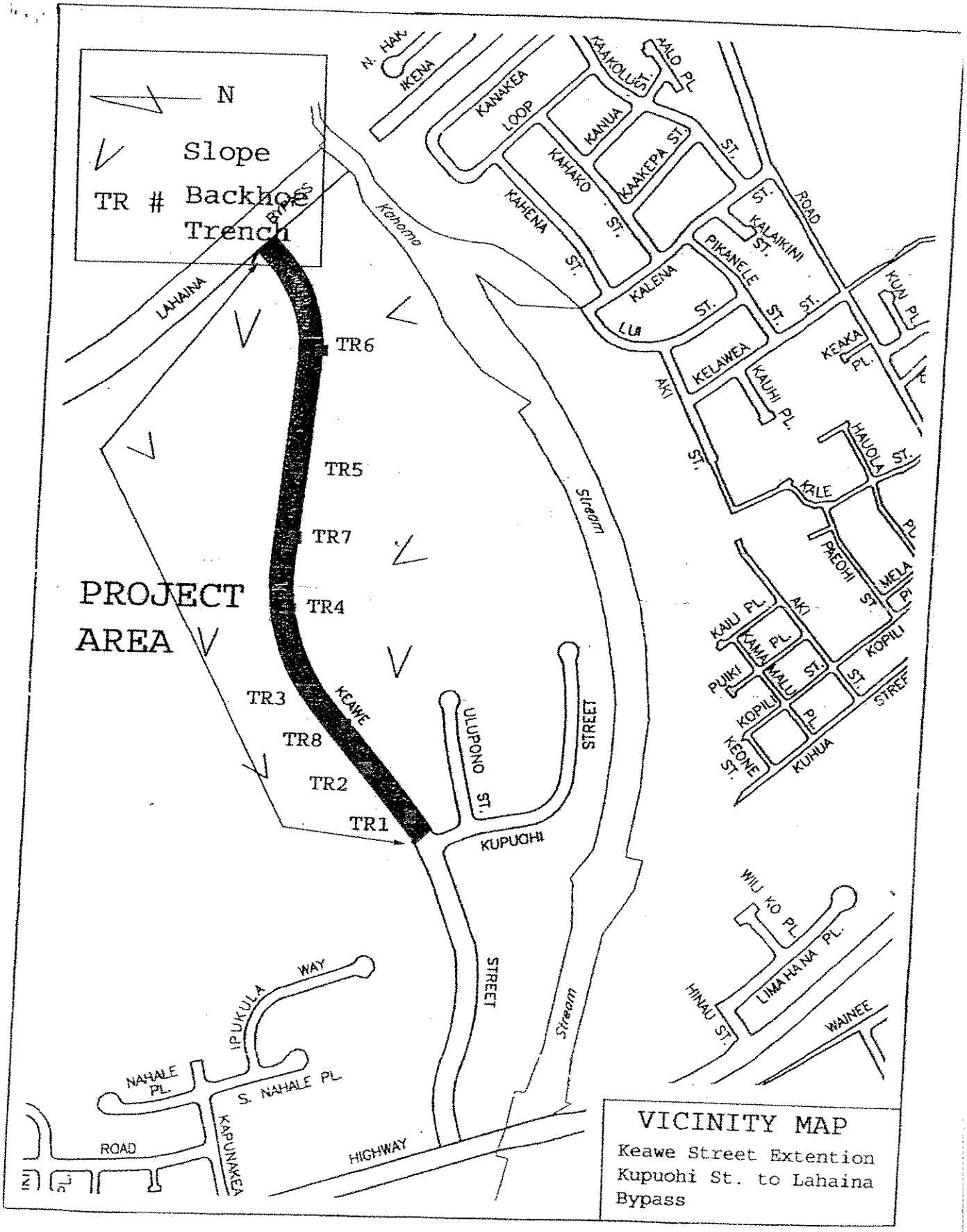


Figure 3. Proposed Roadway Corridor Showing Backhoe Trench Locations

HISTORY

Background information regarding Wahikuli *ahupua'a* and Lahaina District was summarized in Sinoto et al. (2003), Major and Kleiger (1995), and Wong Smith (in Jensen et al. 1989). The reader is referred to these sources for detailed information. Only a brief summary for Wahikuli will be presented here.

Wahikuli literally means "noisy place" (Pukui et al. 1974:218). Traditional and legendary references of Wahikuli are scarce. Lahaina was a favored place of residence by the high chiefs of Maui because of the climate, abundant food resources, easy communication with other populated areas of eastern and northern West Maui, and its proximity to Lanai and Molokai islands (Handy and Handy 1972).

In 1793, Captain George Vancouver visited Maui and noted much devastation as a result of the wars of unification that had been raging since the mid-1700s. At Lahaina, the irrigated taro fields, ponds, and water system had all been destroyed. Alapa'i-nui of Hawaii Island, who was at war against the O'ahu *moi* Peleiohani on Maui, dried up Kaua'ula, Kahana, and Kahoma streams, destroyed the terraces and *auwai*, and the productive capabilities of the *lo'i* below (Kamakau 1961).

In March of 1793, Archibald Menzies, a naturalist and surgeon on board HMS Discovery with Vancouver, described Lahaina:

> March 17. On the forenoon of the 17th, I accompanied Captain Vancouver and a party of officers, with two Niihau women, to see the village of Lahaina, which we found scattered along the shore on a low tract of land that was neatly divided into little fields and laid out in the highest state of cultivation and improvement by being planted in the most regular manner with different esculent roots and useful vegetables of the country, and watered at pleasure by aqueducts that ran here and there along the banks intersecting the fields, and in this manner branching through the plantation.
>
> These little fields were transplanted in a variety of forms, some in rows, in squares, in clumps and others were with equal care kept dry by gathering earth around them in little hills. In short, the whole plantation was cultivated with such studious care and artful industry as to occupy our minds and attention with a constant gaze of admiration during a long walk through it, in which we were accompanied by a numerous group of natives that continued very peaceful and orderly the whole time (Menzies 1920).

Due to its strategic location and resources, Kamehameha I resided in Lahaina for a year to collect taxes due from Maui and the three adjacent islands and build a fleet for his planned invasion of Kauai. In 1802 Kamehameha and a court of 1,000 encamped in Lahaina and constructed a brick palace on the point. The taro field walls that were destroyed during the wars of unification were repaired and the land was made productive once again (Sinoto et al. 2003).

During the reign of Kamehameha, Lahaina was the seat of the Royal Government and the port of Lahaina became a prominent center for the sandalwood trade and whaling industry. Whaling flourished between 1820 to around 1862, and Lahaina was a busy port with a peak of 549 ships in 1859. Around the same time the missionaries started to arrive from New England (Community Planning 1961).

Lahaina became the capital of the Kingdom of Hawaii from ca. 1820-1845, when Kamehameha III moved the capital to Honolulu. Kamehameha II and Kamehameha III often resided in Lahaina. Kamehameha III resided at Hale Pi'ula (the official palace) and Moku'ula (his private residence), on the island of Moku'ula within the Mokuhinia Fishpond (Klieger et al. 1995).

During the Mahele of 1848, two Land Commission Awards (LCA) were recorded in Wahikuli *ahupua'a*. LCA 477F was awarded to P. Keliipoi for 1 acre and LCA 7724:2 was awarded to Poholapu for 12 acres. Land use indicated in these awards included a houselot alongside Kaanapali Road and Chandler's land in Keliipoi's parcel, and 33 taro, 3 lauhala, 4 breadfruit, and sweet potato in Paholapu's parcel (Wong Smith in Jensen 1989:9). A large portion of Wahikuli, including the current project area, was awarded as Crown Land. The Index of Kamehameha Deeds shows 2,194 acres were leased from Kamehameha III to Kamehameha V on March 1, 1854, for $250 per annum.

The Pioneer Mill Co., one of the earliest sugar enterprises in Hawaii, was established in 1863 by Lahaina entrepreneurs James Campbell, Henry Turton, and James Dunbar, on lands deeded to them by Benjamin Pitman. In 1885 H. Hackfield & Company, predecessor of the present owner Amfac/JMB-Hawaii, Inc., bought control of the company (Dorrance 2000:63). The Pioneer Mill Co. built a narrow gauge railroad to transport cane from its west Maui fields to their mill in Lahaina. In 1883 construction of the railroad was completed, running from its terminus at Honokowai along the coast to the mill at Lahaina (Conde 1973:252-253).

In 1900 the Pioneer Mill Co. reorganized and designated the land areas comprising the plantation property, including Wahikuli: A tract of Government land of 5,000 acres, under lease for eighteen years, lies between Lahaina and Kaanapali.

In 1919 the railroad was extended from Honokowai to Kahana. However, the last five mile section of railroad was owned by Baldwin Packers (Honolua Ranch). Around 1920 a lease was let to Pioneer Mill Co. by Baldwin Packers (Honolua Ranch) allowing Pioneer Mill Co. to raise sugarcane in an area extending from Honokowai in the south to Mailepai in the north.

In 1922, the Territory of Hawaii erected Mala Wharf, motivating Baldwin Packers to build a cannery in Lahaina. Pioneer Mill Co. cane cars transported pineapples to this processing plant (Bartholomew 1994:70). By 1929 Pioneer Mill Company's Annual Report lists equipment retirement, indicating the decline of the railroad. The 1946 report revealed serious consideration was being given to abandon the railroad and harvesting exclusively by trucks. The final railroad report appeared in 1953. "Change in operation-...All cane will be hauled by truck on a time shift basis...All railroad tracks were taken up, sorted and subsequently sold to a mainland buyer. Most of the railroad equipment was sold to various purchasers. The mill yard was graded, dressed with cinders and a direct dumping arrangement was built." (Conte 1973:254).

PREVIOUS ARCHAEOLOGY

Winslow Walker (1931) conducted a survey on the island of Maui in the 1920s focusing on large sites and *heiau.* Walker listed Site 11 (Halulukoakoa Heiau) in Wahikuli *ahupua'a.* Halulukoakoa Heiau is located at the "S.E. corner of coconut grove at Mala, just north of Kapunakea Camp. It lies in the *ahupua'a* of Wahikuli according to Thrum" (Sterling 1998:44). The heiau was described as:

> A large heiau for human sacrifice of which but few fragments of walls remain. There is some coral to be found in their construction, but most of the stone has been removed for rock ballast on the railroad. The site has been further cleared and leveled to make a playground, and what remains has been used for a dump of debris of every kind, and the whole is heavily overgrown with kiawe bushes.
>
> Informant J. Kahahana is said to know of some legends connected with this heiau (Sterling 1998:44).

Previous archaeological work conducted within the current project area included Kennedy et al. (1992) and Jensen (1989). Archaeological Consultants of Hawaii, Inc. (Kennedy et al. 1992) conducted an inventory survey for the proposed baseball complex adjacent to the existing Lahaina civic/recreation center (TMK 4-5-21:03). No surface cultural remains were identified, and no further work including data recovery and monitoring was recommended.

State Site 1203, Kahoma Complex, was originally recorded in 1974 as consisting of 38 petroglyphs and a rockshelter. Barrera (1989) relocated this site and also identified additional agricultural features, including terraces and a possible irrigation ditch on the alluvial floodplain on the south side of Kahoma Stream.

Paul H. Rosendahl, Inc. (Jensen 1989) subsequently conducted an archaeological inventory survey of the 1,200-acre Lahaina Master Planned Project Site in Wahikuli, Lahaina District, Maui Island. A total of 12 archaeological sites (50-50-03-1203, and 2478-2488), comprised of 44 component features, were recorded. Types of sites included overhang shelters, platforms, walled enclosures, petroglyphs, graves, terraces, and a historic agricultural access road alignment.

Numerous archeological studies have been conducted near Kahoma Stream and the Mala Wharf boat launch ramp and adjacent areas (Connolly 1974, Burgett and Spear 1994, Donham 1993, Haun 1988, Sinoto 1978). Historic and prehistoric remains have been identified, including historic and prehistoric burials. Radiocarbon dates indicated that the area was occupied and utilized between AD 1260 and 1640 (Haun 1988).

Bishop Museum (Connolly 1974) conducted a surface survey for the Kahoma Stream flood-control project. Three sites, consisting of two terrace systems (50-50-03-1775 and 1776) and a large burial mound (50-50-03-226), were identified. The terraces were located inland along Kahoma Stream at the confluence of Kahoma and Kanaha streams. The burial mound, located at Mala Warf, is a coastal dune containing minimally 25 individual burials. Located across the street from the Chinese cemetery, marked burials

consisting of a cement tomb, a headstone, and 23 low stone platforms, probably represent historic period Hawaiian burials. Subsequent mapping and testing of the coastal burials were undertaken by Davis (1974), Sinoto (1975), and Hammatt (1978).

Archaeological Associates Oceania (Shun 1990) conducted archaeological excavation of human bone remains for the Kahoma Stream Flood Control Project for the U.S. Army Corps of Engineers, Pacific Ocean Division. Human skeletal remains of a complete adult individual and an infant, together with partial remains of at least seven adults and a child, were recovered. All the burials were associated with wooden coffins, indicating post-Contact Period internments. The child coffin overlaid the infant burial, and a dog appeared to have been buried with one or both burials. In addition to the human remains, pre-Contact cultural deposits were exposed underlying the coffin burials.

Numerous archaeological studies have been conducted in Lahaina. For a detailed summary the reader is referred to Klieger et al. (1995), and Fredericksen et al. (1988, 1999, 2000). Table 4 lists the previous archaeological investigations conducted in Lahaina, and Figure 4 depicts some of the location of some studies.

Xamanek Researches conducted numerous inventory surveys in Lahaina. Their studies identified the foundation of the Kamehameha's "Brick Palace" *Hale Piula* (Fredericksen 1965), in addition to the old Armory building foundation (Aus Site 1797), and an historic print shop at Lahainaluna School (Ibid 1988). In 1999 during an inventory survey at the Kamehameha III School a prehistoric subsurface cultural deposit with a possible posthole and 2 pit features were identified in addition to a previously disturbed burial (Ibid 2000a).

Bishop Museum (Kleiger et al. 1995, Major and Kleiger 1995) identified the site of Kamehameha III's private residence at Moku`ula. In addition to Kamehameha's residence, seven subsurface features were identified. Klieger et al. (1995) obtained three early dates. Two dates of 1411-1043 BC and AD 42-232 came from sediments, and another date came from wood charcoal in a mottled deposit that contained mixtures of 1800s to 1900s artifacts. The sample yielded age ranges of AD 1052-1085, 1120-1139, and 1156-1464. Subsequent work identified three human

burial features at Moku'ula. These burials supported the location of the royal mausoleum at Moku'ula (Kleiger et al. 1995).

Aki Sinoto Consulting (Burgett and Spear 1994) conducted an inventory survey of an 8.8-acre parcel in Pauanu *ahupua'a*, Lahaina District. A total of 22 backhoe trenches were excavated in selected locations throughout the parcel. State Site 50-50-03-3550, a human burial, was encountered along the southwestern corner of the project area and left in-situ.

Numerous studies have been conducted for the Lahaina bypass road (Jensen 1991, 1992, Graves et al. 1991, Fredericksen and Fredericksen 2000b). Studies conducted in the sugarcane fields above Lahaina District identified plantation related sites, traditional sites that included petroglyphs, temporary habitation sites, and agricultural sites in gulches not impacted by sugar cultivation.

The remaining studies are confined to very small parcel in Lahaina Town. These studies typically encountered mixed cultural deposits containing traditional Hawaiian and early historic to recent artifacts and food remains. Burials and historic structural remains have also been identified. Twelve radiocarbon dates reported from these studies span between AD 1400 and 1800.

Table I. Previous Archaeological Investigations

Author	Study	Findings
Walker (1931)	Inventory Survey	Archaeology of Maui
Fredericksen and Fredericksen (1965)	Excavation	Identified foundation of the Kamehameha's "Brick Palace"
Hommon (1982)	Reconnaissance Survey	No sites identified in the sugar cane fields
Kennedy (1986)	Field Inspection	No sites identified in the sugar cane fields
Spencer, Mason, Architects (1988)	Reconnasissance Survey	Historic Site Survey for Lahainaluna Road and Wainee Street
Fredericksen, Fredericksen and Fredericksen (1988)	Preliminary Inventory Survey	Identified old Armory building foundation (Aus Site 1797) at site of Kamehameha III palace (Hale Piula)
Fredericksen, Fredericksen Fredericksen (1988)	Inventory Survey	Findings report on excavations conducted in 1981 and1982 at Hale Piula (Site 1797) an historic print shop at Lahainaluna School. No pre- or post contact Hawaiian artifacts were recovered.
Haun (1988)	Subsurface Testing	Historic and prehistoric remains were documented. Radiocarbon Age ranges indicated the area was utilized and occupied between AD 1260 and 1640
Barrera (1988)	Reconnasissance Survey	No sites identified in the sugar cane fields
Graves and Goodfellow (1991)	Inventory Survey	Identified plantation-related sites and agricultural features
Jensen (1991, 1992)	Inventory Survey	Identified plantation-related sites and petroglyphs, temporary habitations, and agricultural features in the gulches
Fredericksen et al (1989a)	Inventory Survey	No pre-contact cultural remains identified
Fredericksen and Fredericsen (1990)	Data Recovery	Historic cultural remains recovered during monitoring
Fredericksen and Fredericksen (1988b, 1989b)	Inventory Survey	Survey and data recovery at the Aus Site 1797 identified ten intrusive historic trash pits
Kennedy (1989)	Excavation	Study determined that the area was a previous swamp drained in the mid 1800s for the construction of a canal
Donham (1993)	Excavation	Burial identified during trenching at Armory Park
Burgett and Spear (1994)	Inventory Survey	Burial identified during subsurface testing
Major and Klieger (1995)	Inventory Survey	Identified a stone alignment and historic house foundation, 7 subsurface features (Loko O Mokuhinia), stone alignments, possible floor, a posthole, and possible pavement, recovered a variety of cultural materials and historic materials radiocarbon age ranges AD 1450-1650
Klieger et al. (1995)	Excavations	Site of Kamehameha III's private residence, identified 34 subsurface features which included pig burials, boulder alignments pond sediments, pits, and charcoal deposits. Radiocarbon age ranges AD 42-231 and 1411-1043 BC from ST-1 and two multiple age dates AD 1052-1085, 1120-1139, 1156-1464 from Unit N60E6, and AD 1459-1680, 1752-1804, 1937-1954 from ST-1
Fredericksen (1997)	Monitoring	No cultural remains identified
Fredericksen and Fredericksen (1999a,b)	Inventory Survey	Identified a wall and prehistoric cultural deposit with a posthole and 2 pit features, radiocarbon age ranges AD 1475-1665
Fredericksen and Fredericksen (2000a)	Inventory Survey	Identified a disturbed burial
Fredericksen and Fredericksen (2000b)	Inventory Survey	Identified plantation camp house and associated historic materials
Borthwick & Hammatt (2000), Hammatt & Schideler (1998)	Inventory and Monitoring	Identified a prehistoric cultural deposit, numerous historic/modern trash pits and a dog burial. Multiple radiocarbon age dates, AD 1420-1660, 1655-1950, 1460-1700, 1720-1820, 166-1950
Rotunno-Hazuka (pending)	Monitoring	Identified burials, cultural deposits, and historic materials

Figure 4. Location of Previous Studies Near the Project Area

SETTLEMENT PATTERN

Land use and settlement patterns along the Lahaina coast of West Maui appear to conform to those described for similar regions of the Hawaiian Islands. Oral traditions, historical accounts, and archaeological investigations indicate that the area supported a large traditional population and early occupation (Pantaleo *et al.* 2004).

The traditional settlement pattern for the Lahaina coastal zone would indicate permanent habitation, with agricultural terraces and mounds, religious sites and *mauka-makai* trails.

Late prehistoric/early historic settlement in Lahaina was characterized by permanent habitation along the coast and limited agricultural expansion into harsher, more ecologically marginal regions (Kirch 1977).

> Radiocarbon dates from the Lahaina District indicated that settlement probably occurred by the 1100 to 1200's. Radiocarbon dates spanning the 1400s to historic period indicate increased population and intensity of land use. The settlement pattern included permanent habitation along the coast and inland, along the main drainages. The valley bottoms were intensively cultivated with irrigated taro and the slopes with dry-land crops. At the lower reaches of the mountain slopes, the stream water was spread by *auwai* to a broad band of taro pondfields just inland of the coastal settlements (Haun *et al.* 2004).

Permanent habitation probably occurred inland as well, with intermediate areas being used for transit stops during *mauka-makai* travels. Sites in these intermediate zones may consist of temporary habitation features such as rock-shelters with exterior modifications, C- and U-shaped enclosures, trails, and trail markers. During the late historic into the historic period, a few permanent habitation sites in the form of feature complexes may have been established in the mid-elevation zones. The formal feature types of inland occupation sites in the Lahaina area are again not well known, but can be surmised to have consisted of enclosures, platforms, and terraces, much like those in the neighboring areas. Sites within the upper elevation zones would consist of large scale taro cultivation, habitation sites, petroglyph boulders and panels, and religious structures like Ukumehame Heiau and Hiikai Heiau.

During the post-1850s era, with the advent of ranching and commercial agricultural activities in the form of sugar cane cultivation, large tracts of the upland areas were transformed into

cultivation fields and the coastal areas were utilized for habitation. Thus, Lahaina was used primarily for sugar cane cultivation. The features associated with this period consisted of long, stone walls, large corrals, enclosures, and large stone piles. Such large-scale activities adversely affected the native Hawaiian inhabitants of the small *kuleana*, who were forced to abandon their holdings and move elsewhere or work for the sugar industry. Toward the late 1800s, permanent habitation flourished in the coastal areas of Lahaina. Historic accounts attest to the concentration of settlement and cultivated areas in the Lahaina area. Habitation sites in the later historic periods took the form of wooden houses within walled yards, generally clustered close to the main roadways or boat landings on the coastal areas. During this period, much of the inland permanent habitation areas were being abandoned, probably along with the intermediate zone and near-shore inland areas immediately behind the coastal settlements.

SITE EXPECTABILITY

The project area has been previously graded for sugar cane cultivation, thus no surface architectural features are expected within the project area. If surface sites were present prior to grading, there may be disturbed remnants of these sites spread along the surface. Subsurface sites below the cultivation zone (which generally averages 2.0 + feet) may be extant. Thus, subsurface remains in the form of buried structural remains and cultural deposits, (midden, artifacts, and or burials) may be encountered. These remains would most likely be related to habitation, marine exploitation, agricultural pursuits (terracing) and ceremonial.

METHODS

A review of previous archaeological investigations in the vicinity was conducted at the State Historic Preservation Division (SHPD) libraries of the Department of Land and Natural Resources (DLNR) at both the Maui and O'ahu offices. Historic land tenure records were researched at the Bureau of Conveyances and Land Management Branch of DLNR, and at the Survey Division of the State Department of Accounting and General Services.

Field work was performed by Ms. Holly Formolo (B.A.) on 10 February 2005 under the direction of Ms. Lisa Rotunno-Hazuka (B.A.). Mr. Jeffrey Pantaleo (M.A.) acted as Principal Investigator and supervised the synthesis of data, and production of this report. Maui Waterfalls, LLC provided the backhoe services. Trenches were placed within the proposed roadway corridor perpendicular to the center line of the road. The center line was previously marked with flagging

tape by a licensed survey crew. Based on DLNR-SHPD rules for inventory survey, the following specific tasks were determined to constitute an appropriate scope of work for the project:

1. Conduct background review and research of existing archaeological and historical documentary literature relating to the project area and its immediate vicinity—including examination of Land Commission Awards, *ahupua'a* records, historic maps, archival materials, archaeological reports, and other historical sources;

2. Undertake surface examination of the project area to locate all extant surface features;

3. Conduct detailed recording of all potentially significant sites including scaled plan drawings, written descriptions, and photographs, as appropriate; and clear vegetation where needed for adequate visibility;

4. Complete a location map of the project area showing identified surface features;

5. Conduct limited subsurface testing at selected features to determine the presence or absence of potentially significant buried cultural deposits or features, and to obtain suitable samples for radiocarbon age determinations;

6. Conduct processing and analysis of recovered materials, as warranted; and,

7. Synthesize data, prepare, and submit a draft report to SHPD for review, and revise and submit final report.

RESULTS

A total of eight backhoe trenches (TR) were placed perpendicularly along the proposed roadway corridor to obtain a representative sample of the subsurface stratigraphy. No cultural materials were observed within any of the backhoe trenches.

BACKHOE TRENCH 1 (TR-1): TR-1 was located along the western edge of the project area on compacted silty clay and oriented on a NNW/SSE axis at 338°/158°. TR-1 measured 2.40 m long, 0.65 m wide, and was excavated to a maximum depth of 0.70 meters below surface (mbs). One stratigraphic layer was identified in this trench. Layer I consisted of a 0.70 m brownish-red (2.5YR 2.5/2) loam with coarse subangular inclusions. Recent, modern trash (plastic soda bottles, and black, plastic dripline fragments) was observed on the surface, and within the trench. No cultural materials were observed in TR-1. Trenching terminated upon large boulders.

BACKHOE TRENCH 2 (TR-2): TR-2 was located northeast of TR-1, on a hardpan area, and was oriented on a NNW/SSE axis at 327°/147°. ST-2 measured 3.0 m long, 0.70 m wide, and a maximum depth of 0.70 mbs. One stratigraphic layer was identified in TR-2 (see TR-1 soil characteristics). Black plastic dripline fragments were observed in this trench also. Coarse subangular inclusions did not occur until the lower depths- starting at 0.50 mbs. No cultural materials were observed in TR-2. Trenching was terminated due to the presence of large boulders.

BACKHOE TRENCH 3 (TR-3): TR-3 was located northeast of TR-2 in tall grasses. The trench was oriented NNW/SSE at 330°/150°. TR-3 measured 3.0 m long, 0.70 m wide, and had a

maximum depth of 1.15 m. Layer I consisted of a 1.15 m dark reddish-brown clay loam ((2.5YR 2.5/4) with medium subangular inclusions. Small to large bed rock boulders appeared at the bottom depths. Black plastic dripline fragments were observed in TR-3. No cultural materials were found in TR-3.

BACKHOE TRENCH 4 (TR-4): TR-4 was located northeast of TR-3 in tall grasses. The trench was oriented NNW/SSE at 329°/149°. TR-4 measured 3.0 m long, 0.70 m wide, and had a maximum depth of 0.95 m. One stratigraphic layer was identified in this trench (see TR-3 soil characteristics). Black plastic dripline was observed, and no cultural materials were recovered from TR-4. Large boulders at base of trench making excavations difficult with backhoe.

BACKHOE TRENCH 5 (TR-5): TR-5 was located northeast of TR-4 in tall grasses. It was oriented NNW/SSE at 316°/136°. TR-5 measured 2.0 m in length, 0.70 m in width, and had a maximum depth of 1.70 m. See TR-3 for soil characteristics. An abundance of small rootlets were observed up to 0.10 m in this trench. Large bed rock boulders appeared at the bottom depth. Black plastic dripline was observed throughout the trench. No cultural materials were recovered from TR-5.

BACKHOE TRENCH 6 (TR-6): TR-6 was located northeast of TR-5 in tall grasses, and represented the highest elevation of the test trenches. The trench was oriented on a NW/SE axis at 320°/140°. TR-6 measured 2.10 m long, 0.70 m wide, and had a maximum depth of 0.80 m. One stratigraphic layer was identified in this trench. Layer I consisted of a 0.80 m dark brown clay loam (2.5YR 2.5/2). The soil here is noticeably dried and rockier with blue rock appearing near 0.40 m. Black plastic dripline fragments were observed here as well. No cultural materials were recovered from ST-6.

BACKHOE TRENCH 7 (TR-7): TR-7 was located southwest of TR-6 in tall grasses. The trench was orientated along a SSE/NNW axis at 170°/350°. TR-7 measured 2.0 m long, 0.70 m wide, and had a maximum depth of 0.85 m. The soil is similar to TR-3 soil characteristics. This soil is a dark brown loam with some subangular rocks after 0.50 m, and larger, blue rock at 0.70 m. Black plastic dripline was present. No cultural materials were observed in this trench.

BACKHOE TRENCH 8 (TR-8): TR-8 is located southwest of TR-7 among intermittent sections of hardpan filled with medium-sized grasses. It is orientated on a SSE/NNW axis at 166°/346°. The trench measured 2.15 m in length, 0.70 m in width, and had a maximum depth of 1.15 m. Soil characteristics and coloring are similar to TR-1 although not as much subangular rocks were observed in the top depths. Additionally, the soil was not as dry as TR-1- most likely due to the appearance of grasses in the immediate area. Black dripline fragments occurred throughout the trench. No cultural materials were observed in TR-8.

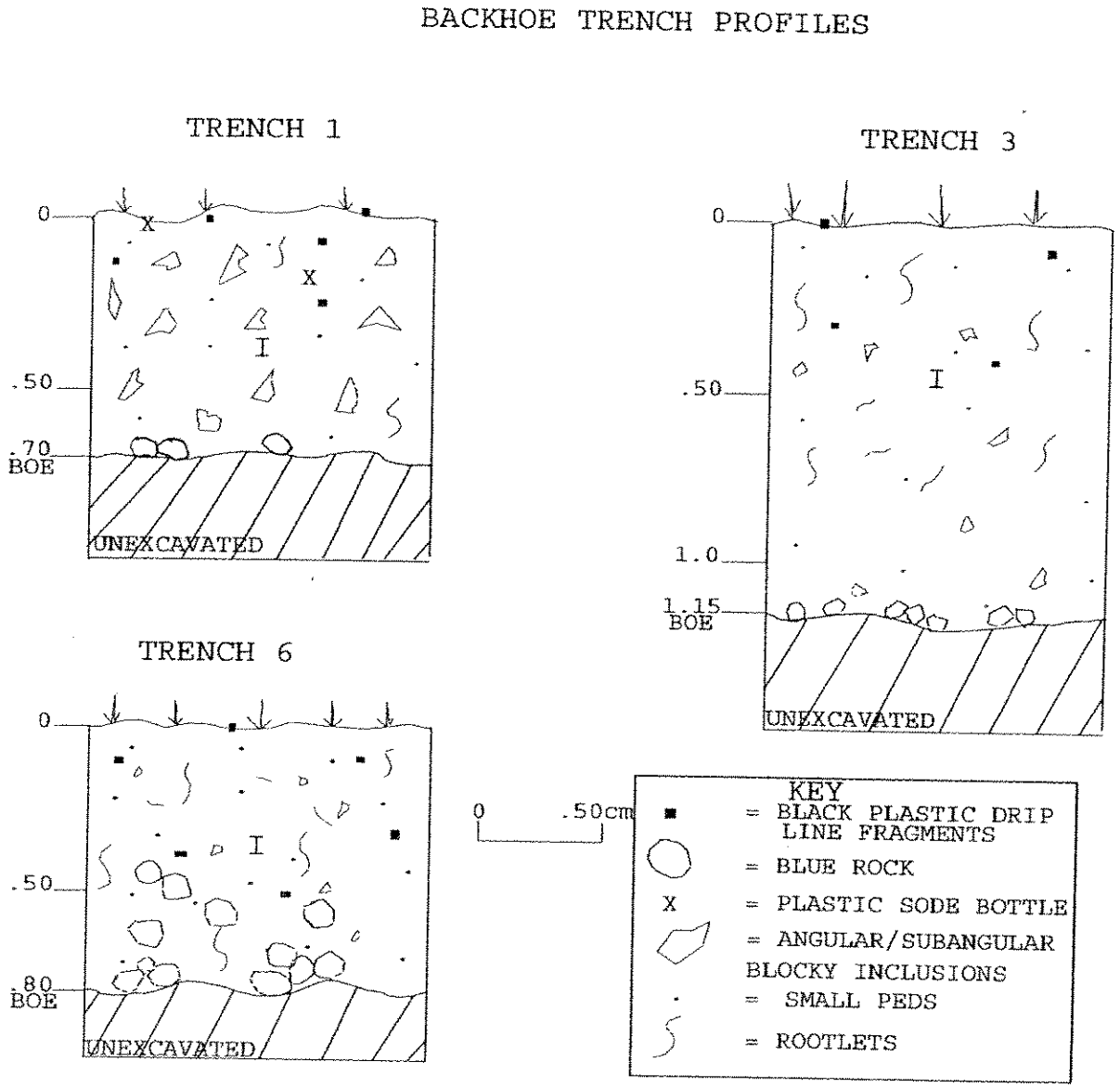


Figure 5. Stratigraphic Profiles of Trenches 1, 3 and 6

Table II. Summary of Backhoe Trench Dimensions and Data

TRENCH #	LOCATION	LENGTH	WIDTH	DEPTH	ORIENTATION	M2 EXC.
1		2.4	0.65	0.7	338	1.56
2		3	0.7	0.7	147	2.1
3		3	0.7	1.15	150	2.1
4		3	0.7	0.95	149	2.1
5		2	0.7	1.7	136	1.4
6		2.1	0.7	0.8	320	1.47
7		2	0.7	0.85	170	1.4
8		2.15	0.7	1.15	166	1.51

DISCUSSION

The project area is located *mauka* of Honoapiilani Highway within fallow sugarcane fields. A total of 8 backhoe trenches were excavated with negative findings. The subject area may have been devoid of subsurface historic properties prior to cultivation clearing, or trenching may have been placed in areas with no historic remains. Observations within the trenches were of geologic significance. As trenching continued *mauka* it appears that the "blue" rock or bedrock was evident at more shallow depths within the trenches, and conversely, soil accumulations were deeper in the trenches at lower elevations. Trenches which were placed in areas with little vegetation were more crumbly and drier, probably due to a lack of water.

Prior to the advent of sugar cane cultivation, the project area's close proximity to Kahoma Stream would have been advantageous for permanent habitation settlement. Sites to be expected within this area would be small enclosures for sleeping, food preparation and work areas, as well as agricultural sites consisting of terraces for *lo'i* and *'auwai* for channeling water from the stream. Ceremonial sites such as *heiau* and *ko'a* would also be expected. These site types, as well as burials have been previously documented earlier studies.

Although the subsurface testing for this project area was negative for historic properties, subsurface sites may be extant in areas that were not tested. Thus archaeological monitoring would be recommended during construction related activities.

RECOMMENDATION

The proposed project consists of the development of a road corridor with drainage utilities. If the construction plans call for minor grubbing or grading (less than 2.0ft) for the development of the roadway corridor, no archaeological monitoring is warranted. However, during the construction of the drainage system, initial archaeological monitoring would be advisable for these deeper excavations. In the event that excavations are primarily in rock, the monitoring process would end. Alternatively, if geological studies or borings are performed prior to construction; these results should be analyzed prior to developing a monitoring plan.

Upon acceptance of this report and concurrence by SHPD that archaeological monitoring is the proposed mitigation measure; a monitoring plan should be developed and submitted to SHPD.

REFERENCES

Barrera, W.
1989 *Honoapiilani Highway, Maui: Archaeological Reconnaissance.* Prepared for Environmental Communications, Inc., Honolulu

Bartholomew, G.
1994 *Maui Remembers: A Local History.* Mutual Publishing, Honolulu, Hawaii

Burgett, B., and R. Spear
1994 *An Archaeological Inventory Survey of an 8.8-Acre Parcel in the Land of Kainehi, District of Lahaina, Pauanu Ahupua'a, Island of Maui.* Aki Sinoto Consulting, Honolulu

Community Planning, Inc.
1961 *Proposal for the Historical Restoration and Preservation of Lahaina, Island of Maui, State of Hawaii.* Community Planning, Inc., Honoulu

Conde, J.C.
1973 *Sugar Trains: Narrow Gauge Rails of Hawaii.* Felton: Glenwood Publishers

Connolly, R.
1974 *Phase I Archaeological Survey of Kahoma Stream Flood-Control Project Area, Lahaina, Maui.* Department of Anthropology, Bishop Museum, Honolulu

Davis, B.D.
1974 *Preliminary Report, Mala Wharf Burials, Phase I, Mala, Lahaina, Maui Island.* Archaeological Research Center Hawaii, Lawai

Donham, T.
1993 *Recovery of an Inadvertently Discovered Human Burial at Hale Pi'ula, Wainee, Lahaina, Maui (TMK 4-6-02:10).* State of Hawaii, Department of Land and Natural Resources.

Dorrance, W.
2000 *Sugar Islands: The 165-Year Story of Sugar in Hawaii.* Mutual Publishing, Honolulu, Hawaii

Fredericksen, W., and D. Fredericksen
1965 *Report on the Archaeological Excavation of the "Brick Palace" of Kamehameha I at Lahaina, Maui, Hawaii (TMK 4-6-01:7).* Prepared for the Maui Historic Commission

Fredericksen, W., D. Fredericksen, and E. Fredericksen
1988 *Report on the Archaeological Inventory Survey at Historic Site 15, Lahaina, Maui, Hawaii.* Xamanek Researches, Pukalani

Fredericksen, D., and E. Fredericksen
1999 *Final Report: Archaeological Inventory Survey in the 'ili of Pakala, Puako Ahupua'a, Lahaina District, Maui Island (TMK 4-6-7:7).* Xamanek Researches, Pukalani

2000a *Archaeological Inventory Survey of a Front Street Parcel Between The Wharf Cinema Complex, and the Banyon Inn Market PLAce (TMK 4-6-08:por. 4), Puako Ahupua'a, Lahaina District, Maui Island.* Xamanek Researches, Pukalani

2000b *An Archaeological Inventory Survey of the West Side Resource Center (Ka Hale A Ke Ola), Lands of Ko'oka, Wainee and Pua'anui, Lahaina District, Maui Island (TMK 4-6-015:por. 1).* Xamanek Researches, Pukalani

Graves, D., and S.T. Goodfellow
1991 *Archaeological Inventory Survy, Launiupoko Golf Course, Land of Launiupoko, Lahaina District, Island of Maui.* PHRI Report No. 837-111390

Hammatt, H.
1978 *Archaeological Investigation and Monitoring, Mala Wharf Boat-Launch Ramp Area, Lahaina, Maui.* Archaeological Research Center Hawaii, Inc., Lawai

Handy, E.S.C., and E.G. Handy
1972 *Native Planters in Old Hawaii.* B.P. Bishop Museum Bulletin 233, Honolulu

Haun, A.
1988 *Subsurface Archaeological Survey, Lahaina Cannery Makai and Mauka Parcels, Land of Moali'i, Lahaina District, Island of Maui (TMK 4-5-05:9-11, 4-5-11:3).* PHRI, Hilo

Jensen, P.
1989 *Archaeological Inventory Survey-Lahaina Master Planned Project Site, Land of Wahikuli, Lahaina District, Island of Maui.* PHRI, Hilo

1991 *Archaeological Inventory Survey, Honoapiilani Highway Realignment Project, Lahaina Bypass Section-Modified Corridor Alignment.* PHRI, Hilo

1992 *Additional Field Survey, Lahaina Bypass Section, Modified Corridor Alignment, Honoapiilani Highway Realignment Project, Lands of Pahoa and Polanui, Lahaina District, Island of Maui.* PHRI, Hilo

Kamakau, S.
1961 *Ruling Chiefs of Hawaii.* Kamehameha Schools Press, Honolulu

Kennedy, J., and T. Denham
1992 *Archaeological Inventory Survey Report for Proposed Baseball Complex Adjacent to the Existing Lahaina Civic/Recreation Center, Located at Lahaina, Island of Maui.* Archaeological Consultants of Hawaii, Inc., Haleiwa

Klieger, P., and S. Clark
1995 *Moku'ula: History and Archaeological Excavations at the Private Palace of King Kamehameha III in Lahaina, Maui.* Department of Anthropology, Bishop Museum, Honolulu

Major, M., and P. Kleiger
1995 *Historical Background and Archaeological Testing at Pikanele's Kuleana in Lahaina, Maui: An Inventory Survey Report of LCA 310.3 (Royal Patent 1792.2, TMK 4-6-07:13).* Department of Anthropology, Bishop Museum, Honolulu

Menzies, A.
1920 *Hawaii Nei 128 Years Ago.* New Freedom Books, Honolulu

Pukui, M.K., S.H. Elbert, and E.T. Mookini
1974 *Place Names of Hawaii.* University of Hawaii Press, Honolulu

Shun, K.
1990 *Archaeological Excavation of Human Bone Remains, Kahoma Stream Flood Control Project, Kahoma Stream, Lahaina, Island of Hawaii.* Archaeological Associates Oceania, Kaneohe

Sinoto, A.
1975 *An Archaeological Reconnaissance of the Mala Wharf Boat-Launch Ramp Area, Lahaina, Maui.* Department of Anthropology, Bishop Museum, Honolulu

Sinoto 1978

Sinoto, A., and J. Pantaleo

2003 *Archaeological Inventory Survey of the Proposed Site for the New Lahaina Kingdom Hall, Puunoa, Paunau Ahupua'a, Lahaina District, Maui Island.* Aki Sinoto Consulting, Honolulu

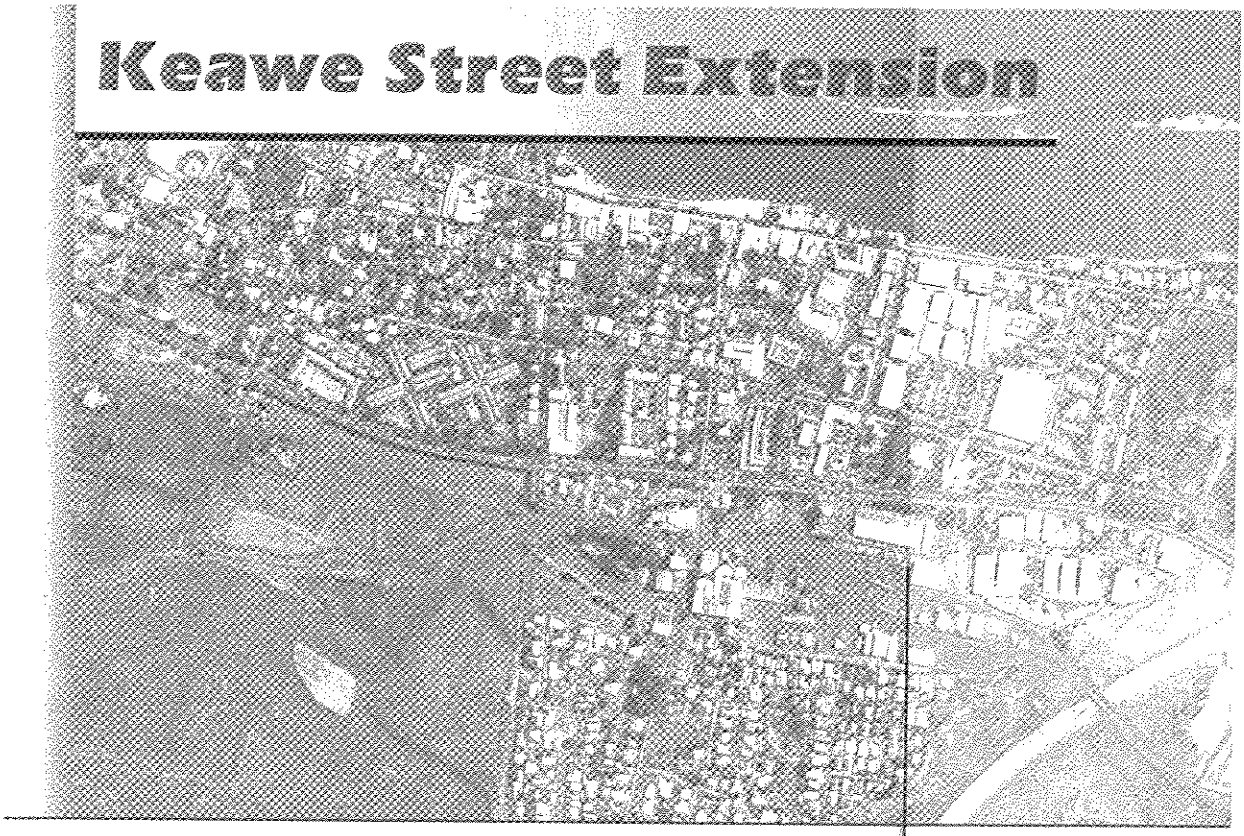
Sterling, E.P.
1998 *Sites of Maui.* Bernice P. Bishop Museum, Honolulu

Walker, W.
1931 *Archaeology of Maui.* Department of Anthropology, Bishop Museum, Honolulu

APPENDIX B.
TRAFFIC
ASSESSMENT REPORT

Traffic Assessment Report

Keawe Street Extension



Prepared For

Shimabukuro, Endo, & Yoshizaki, Inc.

Prepared By

Wilson Okamoto Corporation

April 2005

DRAFT

TRAFFIC ASSESSMENT REPORT

FOR THE PROPOSED

KEAWE STREET EXTENSION

Prepared for:

Shimabukuro, Endo & Yoshizaki, Inc.
1126 12th Avenue, Room 309
Honolulu, HI 96816-3715

Prepared by:

Wilson Okamoto Corporation
1907 South Beretania Street, Suite 400
Honolulu, Hawaii 96826
WOC ref. 7232-01

April 2005

TABLE OF CONTENTS

		Page
I.	Introduction	1
	A. Purpose of Study	1
	B. Scope of Study	1
II.	Project Description	1
III.	Existing Traffic Conditions	3
	A. General	3
	B. Area Roadway System	3
	C. Traffic Volumes and Conditions	4
	1. General	4
	a. Field Investigation	4
	b. Capacity Analysis Methodology	5
	2. Existing Peak Hour of Traffic	5
	a. General	5
	b. Honoapiilani Highway and Lahainaluna Road	8
	c. Honoapiilani Highway and Keawe Street	8
	d. Honoapiilani Highway and Kapunakea Street	9
IV.	Projected Traffic Conditions	10
	A. Site-Generated Traffic	10
	B. Through Traffic Forecasting Methodology	13
	C. Total Traffic Volumes Without Project	13
	D. Total Traffic Volumes With Project	16
V.	Recommendations	21
VI.	Conclusion	21

LIST OF FIGURES

FIGURE 1	Location Map and Vicinity Map
FIGURE 2	Existing AM Peak Hour Traffic Conditions
FIGURE 3	Existing PM Peak Hour Traffic Conditions
FIGURE 4	Trip Reassignment - AM Peak Hour Traffic
FIGURE 5	Trip Reassignment - PM Peak Hour Traffic
FIGURE 6	Year 2007 AM Peak Hour Traffic Conditions Without Project
FIGURE 7	Year 2007 PM Peak Hour Traffic Conditions Without Project
FIGURE 8	Year 2007 AM Peak Hour Traffic Conditions With Project
FIGURE 9	Year 2007 PM Peak Hour Traffic Conditions With Project

LIST OF APPENDICES

APPENDIX A	Existing Traffic Count Data
APPENDIX B	Level of Service Definitions
APPENDIX C	Capacity Analysis Calculations Existing Peak Hour Traffic Analysis
APPENDIX D	Capacity Analysis Calculations Year 2007 Peak Hour Traffic Analysis Without Project
APPENDIX E	Capacity Analysis Calculations Year 2007 Peak Hour Traffic Analysis With Project

I. INTRODUCTION

A. Purpose of Study

The purpose of this study is to assess traffic operations resulting from the proposed extension of Keawe Street from Kupuohi Street to the proposed Lahaina Bypass in Lahaina on the island of Maui. Keawe Street is located on the east side of Honoapiilani Highway across from the Lahaina Cannery Mall and currently serves as an access road for the adjacent industrial area.

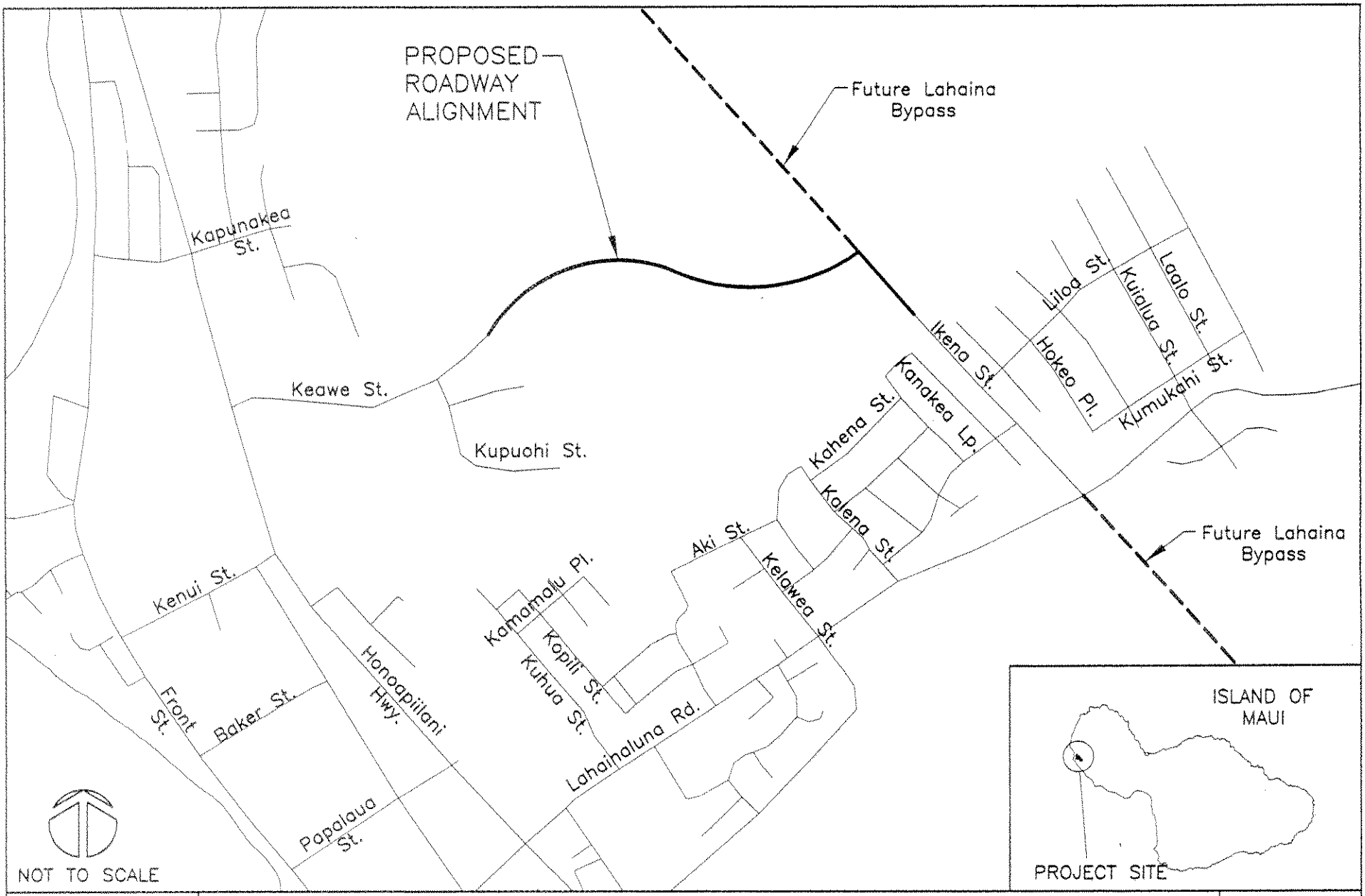
B. Scope of Study

This report presents the findings and conclusions of the traffic assessment, the scope of which includes:

1. Description of the proposed project.
2. Evaluation of existing roadway and traffic operations in the vicinity.
3. Analysis of future roadway and traffic conditions without the proposed project.
4. Analysis and development of trip generation characteristics for the proposed project.
5. Superimposition of site-generated traffic over future traffic conditions.
6. Identification and analysis of traffic impacts resulting from the proposed project.
7. Recommendation of improvements, if appropriate, that would mitigate the traffic impacts resulting from the proposed project.

II. PROJECT DESCRIPTION

Keawe Street is located east of Honoapiilani Highway across from the Lahaina Cannery Mall in Lahaina on the island of Maui. The proposed project would extend the existing roadway from Kupuohi Street to the proposed Lahaina Bypass (see Figure 1). According to the Maui Long-Range Land Transportation Plan (MLRLTP) prepared for the State of Hawaii Department of Transportation in cooperation with the County of Maui Department of Public Works and the County of Maui Planning Department, the future Lahaina Bypass will run parallel to Honoapiilani Highway between Puamana and Honokowai and is intended to serve as an alternate route along this section of the west coast



WILSON OKAMOTO CORPORATION
ENGINEERS · PLANNERS

KEAWE STREET EXTENSION

LOCATION MAP AND VICINITY MAP

FIGURE 1

of Maui. In the vicinity of the project site, the bypass is expected to connect to Lahainaluna Road at Ikena Street. For the purpose of this study, since the schedule for the Lahaina Bypass is unknown at this time, the Keawe Street Extension project is assumed to include the construction of the portion of the bypass between Keawe Street and Ikena Street. The proposed extension, which is assumed to be completed by the Year 2007, will include two twelve-foot lanes with six-foot wide paved shoulders on either side and is expected to improve traffic operating conditions at the intersection of Honoapiilani Highway and Lahainaluna Road by providing an alternate route between the residential areas located east of the highway.

III. EXISTING TRAFFIC CONDITIONS

A. General

Keawe Street is located east of Honoapiilani Highway in Lahaina across from the Lahaina Cannery Mall. Honoapiilani Highway serves as a major collector roadway through central Maui and along the northwest coast of the island from its origin in Wailuku to its terminus near the north shore of Maui. Traffic volumes along the coastline north of Lahaina have not increased significantly in recent years.

B. Area Roadway System

In the vicinity of the proposed project, Honoapiilani Highway is generally a four-lane, two-way, State of Hawaii roadway with traffic signal systems and turning lanes provided at major intersections along its alignment. At the intersection with Lahainaluna Road, the northbound and southbound approaches of Honoapiilani Highway include exclusive left-turn lanes and two lanes designated for through and right-turn traffic movements. Lahainaluna Road is generally a two-lane, two-way, County of Maui roadway generally oriented in the east-west direction. Lahainaluna Road originates near the coast at Front Street and continues northeast past the intersection with Honoapiilani Highway to its terminus near Lahainaluna High School. The westbound approach of Lahainaluna Road includes an exclusive left-turn lane, a through lane, and an exclusive right-turn lane. The eastbound approach of Lahainaluna Road consists of an exclusive left-turn lane and a shared through and right-turn lane.

Approximately 3,300 feet (0.6 miles) northwest of the Honoapiilani Highway and Lahainaluna Road intersection, Honoapiilani Highway intersects with Keawe Street. At this intersection, the northbound and southbound approaches of the highway both have exclusive left-turn lanes, as well as, one lane for through traffic movements and one shared lane servicing through and right-turn traffic movements. Keawe Street comprises the westbound approach of this intersection and is generally a two-lane, two-way County of Maui roadway that currently serves as an access road for the adjacent industrial area. At the intersection with Honoapiilani Highway, the Keawe Street approach includes a shared left-turn and through lane and an exclusive right-turn lane. The eastbound approach of this intersection is comprised of the driveway to the Lahaina Cannery Mall which has a shared left-turn and through lane and an exclusive right-turn lane.

Approximately 1,000 feet (0.2 miles) northwest of the Honoapiilani Highway and Keawe Street intersection, Honoapiilani Highway intersects with Kapunakea Street. At this intersection, the northbound and southbound approaches of Honoapiilani Highway both include exclusive left-turn lanes, one through lane, and a shared through and right-turn lane. Kapunakea Street is generally a two-lane, two-way County of Maui roadway that originates near the coast at Front Street and continues northeast past the intersection with Honoapiilani Highway to its terminus at Nahale Place. At the intersection with Honoapiilani Highway, the westbound approach of Kapunakea Street consists of an exclusive left turn lane and a shared through and right-turn lane while the eastbound approach includes a shared left-turn and through lane and an exclusive right-turn lane.

C. Traffic Volumes and Conditions

1. General

a. Field Investigation

Field investigations were conducted on October 20 and 21, 2004 and consisted of 24-hour mechanical count surveys along Keawe Street and Ikena Street while manual turning movement count surveys were conducted between the morning peak hours of 6:00 AM and 8:30

AM, and the afternoon peak hours of 3:00 PM and 6:00 PM at the following intersections:

- Honoapiilani Highway and Lahainaluna Road
- Honoapiilani Highway and Keawe Street
- Honoapiilani Highway and Kapunakea Street

Appendix A includes the existing traffic count data.

b. Capacity Analysis Methodology

The highway capacity analysis performed in this study is based upon procedures presented in the "Highway Capacity Manual", Transportation Research Board, 2000, and the "Highway Capacity Software", developed by the Federal Highway Administration. The analysis is based on the concept of Level of Service (LOS).

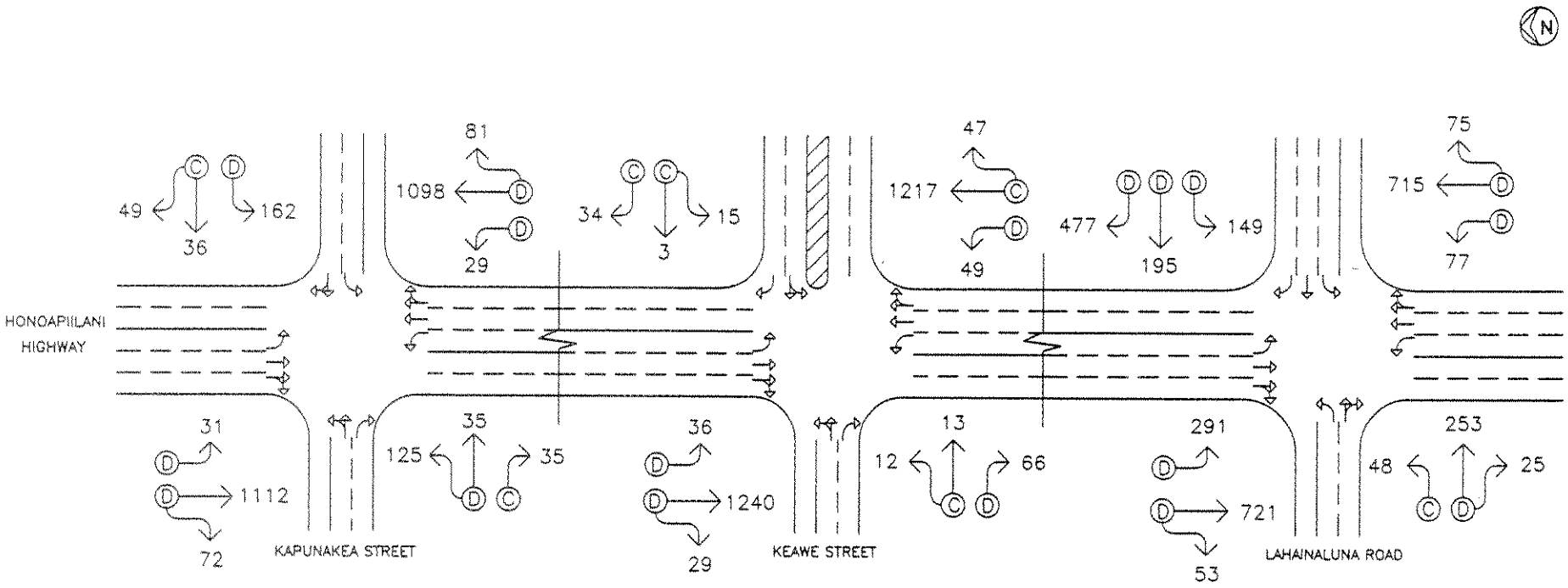
LOS is a quantitative and qualitative assessment of traffic operations. Levels of Service are defined by LOS "A" through "F"; LOS "A" representing ideal or free-flow traffic operating conditions and LOS "F" unacceptable or potentially congested traffic operating conditions. The LOS definitions are included in Appendix B.

"Volume-to-Capacity" (v/c) ratio is another measure indicating the relative traffic demand to the road carrying capacity. A v/c ratio of one (1.00) indicates that the roadway is operating near or at capacity. A v/c ratio of greater than 1.00 indicates that the traffic demand exceeds the road's carrying capacity.

2. Existing Peak Hour Traffic

a. General

Figures 2 and 3 show the existing AM and PM peak hour traffic volumes and operating traffic conditions. The AM peak hour of traffic occurs between 7:00 AM and 8:00 AM in the vicinity of the proposed project. In the afternoon, the PM peak hour of traffic occurs between the hours of 4:00 PM and 5:00 PM. The analysis is based on these peak hour time periods to identify the traffic impacts resulting



LEGEND

90 — TRAFFIC MOVEMENT VOLUME (VPH)

LANE USAGE

(A) LANE GROUP LEVEL OF SERVICE

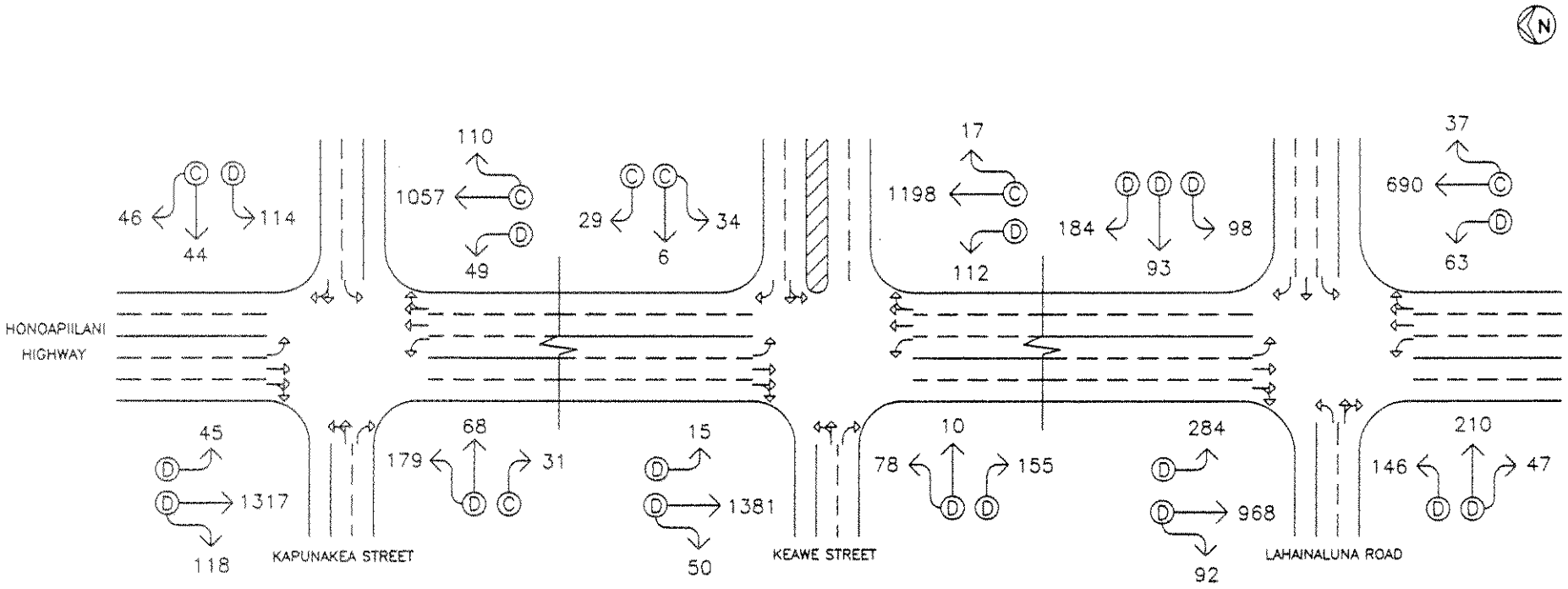
DATE OF COUNT: OCTOBER 20 & 21, 2004

WILSON OKAMOTO CORPORATION
ENGINEERS · PLANNERS

KEAWE STREET EXTENSION

EXISTING AM PEAK HOUR OF TRAFFIC

FIGURE 2



LEGEND

90 — TRAFFIC MOVEMENT VOLUME (VPH)

LANE USAGE

(A) — LANE GROUP LEVEL OF SERVICE

DATE OF COUNT: OCTOBER 20 & 21, 2004

WILSON OKAMOTO

KEAWE STREET EXTENSION

EXISTING PM PEAK HOUR OF TRAFFIC

FIGURE 3

from the proposed project. LOS calculations are included in Appendix C.

b. Honoapiilani Highway and Lahainaluna Road

North of the intersection of Honoapiilani Highway and Lahainaluna Road, Honoapiilani Highway carries 2,305 vehicles during the AM peak hour of traffic, 1,240 vehicles traveling northbound and 1,065 vehicles traveling southbound. During the PM peak hour of traffic, the highway carries 2,364 vehicles, 1,020 vehicles traveling northbound and 1,344 vehicles traveling southbound. All of the traffic movements along Honoapiilani Highway at the intersection with Lahainaluna Road operate at LOS "D" during both peak hours of traffic with the exception of the northbound through and right-turn traffic movement which operates at LOS "C" during the PM peak period.

East of the intersection of Honoapiilani Highway and Lahainaluna Road, Lahainaluna Road carries 1,440 vehicles during the AM peak hour of traffic, 821 vehicles traveling westbound and 619 vehicles traveling eastbound. During the PM peak hour of traffic, Lahainaluna Road just east of Honoapiilani Highway carries 906 vehicles, 375 vehicles traveling westbound and 531 vehicles traveling eastbound. The eastbound left-turn movement of Lahainaluna Road at the intersection of Honoapiilani Highway operates at LOS "C" and LOS "D" during the AM and PM peak hours of traffic, respectively, while the through and right-turn movement of that approach operates at LOS "D" during both peak hours of traffic. On the westbound approach of the intersection, all of the traffic movements operate at LOS "D" during the both peak hours of traffic.

c. Honoapiilani Highway and Keawe Street

At the intersection of Honoapiilani Highway and Keawe Street, Honoapiilani Highway just north of Keawe Street carries 2,568 vehicles during the AM peak hour of traffic, 1,263 vehicles traveling

northbound and 1,305 vehicles traveling southbound. During the PM peak hour of traffic, Honoapiilani Highway just north of Keawe Street carries 2,751 vehicles, 1,305 vehicles traveling northbound and 1,446 vehicles traveling southbound. All of the traffic movements on the southbound approach Honoapiilani Highway at the intersection with Keawe Street operate at LOS "D" during both peak hours of traffic while the northbound left-turn movement and through and right-turn movement operate at LOS "D" and LOS "C" during the both peak periods.

East of the intersection of Honoapiilani Highway and Keawe Street, Keawe Street carries 148 vehicles during the AM peak hour of traffic, 52 vehicles traveling westbound and 96 vehicles traveling eastbound. During the PM peak hour of traffic, Keawe Street just east of the intersection carries 111 vehicles, 69 vehicles traveling westbound and 42 vehicles traveling eastbound. All the traffic movements on the westbound approach of Keawe Street at the intersection with Honoapiilani Highway operate at LOS "C" during both peak hours of traffic. On the Lahaina Cannery Mall approach of the intersection, the westbound left-turn and through movement operates at LOS "C" and LOS "D" during the AM and PM peak periods, respectively, while the right-turn movement operates at LOS "D" during both peak hours of traffic.

d. Honoapiilani Highway and Kapunakea Street

North of the intersection of Honoapiilani Highway and Kapunakea Street, Honoapiilani Highway carries 2,487 vehicles during the AM peak hour of traffic, 1,272 vehicles traveling northbound and 1,215 vehicles traveling southbound. During the PM peak hour of traffic, Honoapiilani Highway just north of Kapunakea Street carries 2,762 vehicles, 1,282 vehicles traveling northbound and 1,480 vehicles traveling southbound. All of the traffic movements on the southbound approach Honoapiilani Highway at the intersection

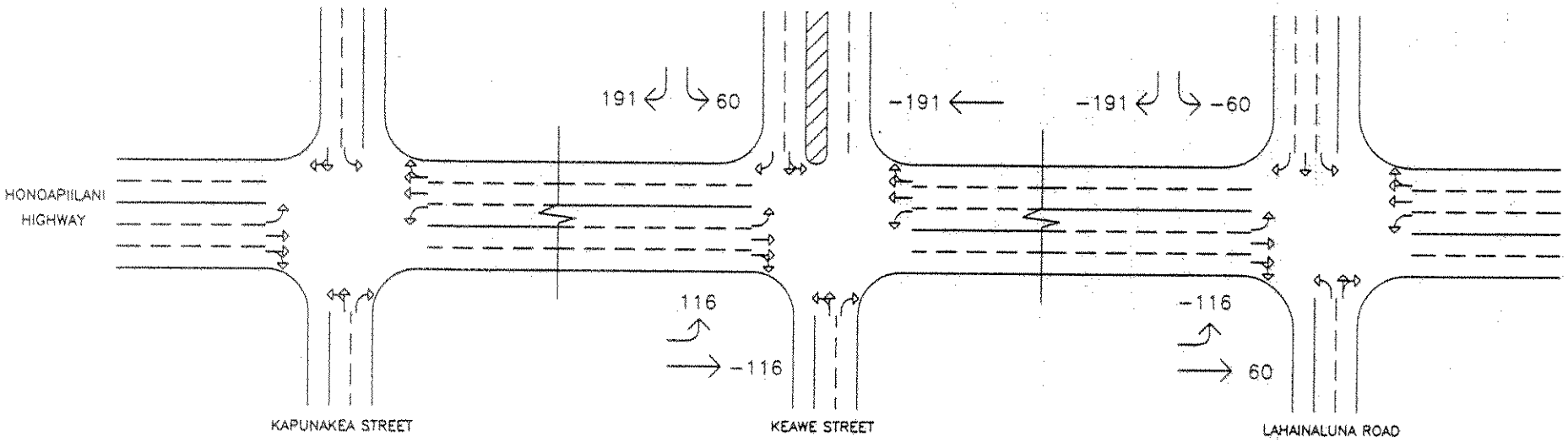
with Kapunakea Street operate at LOS "D" during both peak hours of traffic while the northbound left-turn movement and through and right-turn movement operate at LOS "D" and LOS "C" during the both peak periods.

East of the intersection of Honoapiilani Highway and Kapunakea Street, Kapunakea Street carries 394 vehicles during the AM peak hour of traffic, 247 vehicles traveling westbound and 147 vehicles traveling eastbound. During the PM peak hour of traffic, Kapunakea Street just east of Honoapiilani Highway carries 427 vehicles, 204 vehicles traveling westbound and 223 vehicles traveling eastbound. The westbound left-turn and eastbound left-turn and through movements on the Kapunakea Street approaches of the intersection with Honoapiilani Highway operate at LOS "D" during both peak periods while the westbound through and right-turn and eastbound right-turn movements operates at LOS "C" during both peak hours of traffic.

IV. PROJECTED TRAFFIC CONDITIONS

A. Site-Generated Traffic

Figures 4 and 5 show the reassignment of vehicular trips at the study intersections during the AM and PM peak hours. The proposed roadway extension is intended to provide an alternate route between the residential areas locate east of Honoapiilani Highway. As such, the proposed extension is expected to divert local trips from Honoapiilani Highway to Keawe Street rather than increase regional trips in the vicinity. A portion of the trips utilizing the Honoapiilani Highway and Lahainaluna Road intersection are anticipated to utilize the Keawe Street intersection instead. For the purpose of this study, 40% of the westbound left turning and right turning vehicles along Lahainaluna Road at the intersection with Honoapiilani Highway are assumed to divert to Keawe Street. Similarly, 40% of the southbound left-turning vehicles along Honoapiilani Highway at that intersection are assumed to divert to Keawe Street.



LEGEND

90 TRAFFIC MOVEMENT VOLUME (VPH)

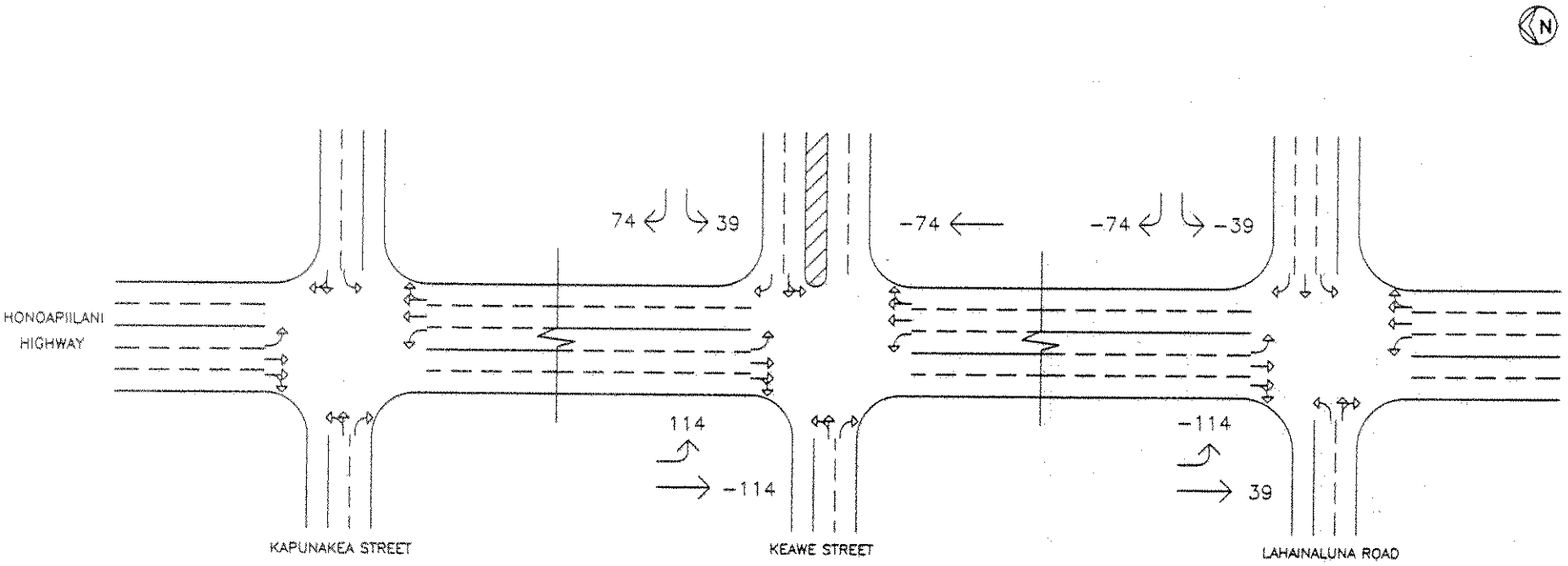
LANE USAGE

WILSON OKAMOTO CORPORATION

KEAWE STREET EXTENSION

TRIP REASSIGNMENT - AM PEAK HOUR OF TRAFFIC

FIGURE 4



LEGEND

90 TRAFFIC MOVEMENT VOLUME (VPH)

LANE USAGE

WILSON OKAMOTO CORPORATION
ENGINEERS · PLANNERS

KEAWE STREET EXTENSION

TRIP REASSIGNMENT - PM PEAK HOUR OF TRAFFIC

FIGURE 5

B. Through Traffic Forecasting Methodology

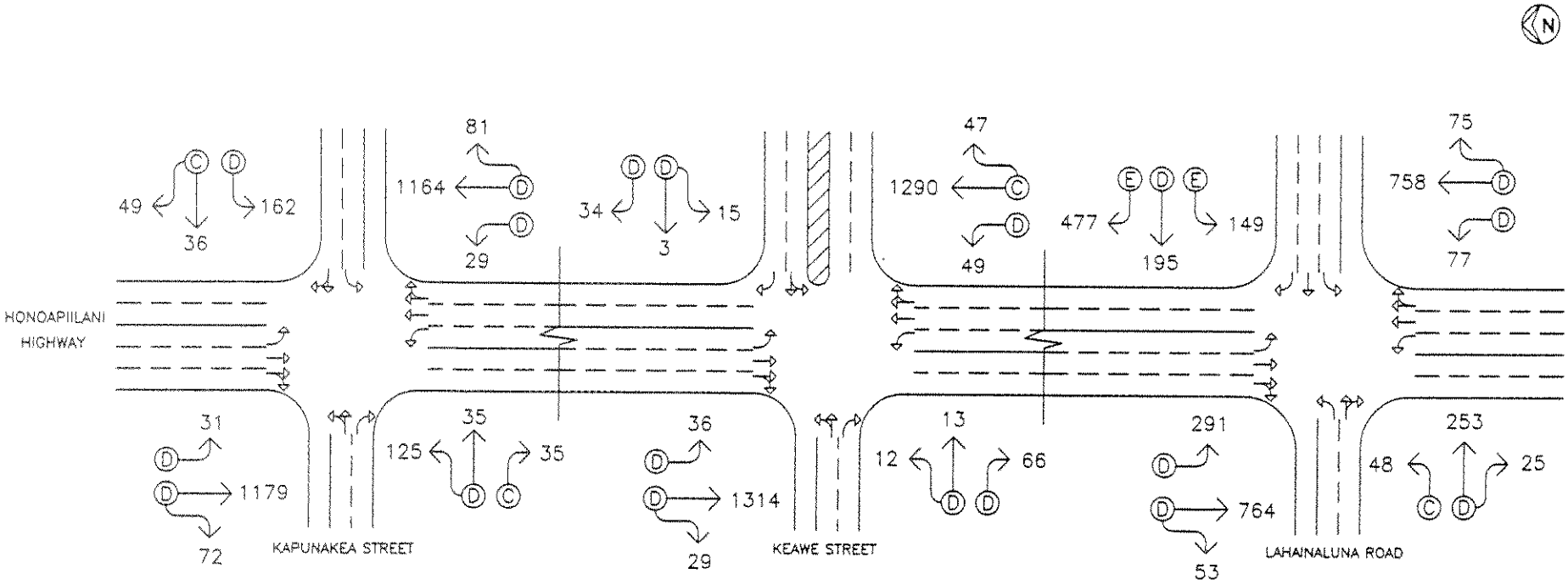
The travel forecast is based upon historical traffic count data obtained from the State DOT, Highways Division at a survey station located along Honoapiilani Highway in the project vicinity. The historical data were analyzed by linear regression techniques to obtain an annual traffic growth rate. However, historical trends indicate a net decrease in traffic demands in the project vicinity partly due to the increased availability of roadways serving as alternate routes, effects of tourism, and other factors contributing to the traffic demand. For the purpose of this study, however, a 2% per year growth was conservatively assumed to encompass other developments in the area. A growth factor of 1.06 was applied to the existing through traffic along Honoapiilani Highway to achieve the projected Year 2007 traffic demands.

C. Total Traffic Volumes Without Project

Figures 6 and 7 show the projected Year 2007 AM and PM peak hour traffic volumes and operating conditions within the project vicinity without the construction of the proposed Keawe Street Extension. The existing levels of service are included in Table 1 for comparison purposes. LOS calculations are included in Appendix D.

Table 1: Existing and Projected (Without Project) Intersection LOS Traffic Operating Conditions

Intersection	Traffic Movement		AM		PM	
			Existing	Year 2007 w/out Project	Existing	Year 2007 w/out Project
Honoapiilani Highway and Lahainaluna Road	WB	LT	D	E	D	D
		TH	D	D	D	D
		RT	D	E	D	D
	EB	LT	C	C	D	D
		TH-RT	D	D	D	D
	NB	LT	D	D	D	D
		TH-RT	D	D	C	C
	SB	LT	D	D	D	D
		TH-RT	D	D	D	D



LEGEND

90 — TRAFFIC MOVEMENT VOLUME (VPH)

LANE USAGE

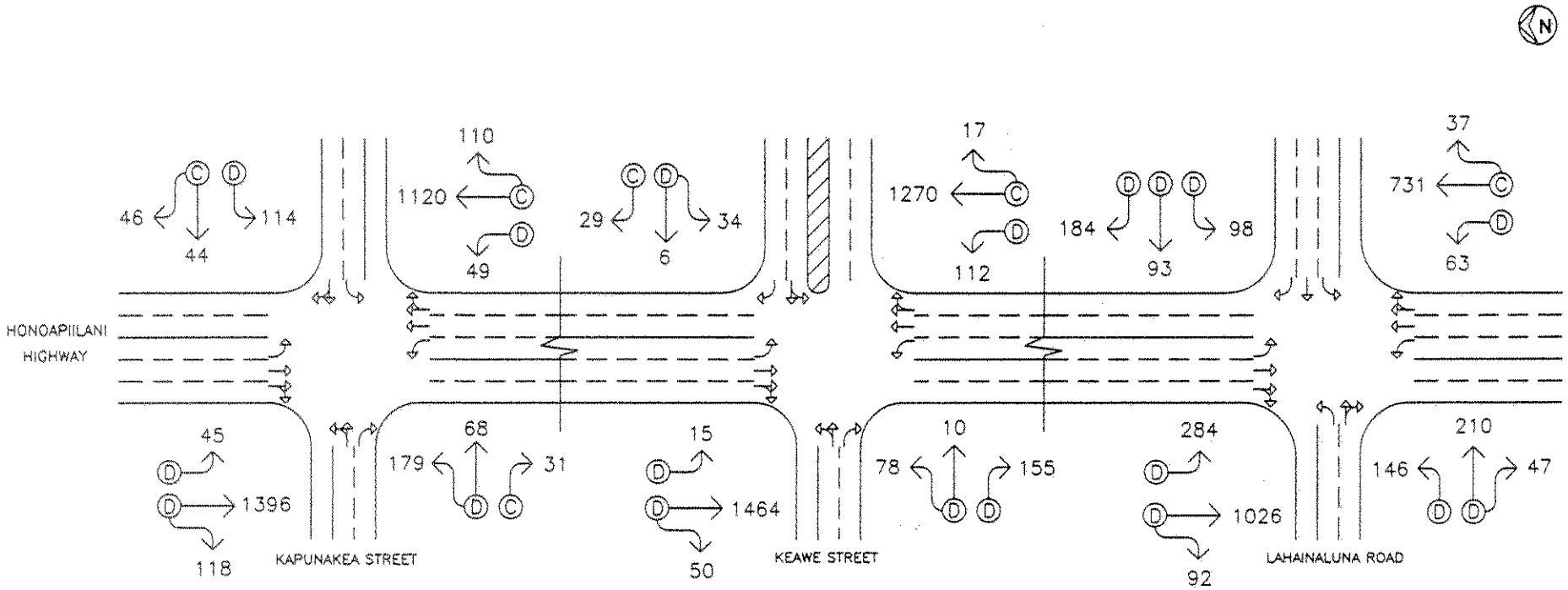
(A) — LANE GROUP LEVEL OF SERVICE

WILSON OKAMOTO CORPORATION
ENGINEERS · PLANNERS

KEAWE STREET EXTENSION

YEAR 2007 AM PEAK HOUR OF TRAFFIC WITHOUT PROJECT

FIGURE 6



LEGEND

90 — TRAFFIC MOVEMENT VOLUME (VPH)

LANE USAGE

(A) — LANE GROUP LEVEL OF SERVICE

WILSON OKAMOTO

KEAWE STREET EXTENSION

YEAR 2007 PM PEAK HOUR OF TRAFFIC WITHOUT PROJECT

FIGURE 7

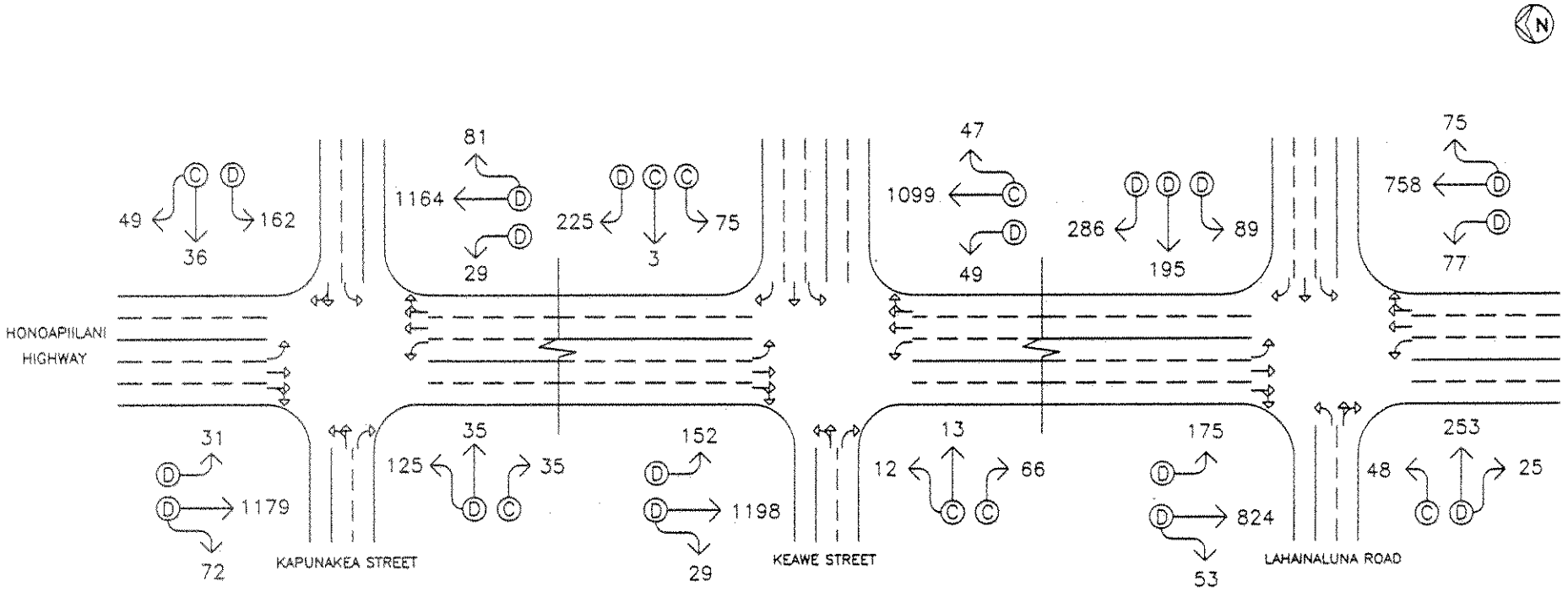
Table 1: Existing and Projected (Without Project) Intersection LOS Traffic Operating Conditions (Continued)

Intersection	Traffic Movement		AM		PM	
			Existing	Year 2007 w/out Project	Existing	Year 2007 w/out Project
Honoapiilani Highway and Keawe Street	WB	LT-TH	C	D	C	D
		RT	C	D	C	C
	EB	LT-TH	C	D	D	D
		RT	D	D	D	D
	NB	LT	D	D	D	D
		TH-RT	C	C	C	C
	SB	LT	D	D	D	D
		TH-RT	D	D	D	D
Honoapiilani Highway and Kapunakea Street	WB	LT	D	D	D	D
		TH-RT	C	C	C	C
	EB	LT-TH	D	D	D	D
		RT	C	C	C	C
	NB	LT	D	D	D	D
		TH-RT	D	D	C	C
	SB	LT	D	D	D	D
		TH-RT	D	D	D	D

Traffic operations under Year 2007 without project conditions are expected to deteriorate slightly from existing conditions within the project vicinity. At the intersection of Honoapiilani Highway and Lahainaluna Road, the westbound left-turn and right turn movements are expected to deteriorate from LOS "D" to an unacceptable LOS "E" during the AM peak period while the westbound left-turn and through movement at the intersection with Keawe Street is expected to deteriorate from LOS "C" to LOS "D" during both peak periods. The remaining movements at these intersections, as well as, all the movements at the intersection with Kapunakea Street are expected to operate at levels of service similar to existing conditions during both projected peak hours of traffic.

D. Total Traffic Volumes With Project

The Year 2007 cumulative AM and PM peak hour traffic conditions resulting from the projected ambient traffic growth and the extension of Keawe Street are shown on Figures 8 and 9, and summarized in Table 2. The cumulative volumes



LEGEND

90 — TRAFFIC MOVEMENT VOLUME (VPH)

LANE USAGE

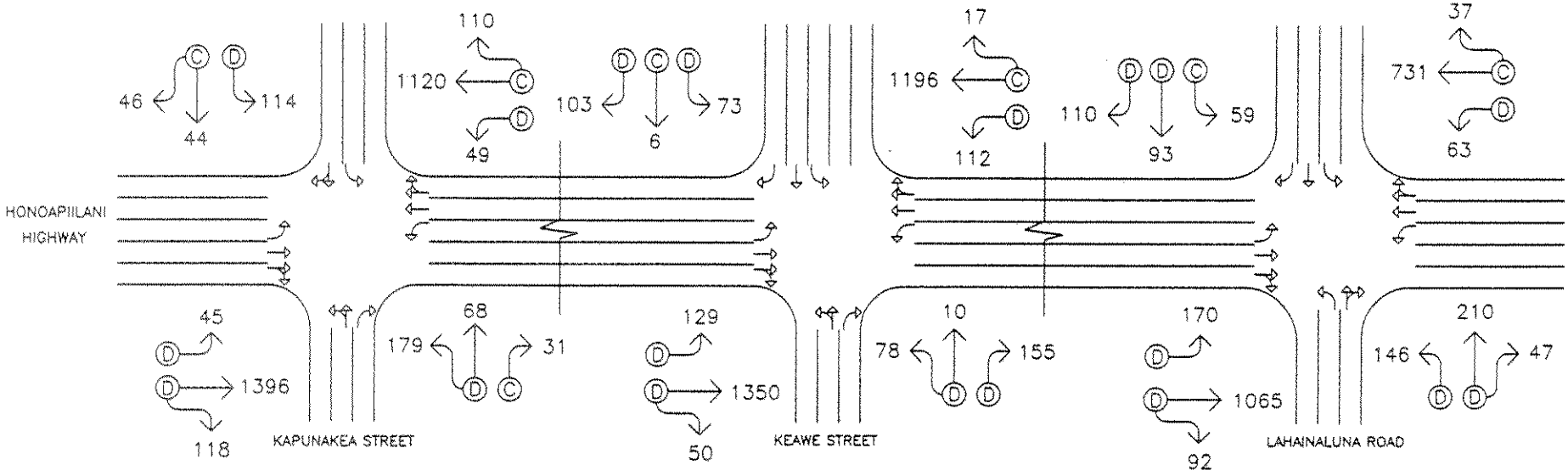
(A) LANE GROUP LEVEL OF SERVICE

WILSON OKAMOTO

KEAWE STREET EXTENSION

YEAR 2007 AM PEAK HOUR OF TRAFFIC WITH PROJECT

FIGURE 8



LEGEND

90 — TRAFFIC MOVEMENT VOLUME (VPH)

LANE USAGE

(A) — LANE GROUP LEVEL OF SERVICE

WILSON OKAMOTO CORPORATION
ENGINEERS · PLANNERS

KEAWE STREET EXTENSION

YEAR 2007 PM PEAK HOUR OF TRAFFIC WITH PROJECT

FIGURE 9

consist of vehicular trip reassignments superimposed over Year 2007 projected traffic demands. For the purpose of this report, the Keawe Street approach of the intersection with Honoapiilani Highway is assumed to be modified to provide dedicated left-turn, through, and right-turn lanes prior to the Year 2007. The projected Year 2007 (Without Project) operating conditions are provided for comparison purposes. LOS calculations are included in Appendix E.

Table 2: Existing and Projected (With and Without Project) Intersection LOS Traffic Operating Conditions

Intersection	Traffic Movement		AM			PM		
			Exist	Year 2007 w/out Proj	Year 2007 w/ Proj	Exist	Year 2007 w/out Proj	Year 2007 w/ Proj
Honoapiilani Highway and Lahainaluna Road	WB	LT	D	E	D	D	D	C
		TH	D	D	D	D	D	D
		RT	D	E	D	D	D	D
	EB	LT	C	C	C	D	D	D
		TH-RT	D	D	D	D	D	D
	NB	LT	D	D	D	D	D	D
		TH-RT	D	D	D	C	C	C
	SB	LT	D	D	D	D	D	D
		TH-RT	D	D	D	D	D	D
Honoapiilani Highway and Keawe Street	WB	LT	C	D	C	C	D	D
		TH			C			C
		RT	C	D	D	C	C	D
	EB	LT-TH	C	D	C	D	D	D
		RT	D	D	C	D	D	D
	NB	LT	D	D	D	D	D	D
		TH-RT	C	C	C	C	C	C
	SB	LT	D	D	D	D	D	D
		TH-RT	D	D	D	D	D	D
Honoapiilani Highway and Kapunakea Street	WB	LT	D	D	D	D	D	D
		TH-RT	C	C	C	C	C	C
	EB	LT-TH	D	D	D	D	D	D
		RT	C	C	C	C	C	C
	NB	LT	D	D	D	D	D	D
		TH-RT	D	D	D	C	C	C
	SB	LT	D	D	D	D	D	D
		TH-RT	D	D	D	D	D	D

Traffic operations under Year 2007 with project conditions at the intersection of Honoapiilani Highway with Lahainaluna Road are expected to improve slightly from Year 2007 without project conditions due to the decrease in traffic volumes at that intersection. The westbound left-turn and right-turn movements are expected to improve from LOS "E" to LOS "D" during the projected AM peak hour of traffic. The remainder of the traffic movements at that intersection are expected to continue operating at levels of service similar to Year 2007 without project conditions during both peak hours of traffic.

At the intersection of Honoapiilani Highway with Keawe Street, traffic operations are expected, in general, remain similar to Year 2007 without project conditions despite the increase in traffic volumes at that intersection due to the provision of exclusive left-turn, through, and right-turn lanes on the Keawe Street approach of the intersection. The westbound left-turn and through movements are anticipated to operate at LOS "C" during the AM peak period and LOS "D" and LOS "C," respectively, during the PM peak period while the right-turn movement of that approach is expected to operate at LOS "D" during both peak periods. On the Lahaina Cannery Mall approach of the intersection, all of the traffic movements are anticipated to improve slightly from LOS "D" to LOS "C" due to adjustments to the traffic signal timing at that intersection to accommodate the increased traffic volumes along Keawe Street.

At the third study intersection of Honoapiilani Highway with Kapunakea Street, traffic operating conditions are expected to remain the same as Year 2007 without project conditions. Although traffic volumes at the other two study intersections are anticipated to change due to the proposed project, the traffic volumes at this intersection are anticipated to remain the same as without project conditions. As such, the associated levels of service for each of the traffic movements at this intersection are also expected to remain unchanged.

V. RECOMMENDATIONS

Based on the analysis of the traffic data, the following are the recommendations of this study:

1. Maintain adequate traffic control measures during construction to ensure motorist safety.

2. Provide adequate turning radii and sight distances at all roadway connections to ensure safe access to and from the extension.

3. Provide exclusive westbound left-turn, through, and right-turn lanes on the Keawe Street approach of the intersection with Honoapiilani Highway. The dimensions of these lanes should be determined during the design phase of the project.

4. Provide exclusive southbound left-turn and right-turn lanes on the Keawe Street approach of the intersection with Ikena Street. The dimensions of these lanes should be determined during the design phase of the project.

VI. CONCLUSION

The proposed project with extend Keawe Street from its current eastern terminus at Kupuohi Street to the proposed Lahaina Bypass. Since the schedule for the bypass is not known at this time, the project is also assumed to include the portion of the bypass between Keawe Street and the current northern terminus of Ikena Street. The extension is intended to serve as an alternate route between the residential areas located east of Honoapiilani Highway and is expected to divert vehicles from Honoapiilani Highway. The total traffic volumes entering the intersection of Honoapiilani Highway and Lahainaluna Road are expected to decrease by approximately 7% and 3% during the AM and PM peak hours of traffic, respectively, while those at the Keawe Street intersection with the highway are expected to increase proportionately. With the implementation of the aforementioned recommendations, the traffic movements at all of the study intersections are expected to operate at acceptable levels of service during both peak periods.

APPENDIX A

EXISTING TRAFFIC COUNT DATA

. Wilson Okamoto Corporation
1907 S. Beretania St. Suite 400
Honolulu, HI 96826

Counter: D1-0526 / D1-0528
Counted By: GMT / KT
Weather: Clear

File Name : honlaha
Site Code : 00000001
Start Date : 10/21/2004
Page No : 1

Groups Printed- Unshifted

	Honoapiilani Highway Southbound				Lahainaluna Road Westbound				Honoapiilani Highway Northbound				Lahainaluna Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Factor	1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		
06:00 AM	17	131	4	152	11	11	40	62	7	101	5	113	3	7	4	14	341
06:15 AM	19	123	4	146	15	21	33	69	5	137	10	152	5	6	5	16	383
06:30 AM	42	97	8	147	13	25	60	98	11	203	14	228	5	14	2	21	494
06:45 AM	52	100	8	160	26	36	52	114	8	190	12	210	4	18	6	28	512
Total	130	451	24	605	65	93	185	343	31	631	41	703	17	45	17	79	1730
07:00 AM	82	150	13	245	30	41	86	157	9	187	18	214	9	41	6	56	672
07:15 AM	78	219	14	311	38	45	132	215	12	181	17	210	7	70	2	79	815
07:30 AM	82	210	15	307	31	55	117	203	41	129	26	196	9	83	7	99	805
07:45 AM	49	142	11	202	50	54	142	246	15	218	14	247	23	59	10	92	787
Total	291	721	53	1065	149	195	477	821	77	715	75	867	48	253	25	326	3079
08:00 AM	32	156	20	208	27	30	65	122	25	190	14	229	17	33	13	63	622
08:15 AM	29	171	19	219	32	30	37	99	10	143	12	165	14	24	15	53	536
Grand Total	482	1499	116	2097	273	348	764	1385	143	1679	142	1964	96	355	70	521	5967
Apprch %	23.0	71.5	5.5		19.7	25.1	55.2		7.3	85.5	7.2		18.4	68.1	13.4		
Total %	8.1	25.1	1.9	35.1	4.6	5.8	12.8	23.2	2.4	28.1	2.4	32.9	1.6	5.9	1.2	8.7	

	Honoapiilani Highway Southbound				Lahainaluna Road Westbound				Honoapiilani Highway Northbound				Lahainaluna Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 06:00 AM to 08:15 AM - Peak 1 of 1																	
Intersection	07:00 AM																
Volume	291	721	53	1065	149	195	477	821	77	715	75	867	48	253	25	326	3079
Percent	27.3	67.7	5.0		18.1	23.8	58.1		8.9	82.5	8.7		14.7	77.6	7.7		
07:15 Volume	78	219	14	311	38	45	132	215	12	181	17	210	7	70	2	79	815
Peak Factor																	0.944
High Int.	07:15 AM				07:45 AM				07:45 AM				07:30 AM				
Volume	78	219	14	311	50	54	142	246	15	218	14	247	9	83	7	99	
Peak Factor				0.856				0.834				0.878				0.823	

1907 S. Beretania St. Suite 400
Honolulu, HI 96826

Counter: D1-0526 / D1-0528
Counted By: GMT / KT
Weather: Clear
Other:

File Name : honlahp
Site Code : 00000001
Start Date : 10/20/2004
Page No : 1

Groups Printed- Unshifted

	Honoapiilani Highway Southbound				Lahainaluna Road Westbound				Honoapiilani Highway Northbound				Lahainaluna Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Factor	1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		
03:00 PM	67	172	17	256	30	27	60	117	12	146	9	167	39	43	22	104	644
03:15 PM	70	215	12	297	34	30	46	110	5	162	7	174	38	41	10	89	670
03:30 PM	64	256	14	334	38	33	78	149	9	105	16	130	28	43	16	87	700
03:45 PM	54	198	16	268	24	44	48	116	14	203	15	232	30	39	8	77	693
Total	255	841	59	1155	126	134	232	492	40	616	47	703	135	166	56	357	2707
04:00 PM	57	220	17	294	32	27	50	109	15	182	14	211	36	50	8	94	708
04:15 PM	71	294	29	394	21	21	30	72	10	186	6	202	51	49	11	111	779
04:30 PM	80	238	25	343	18	25	62	105	31	144	12	187	34	46	10	90	725
04:45 PM	76	216	21	313	27	20	42	89	7	178	5	190	25	65	18	108	700
Total	284	968	92	1344	98	93	184	375	63	690	37	790	146	210	47	403	2912
05:00 PM	65	209	11	285	43	30	37	110	9	165	18	192	26	48	6	80	667
05:15 PM	57	228	23	308	21	22	32	75	14	198	20	232	24	45	12	81	696
05:30 PM	53	149	17	219	38	28	41	107	12	189	7	208	20	40	12	72	606
05:45 PM	47	183	18	248	35	19	40	94	10	195	12	217	13	34	14	61	620
Total	222	769	69	1060	137	99	150	386	45	747	57	849	83	167	44	294	2589
Grand Total	761	2578	220	3559	361	326	566	1253	148	2053	141	2342	364	543	147	1054	8208
Apprch %	21.4	72.4	6.2		28.8	26.0	45.2		6.3	87.7	6.0		34.5	51.5	13.9		
Total %	9.3	31.4	2.7	43.4	4.4	4.0	6.9	15.3	1.8	25.0	1.7	28.5	4.4	6.6	1.8	12.8	

	Honoapiilani Highway Southbound				Lahainaluna Road Westbound				Honoapiilani Highway Northbound				Lahainaluna Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	04:00 PM																
Volume	284	968	92	1344	98	93	184	375	63	690	37	790	146	210	47	403	2912
Percent	21.1	72.0	6.8		26.1	24.8	49.1		8.0	87.3	4.7		36.2	52.1	11.7		
04:15 Volume	71	294	29	394	21	21	30	72	10	186	6	202	51	49	11	111	779
Peak Factor																	0.935
High Int.	04:15 PM				04:00 PM				04:00 PM				04:15 PM				
Volume	71	294	29	394	32	27	50	109	15	182	14	211	51	49	11	111	
Peak Factor				0.853				0.860				0.936				0.908	

Wilson Okamoto Corporation
1907 S. Beretania St. Suite 400
Honolulu, HI 96826

Counter: D1-0525 / D1-0769
Counted By: TO / RR
Weather: Clear

File Name : honkeaa
Site Code : 00000002
Start Date : 10/21/2004
Page No : 1

Groups Printed- Unshifted

	Honoapiilani Highway Southbound				Keawe Street Westbound				Honoapiilani Highway Northbound				Keawe Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Factor	1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		
06:00 AM	1	160	2	163	0	1	0	1	3	143	1	147	0	0	4	4	315
06:15 AM	1	138	2	141	0	0	0	0	2	156	2	160	2	1	4	7	308
06:30 AM	1	184	3	188	1	0	0	1	13	260	2	275	1	0	6	7	471
06:45 AM	14	208	6	228	3	0	0	3	6	244	12	262	0	3	10	13	506
Total	17	690	13	720	4	1	0	5	24	803	17	844	3	4	24	31	1600
07:00 AM	5	291	7	303	2	1	10	13	11	273	14	298	0	2	16	18	632
07:15 AM	10	386	6	402	4	1	7	12	10	326	7	343	2	3	14	19	776
07:30 AM	7	309	8	324	5	1	7	13	11	275	12	298	7	5	14	26	661
07:45 AM	14	254	8	276	4	0	10	14	17	343	14	374	3	3	22	28	692
Total	36	1240	29	1305	15	3	34	52	49	1217	47	1313	12	13	66	91	2761
08:00 AM	9	241	9	259	10	1	9	20	18	285	24	327	2	3	17	22	628
08:15 AM	17	223	17	257	8	5	11	24	21	177	6	204	2	6	27	35	520
Grand Total	79	2394	68	2541	37	10	54	101	112	2482	94	2688	19	26	134	179	5509
Apprch %	3.1	94.2	2.7		36.6	9.9	53.5		4.2	92.3	3.5		10.6	14.5	74.9		
Total %	1.4	43.5	1.2	46.1	0.7	0.2	1.0	1.8	2.0	45.1	1.7	48.8	0.3	0.5	2.4	3.2	

	Honoapiilani Highway Southbound				Keawe Street Westbound				Honoapiilani Highway Northbound				Keawe Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 06:00 AM to 08:15 AM - Peak 1 of 1																	
Intersection	07:00 AM																
Volume	36	1240	29	1305	15	3	34	52	49	1217	47	1313	12	13	66	91	2761
Percent	2.8	95.0	2.2		28.8	5.8	65.4		3.7	92.7	3.6		13.2	14.3	72.5		
07:15 Volume	10	386	6	402	4	1	7	12	10	326	7	343	2	3	14	19	776
Peak Factor																	0.889
High Int.	07:15 AM				07:45 AM				07:45 AM				07:45 AM				
Volume	10	386	6	402	4	0	10	14	17	343	14	374	3	3	22	28	
Peak Factor				0.812				0.929				0.878				0.813	

1907 S. Beretania St. Suite 400
Honolulu, HI 96826

Counter: D1-0525 / D1-0769
Counted By: TO / RR
Weather: Clear
Other:

File Name : honkeap
Site Code : 00000002
Start Date : 10/20/2004
Page No : 1

Groups Printed- Unshifted

	Honoapiilani Highway Southbound				Keawe Street Westbound				Honoapiilani Highway Northbound				Keawe Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Factor	1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		
03:00 PM	10	289	7	306	17	1	11	29	35	263	5	303	15	2	19	36	674
03:15 PM	7	285	8	300	13	0	10	23	33	291	4	328	18	2	25	45	696
03:30 PM	4	352	15	371	11	2	6	19	32	245	8	285	18	2	29	49	724
03:45 PM	11	280	11	302	6	0	7	13	35	276	8	319	24	0	45	69	703
Total	32	1206	41	1279	47	3	34	84	135	1075	25	1235	75	6	118	199	2797
04:00 PM	4	368	14	386	11	3	11	25	30	323	8	361	19	4	41	64	836
04:15 PM	1	385	8	394	7	0	10	17	28	301	4	333	24	3	48	75	819
04:30 PM	6	316	15	337	9	3	3	15	25	282	5	312	16	2	32	50	714
04:45 PM	4	312	13	329	7	0	5	12	29	292	0	321	19	1	34	54	716
Total	15	1381	50	1446	34	6	29	69	112	1198	17	1327	78	10	155	243	3085
05:00 PM	1	288	13	302	3	3	8	14	33	306	3	342	14	5	42	61	719
05:15 PM	1	270	8	279	3	1	3	7	36	259	3	298	16	0	29	45	629
05:30 PM	2	259	12	273	7	0	4	11	14	313	3	330	8	0	27	35	649
05:45 PM	1	263	15	279	2	0	3	5	41	252	8	301	15	0	29	44	629
Total	5	1080	48	1133	15	4	18	37	124	1130	17	1271	53	5	127	185	2626
Grand Total	52	3667	139	3858	96	13	81	190	371	3403	59	3833	206	21	400	627	8508
Apprch %	1.3	95.0	3.6		50.5	6.8	42.6		9.7	88.8	1.5		32.9	3.3	63.8		
Total %	0.6	43.1	1.6	45.3	1.1	0.2	1.0	2.2	4.4	40.0	0.7	45.1	2.4	0.2	4.7	7.4	

	Honoapiilani Highway Southbound				Keawe Street Westbound				Honoapiilani Highway Northbound				Keawe Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	04:00 PM																
Volume	15	1381	50	1446	34	6	29	69	112	1198	17	1327	78	10	155	243	3085
Percent	1.0	95.5	3.5		49.3	8.7	42.0		8.4	90.3	1.3		32.1	4.1	63.8		
04:00 Volume	4	368	14	386	11	3	11	25	30	323	8	361	19	4	41	64	836
Peak Factor																	0.923
High Int.	04:15 PM				04:00 PM				04:00 PM				04:15 PM				
Volume	1	385	8	394	11	3	11	25	30	323	8	361	24	3	48	75	
Peak Factor				0.918				0.690				0.919				0.810	

Wilson Okamoto Corporation
1907 S. Beretania St. Suite 400
Honolulu, HI 96826

Counter: D1-0527 / D1-0768
Counted By: JG / JL
Weather: Clear

File Name : honkapa
Site Code : 00000003
Start Date : 10/21/2004
Page No : 1

Groups Printed- Unshifted

	Honoapiilani Highway Southbound				Kapunakea Road Westbound				Honoapiilani Highway Northbound				Kapunakea Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Factor	1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		
06:00 AM	4	143	11	158	9	3	9	21	5	123	9	137	8	8	2	18	334
06:15 AM	3	119	12	134	20	9	7	36	9	135	6	150	17	2	4	23	343
06:30 AM	4	162	11	177	23	4	8	35	3	242	10	255	16	6	3	25	492
06:45 AM	2	191	19	212	25	8	15	48	5	213	13	231	17	4	7	28	519
Total	13	615	53	681	77	24	39	140	22	713	38	773	58	20	16	94	1688
07:00 AM	7	263	17	287	35	10	9	54	7	238	15	260	24	9	5	38	639
07:15 AM	17	333	15	365	59	13	17	89	5	295	22	322	25	6	9	40	816
07:30 AM	3	278	18	299	37	5	15	57	8	251	19	278	35	9	12	56	690
07:45 AM	4	238	22	264	31	8	8	47	9	314	25	348	41	11	9	61	720
Total	31	1112	72	1215	162	36	49	247	29	1098	81	1208	125	35	35	195	2865
08:00 AM	5	222	18	245	35	9	7	51	9	252	22	283	31	3	11	45	624
08:15 AM	4	232	27	263	24	4	13	41	5	170	16	191	31	7	11	49	544
Grand Total	53	2181	170	2404	298	73	108	479	65	2233	157	2455	245	65	73	383	5721
Apprch %	2.2	90.7	7.1		62.2	15.2	22.5		2.6	91.0	6.4		64.0	17.0	19.1		
Total %	0.9	38.1	3.0	42.0	5.2	1.3	1.9	8.4	1.1	39.0	2.7	42.9	4.3	1.1	1.3	6.7	

	Honoapiilani Highway Southbound				Kapunakea Road Westbound				Honoapiilani Highway Northbound				Kapunakea Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 06:00 AM to 08:15 AM - Peak 1 of 1																	
Intersection	07:00 AM																
Volume	31	1112	72	1215	162	36	49	247	29	1098	81	1208	125	35	35	195	2865
Percent	2.6	91.5	5.9		65.6	14.6	19.8		2.4	90.9	6.7		64.1	17.9	17.9		
07:15 Volume	17	333	15	365	59	13	17	89	5	295	22	322	25	6	9	40	816
Peak Factor																	0.878
High Int.	07:15 AM				07:15 AM				07:45 AM				07:45 AM				
Volume	17	333	15	365	59	13	17	89	9	314	25	348	41	11	9	61	
Peak Factor				0.832				0.694				0.868				0.799	

1907 S. Beretania St. Suite 400
Honolulu, HI 96826

Counter: D1-0527 / D1-0768
Counted By: JG / JL
Weather: Clear
Other:

File Name : honkapp
Site Code : 00000003
Start Date : 10/20/2004
Page No : 1

Groups Printed- Unshifted

	Honoapiilani Highway Southbound				Kapunakea Road Westbound				Honoapiilani Highway Northbound				Kapunakea Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Factor	1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		1.0	1.0	1.0		
03:00 PM	18	296	28	342	30	10	15	55	20	252	29	301	52	8	4	64	762
03:15 PM	15	300	25	340	31	4	14	49	14	278	22	314	49	10	8	67	770
03:30 PM	7	326	23	356	29	9	11	49	7	232	26	265	47	9	3	59	729
03:45 PM	9	297	25	331	26	6	20	52	17	254	22	293	39	11	6	56	732
Total	49	1219	101	1369	116	29	60	205	58	1016	99	1173	187	38	21	246	2993
04:00 PM	12	364	33	409	22	11	9	42	11	297	36	344	49	19	4	72	867
04:15 PM	9	366	31	406	22	6	13	41	16	275	31	322	34	10	12	56	825
04:30 PM	12	311	14	337	31	13	10	54	11	228	21	260	51	24	8	83	734
04:45 PM	12	276	40	328	39	14	14	67	11	257	22	290	45	15	7	67	752
Total	45	1317	118	1480	114	44	46	204	49	1057	110	1216	179	68	31	278	3178
05:00 PM	5	292	28	325	30	7	9	46	13	257	29	299	36	19	5	60	730
05:15 PM	4	256	22	282	25	5	10	40	24	234	26	284	52	4	3	59	665
05:30 PM	1	227	27	255	25	7	7	39	10	240	22	272	48	15	7	70	636
05:45 PM	4	252	27	283	23	9	9	41	17	218	24	259	32	13	5	50	633
Total	14	1027	104	1145	103	28	35	166	64	949	101	1114	168	51	20	239	2664
Grand Total	108	3563	323	3994	333	101	141	575	171	3022	310	3503	534	157	72	763	8835
Apprch %	2.7	89.2	8.1		57.9	17.6	24.5		4.9	86.3	8.8		70.0	20.6	9.4		
Total %	1.2	40.3	3.7	45.2	3.8	1.1	1.6	6.5	1.9	34.2	3.5	39.6	6.0	1.8	0.8	8.6	

	Honoapiilani Highway Southbound				Kapunakea Road Westbound				Honoapiilani Highway Northbound				Kapunakea Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	04:00 PM																
Volume	45	1317	118	1480	114	44	46	204	49	1057	110	1216	179	68	31	278	3178
Percent	3.0	89.0	8.0		55.9	21.6	22.5		4.0	86.9	9.0		64.4	24.5	11.2		
04:00 Volume	12	364	33	409	22	11	9	42	11	297	36	344	49	19	4	72	867
Peak Factor																	0.916
High Int.	04:00 PM				04:45 PM				04:00 PM				04:30 PM				
Volume	12	364	33	409	39	14	14	67	11	297	36	344	51	24	8	83	
Peak Factor				0.905				0.761				0.884				0.837	

Wilson Okamoto Corporation

1907 S. Beretania St., #400

Honolulu, HI 96826

le1 : Keawe Street

le2 :

e3 :

Site:

Date: 10/20/0

Day: Wednesday

val	WB			EB			Combined		
gin	AM	PM		AM	PM		AM	PM	
12:00	*	*		*	*		*	*	
12:15	*	*		*	*		*	*	
12:30	*	*		*	*		*	*	
12:45	*	*		*	*		*	*	
01:00	*	*		*	*		*	*	
01:15	*	*		*	*		*	*	
01:30	*	*		*	*		*	*	
01:45	*	16		*	22		*	38	
02:00	*	26	109	*	52	186	*	78	295
02:15	*	26		*	46		*	72	
02:30	*	32		*	42		*	74	
02:45	*	25		*	46		*	71	
03:00	*	22	106	*	45	194	*	67	300
03:15	*	32		*	55		*	87	
03:30	*	28		*	52		*	80	
03:45	*	24		*	42		*	66	
04:00	*	28	106	*	43	177	*	71	283
04:15	*	22		*	38		*	60	
04:30	*	30		*	54		*	84	
04:45	*	26		*	42		*	68	
05:00	*	30	125	*	47	191	*	77	316
05:15	*	26		*	44		*	70	
05:30	*	38		*	52		*	90	
05:45	*	31		*	48		*	79	
06:00	*	30	121	*	44	185	*	74	306
06:15	*	31		*	41		*	72	
06:30	*	30		*	58		*	88	
06:45	*	30		*	42		*	72	
07:00	*	23	85	*	36	121	*	59	206
07:15	*	24		*	38		*	62	
07:30	*	20		*	24		*	44	
07:45	*	18		*	23		*	41	
08:00	*	21	73	*	30	103	*	51	176
08:15	*	14		*	25		*	39	
08:30	*	18		*	22		*	40	
08:45	*	20		*	26		*	46	
09:00	*	16	91	*	24	125	*	40	216
09:15	*	30		*	38		*	68	
09:30	*	25		*	35		*	60	
09:45	*	20		*	28		*	48	
10:00	*	13	91	*	17	109	*	30	200
10:15	*	40		*	45		*	85	
10:30	*	26		*	31		*	57	
10:45	*	12		*	16		*	28	
11:00	*	12	59	*	14	74	*	26	133
11:15	*	16		*	21		*	37	
11:30	*	14		*	17		*	31	
11:45	*	17		*	22		*	39	
als	0	982		0	1,487		0	2,469	
%	*	39.8		*	60.2				

Totals	982	1,487	2,469
Splits	39.8	60.2	

Hour	*	05:30	*	02:45	*	05:00
lume	*	130	*	198	*	316
tor	*	0.86	*	0.90	*	0.88

Wilson Okamoto Corporation

1907 S. Beretania St., #400

Honolulu, HI 96826

: Keawe Street

Site:

:

Date: 10/21/04

:

WB			EB			Combined			Day: Thursday
AM		PM	AM		PM	AM		PM	
9	30	19	12	37	32	21	67	51	
7		0	7		0	14		0	
6		*	8		*	14		*	
8		*	10		*	18		*	
3	21	*	3	23	*	6	44	*	
8		*	8		*	16		*	
6		*	6		*	12		*	
4		*	6		*	10		*	
2	8	*	2	12	*	4	20	*	
2		*	4		*	6		*	
4		*	6		*	10		*	
0		*	0		*	0		*	
2	13	*	2	16	*	4	29	*	
5		*	5		*	10		*	
2		*	3		*	5		*	
4		*	6		*	10		*	
8	37	*	9	44	*	17	81	*	
13		*	15		*	28		*	
10		*	11		*	21		*	
6		*	9		*	15		*	
2	25	*	4	44	*	6	69	*	
10		*	14		*	24		*	
5		*	12		*	17		*	
8		*	14		*	22		*	
9	66	*	18	116	*	27	182	*	
17		*	24		*	41		*	
20		*	36		*	56		*	
20		*	38		*	58		*	
22	143	*	58	291	*	80	434	*	
39		*	90		*	129		*	
42		*	73		*	115		*	
40		*	70		*	110		*	
22	81	*	39	135	*	61	216	*	
14		*	30		*	44		*	
24		*	34		*	58		*	
21		*	32		*	53		*	
14	56	*	30	111	*	44	167	*	
15		*	31		*	46		*	
11		*	24		*	35		*	
16		*	26		*	42		*	
18	62	*	24	98	*	42	160	*	
15		*	23		*	38		*	
15		*	24		*	39		*	
14		*	27		*	41		*	
18	68	*	26	126	*	44	194	*	
18		*	38		*	56		*	
12		*	24		*	36		*	
20		*	38		*	58		*	
610		19	1,053		32	1,663		51	
36.7		37.3	63.3		62.7				
	629			1,085			1,714		
	36.7			63.3					
07:00		12:00	07:00		12:00	07:00		12:00	
143		19	291		32	434		51	
0.85		0.25	0.81		0.25	0.84		0.25	

Wilson Okamoto Corporation
1907 S. Beretania Street #400
Honolulu, HI 96826

Title1 : Ikena Rd/Lahainaluna Rd
Title2 : SUNNY
Title3 : 3326

Site:
Date: 10/20

Day: Wednesday

Interval	NB			SB			Combined		
Begin	AM	PM		AM	PM		AM	PM	
12:00	*	*		*	*		*	*	
12:15	*	*		*	*		*	*	
12:30	*	*		*	*		*	*	
12:45	*	*		*	*		*	*	
01:00	*	*		*	*		*	*	
01:15	*	*		*	*		*	*	
01:30	*	*		*	*		*	*	
01:45	*	16		*	6		*	22	
02:00	*	26	109	*	26	79	*	52	188
02:15	*	26		*	20		*	46	
02:30	*	32		*	11		*	43	
02:45	*	25		*	22		*	47	
03:00	*	22	106	*	24	89	*	46	195
03:15	*	32		*	24		*	56	
03:30	*	28		*	24		*	52	
03:45	*	24		*	17		*	41	
04:00	*	28	106	*	16	73	*	44	179
04:15	*	22		*	16		*	38	
04:30	*	30		*	24		*	54	
04:45	*	26		*	17		*	43	
05:00	*	30	125	*	17	65	*	47	190
05:15	*	26		*	18		*	44	
05:30	*	38		*	14		*	52	
05:45	*	31		*	16		*	47	
06:00	*	30	121	*	14	64	*	44	185
06:15	*	31		*	10		*	41	
06:30	*	30		*	28		*	58	
06:45	*	30		*	12		*	42	
07:00	*	23	85	*	12	35	*	35	120
07:15	*	24		*	14		*	38	
07:30	*	20		*	4		*	24	
07:45	*	18		*	5		*	23	
08:00	*	21	73	*	9	31	*	30	104
08:15	*	14		*	12		*	26	
08:30	*	18		*	4		*	22	
08:45	*	20		*	6		*	26	
09:00	*	16	91	*	8	34	*	24	125
09:15	*	30		*	8		*	38	
09:30	*	25		*	10		*	35	
09:45	*	20		*	8		*	28	
10:00	*	13	91	*	4	21	*	17	112
10:15	*	40		*	6		*	46	
10:30	*	26		*	6		*	32	
10:45	*	12		*	5		*	17	
11:00	*	12	59	*	2	16	*	14	75
11:15	*	16		*	6		*	22	
11:30	*	14		*	4		*	18	
11:45	*	17		*	4		*	21	
Totals	0	982		0	513		0	1,495	
Split%	*	65.7		*	34.3				

Day Totals	982	513	1,495
Day Splits	65.7	34.3	

Peak Hour	*	05:30	*	02:45	*	02:45
Volume	*	130	*	94	*	201
Factor	*	0.86	*	0.98	*	0.90

Wilson Okamoto Corporation
1907 S. Beretania Street #400
Honolulu, HI 96826

: Ikena Rd/Lahainaluna Rd
: SUNNY
: 3326

Site: 1
Date: 10/21/04
Day: Thursday

	NB			SB			Combined		
	AM		PM	AM		PM	AM		PM
0	9	30	19	3	6	13	12	36	32
5	7		0	0		0	7		0
0	6		*	1		*	7		*
5	8		*	2		*	10		*
0	3	21	*	0	2	*	3	23	*
5	8		*	0		*	8		*
0	6		*	0		*	6		*
5	4		*	2		*	6		*
0	2	8	*	0	4	*	2	12	*
5	2		*	2		*	4		*
0	4		*	2		*	6		*
5	0		*	0		*	0		*
0	2	13	*	0	3	*	2	16	*
5	5		*	0		*	5		*
0	2		*	1		*	3		*
5	4		*	2		*	6		*
0	8	37	*	0	6	*	8	43	*
5	13		*	2		*	15		*
0	10		*	1		*	11		*
5	6		*	3		*	9		*
0	2	25	*	2	19	*	4	44	*
5	10		*	4		*	14		*
0	5		*	7		*	12		*
5	8		*	6		*	14		*
0	9	66	*	9	51	*	18	117	*
5	17		*	7		*	24		*
0	20		*	17		*	37		*
5	20		*	18		*	38		*
0	22	143	*	36	148	*	58	291	*
5	39		*	52		*	91		*
0	42		*	30		*	72		*
5	40		*	30		*	70		*
0	22	81	*	17	53	*	39	134	*
5	14		*	16		*	30		*
0	24		*	10		*	34		*
5	21		*	10		*	31		*
0	14	56	*	16	54	*	30	110	*
5	15		*	16		*	31		*
0	11		*	12		*	23		*
5	16		*	10		*	26		*
0	18	62	*	6	34	*	24	96	*
5	15		*	8		*	23		*
0	15		*	8		*	23		*
5	14		*	12		*	26		*
0	18	68	*	8	57	*	26	125	*
5	18		*	19		*	37		*
0	12		*	12		*	24		*
5	20		*	18		*	38		*
	610		19	437		13	1,047		32
	58.3		59.4	41.7		40.6			
otals		629			450			1,079	
plits		58.3			41.7				

	NB		SB		Combined	
four	07:00	12:00	07:00	12:00	07:00	12:00
e	143	19	148	13	291	32
	0.85	0.25	0.71	0.25	0.80	0.25

APPENDIX B

LEVEL OF SERVICE DEFINITIONS

LEVEL OF SERVICE DEFINITIONS

LEVEL-OF-SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS

Level of Service (LOS) for signalized intersections is defined in terms of delay, which is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. Specifically, level-of-service (LOS) criteria are stated in terms of the average control delay per vehicle, typically a 15-min analysis period. The criteria are given in the following table.

Table 1: 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 depends 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.

Level of Service A describes operations with low control delay, up to 10 sec per vehicle. This level of service occurs when progression is extremely favorable and most vehicles arrive during the green phase. Many vehicles do not stop at all. Short cycle lengths may tend to contribute to low delay values.

Level of Service B describes operations with control delay greater than 10 and up to 20 sec per vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of delay.

Level of Service C describes operations with control delay greater than 20 and up to 35 sec per vehicle. These higher delays may result from only fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. Cycle failure occurs when a given green phase does not serve queued vehicles and overflows occur. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

Level of Service D describes operations with control delay greater than 35 and up to 55 sec per vehicle. At level of service D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

"Highway Capacity Manual," Transportation Research Board, 2000

Level of Service E describes operation with control delay greater than 55 and up to 80 sec per vehicle. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent.

Level of Service F describes operations with control delay in excess of 80 sec per vehicle. This level, considered to be unacceptable to most drivers, often occurs with oversaturation, that is, when arrival flow rates exceed the capacity lane groups. It may also occur at high v/c ratios with many individual cycle failures. Poor progression and long cycle lengths may also contribute significantly to high delay levels.

"Highway Capacity Manual," Transportation Research Board, 2000

APPENDIX C

CAPACITY ANALYSIS CALCULATIONS
EXISTING PEAK HOUR TRAFFIC ANALYSIS

HCS2000: Signalized Intersections Release 4.1e

Analyst: GMT
Agency:
Date: 10/21/04
Period: AM PEAK
Project ID:
E/W St: Lahainaluna Road

Inter.:
Area Type: All other areas
Jurisd:
Year : Existing

N/S St: Honoapiilani Highway

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	1	1	2	0	1	2	0
LGConfig	L	TR		L	T	R	L	TR		L	TR	
Volume	48	253	25	149	195	477	77	715	75	291	721	53
Lane Width	12.0	12.0		12.0	12.0	12.0	12.0	12.0		12.0	12.0	
RTOR Vol			3			119			8			5

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	A	A			NB	Left	A			
	Thru		A				Thru		A		
	Right		A				Right		A		
	Peds						Peds				
WB	Left	A	A			SB	Left	A			
	Thru		A				Thru		A		
	Right		A				Right		A		
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right				
Green		5.5	46.5					34.0	39.0		
Yellow		0.0	4.0					4.0	4.0		
All Red		0.0	1.0					1.0	1.0		

Cycle Length: 140.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	334	1770	0.18	0.37	29.6	C		
TR	611	1840	0.55	0.33	39.3	D	37.8	D
Westbound								
L	256	1770	0.70	0.37	53.5	D		
T	619	1863	0.38	0.33	36.1	D	48.8	D
R	526	1583	0.82	0.33	53.7	D		
Northbound								
L	475	1956	0.19	0.24	42.2	D		
TR	1078	3870	0.82	0.28	52.9	D	51.9	D
Southbound								
L	475	1956	0.71	0.24	53.6	D		
TR	1082	3883	0.83	0.28	53.0	D	53.2	D

Intersection Delay = 50.0 (sec/veh) Intersection LOS = D

HCS2000: Signalized Intersections Release 4.1e

Analyst: GMT
Agency:
Date: 10/21/04
Period: PM PEAK
Project ID:
E/W St: Lahainaluna Road

Inter.:
Area Type: All other areas
Jurisd:
Year : Existing
N/S St: Honoapiilani Highway

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	1	1	2	0	1	2	0
LGConfig	L	TR		L	T	R	L	TR		L	TR	
Volume	146	210	47	98	93	184	63	690	37	284	968	92
Lane Width	12.0	12.0		12.0	12.0	12.0	12.0	12.0		12.0	12.0	
RTOR Vol			5			46			4			9

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	A	A			NB Left	A			
Thru		A			Thru		A		
Right		A			Right		A		
Peds					Peds				
WB Left	A	A			SB Left	A			
Thru		A			Thru		A		
Right		A			Right		A		
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green	5.5	27.5				29.5	42.5		
Yellow	0.0	4.0				4.0	4.0		
All Red	0.0	1.0				1.0	1.0		

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	312	1770	0.51	0.28	39.6	D		
TR	416	1816	0.67	0.23	46.2	D	43.8	D
Westbound								
L	180	1770	0.63	0.28	46.9	D		
T	427	1863	0.25	0.23	38.2	D	41.8	D
R	363	1583	0.44	0.23	40.5	D		
Northbound								
L	481	1956	0.14	0.25	35.5	D		
TR	1378	3893	0.56	0.35	31.7	C	32.0	C
Southbound								
L	481	1956	0.69	0.25	45.6	D		
TR	1371	3873	0.90	0.35	46.5	D	46.3	D

Intersection Delay = 41.7 (sec/veh) Intersection LOS = D

HCS2000: Signalized Intersections Release 4.1e

Analyst: GMT
Agency:
Date: 10/21/04
Period: AM PEAK
Project ID:
E/W St: Keawe Street

Inter.:
Area Type: All other areas
Jurisd:
Year : Existing

N/S St: Honoapiilani Highway

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	0	1	1	1	2	0	1	2	0
LGConfig		LT	R		LT	R	L	TR		L	TR	
Volume	12	13	66	15	3	34	49	1217	47	36	1240	29
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0		12.0	12.0	
RTOR Vol			7			3			5			3

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	A				NB Left	A			
Thru	A				Thru		A		
Right	A				Right		A		
Peds					Peds				
WB Left	A				SB Left	A			
Thru	A				Thru		A		
Right	A				Right		A		
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green	23.5					22.5	49.0		
Yellow	4.0					4.0	4.0		
All Red	1.0					1.0	1.0		

Cycle Length: 110.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LT	358	1678	0.09	0.21	34.8	C	35.6	D
R	338	1583	0.22	0.21	36.0	D		
Westbound								
LT	333	1559	0.06	0.21	34.5	C	34.7	C
R	338	1583	0.10	0.21	34.9	C		
Northbound								
L	400	1956	0.14	0.20	36.0	D		
TR	1737	3900	0.82	0.45	30.2	C	30.4	C
Southbound								
L	400	1956	0.11	0.20	35.7	D		
TR	1741	3908	0.90	0.45	35.5	D	35.5	D

Intersection Delay = 33.2 (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1e

Analyst: GMT
Agency:
Date: 10/21/04
Period: PM PEAK
Project ID:
E/W St: Keawe Street

Inter.:
Area Type: All other areas
Jurisd:
Year : Existing

N/S St: Honoapiilani Highway

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	0	1	1	1	2	0	1	2	0
LGConfig		LT	R		LT	R	L	TR		L	TR	
Volume	78	10	155	34	6	29	112	1198	17	15	1381	50
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0		12.0	12.0	
RTOR Vol			16			3			2			5

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left	A			
Thru	A					Thru		A		
Right	A					Right		A		
Peds						Peds				
WB Left	A				SB	Left	A			
Thru	A					Thru		A		
Right	A					Right		A		
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	25.0						22.0	48.0		
Yellow	4.0						4.0	4.0		
All Red	1.0						1.0	1.0		

Cycle Length: 110.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LT	300	1319	0.36	0.23	36.5	D	37.3	D
R	360	1583	0.48	0.23	37.8	D		
Westbound								
LT	305	1340	0.19	0.23	34.6	C	34.3	C
R	360	1583	0.11	0.23	33.8	C		
Northbound								
L	391	1956	0.31	0.20	38.0	D		
TR	1707	3913	0.77	0.44	28.6	C	29.4	C
Southbound								
L	391	1956	0.04	0.20	35.5	D		
TR	1702	3901	0.91	0.44	37.8	D	37.8	D

Intersection Delay = 34.1 (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1e

Analyst: GMT
Agency:
Date: 10/21/04
Period: AM PEAK
Project ID:
E/W St: Kapunakea Road

Inter.:
Area Type: All other areas
Jurisd:
Year : Existing

N/S St: Honoapiilani Highway

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	1	1	0	1	2	0	1	2	0
LGConfig		LT	R	L	TR		L	TR		L	TR	
Volume	125	35	35	162	36	49	29	1098	81	31	1112	72
Lane Width		12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			4			5			8			7

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left		A			NB Left	A			
Thru		A			Thru		A		
Right		A			Right		A		
Peds					Peds				
WB Left	A	A			SB Left	A			
Thru	A	A			Thru		A		
Right	A	A			Right		A		
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green	9.0	27.0				15.0	44.0		
Yellow	0.0	4.0				4.0	4.0		
All Red	0.0	1.0				1.0	1.0		

Cycle Length: 110.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LT	319	1299	0.63	0.25	41.0	D	39.5	D
R	389	1583	0.10	0.25	32.2	C		
Westbound								
L	323	1770	0.73	0.33	42.6	D		
TR	559	1709	0.21	0.33	26.9	C	37.4	D
Northbound								
L	267	1956	0.12	0.14	41.9	D		
TR	1553	3883	0.87	0.40	36.1	D	36.3	D
Southbound								
L	267	1956	0.14	0.14	42.1	D		
TR	1555	3888	0.91	0.40	40.9	D	40.9	D

Intersection Delay = 38.6 (sec/veh) Intersection LOS = D

HCS2000: Signalized Intersections Release 4.1e

Analyst: GMT
Agency:
Date: 10/21/04
Period: PM PEAK
Project ID:
E/W St: Kapunakea Road

Inter.:
Area Type: All other areas
Jurisd:
Year : Existing

N/S St: Honoapiilani Highway

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	1	1	0	1	2	0	1	2	0
LGConfig		LT	R	L	TR		L	TR		L	TR	
Volume	179	68	31	114	44	46	49	1057	110	45	1317	118
Lane Width		12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			3			5			11			12

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	A				NB Left	A			
Thru	A				Thru		A		
Right	A				Right		A		
Peds					Peds				
WB Left	A				SB Left	A			
Thru	A				Thru		A		
Right	A				Right		A		
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green	32.5					14.5	48.0		
Yellow	4.0					4.0	4.0		
All Red	1.0					1.0	1.0		

Cycle Length: 110.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LT	392	1327	0.75	0.30	43.3	D	41.8	D
R	468	1583	0.07	0.30	27.9	C		
Westbound								
L	220	744	0.68	0.30	42.9	D		
TR	511	1728	0.22	0.30	29.4	C	37.1	D
Northbound								
L	258	1956	0.22	0.13	43.1	D		
TR	1688	3869	0.78	0.44	28.9	C	29.5	C
Southbound								
L	258	1956	0.19	0.13	42.9	D		
TR	1691	3876	0.93	0.44	41.9	D	42.0	D

Intersection Delay = 36.8 (sec/veh) Intersection LOS = D

APPENDIX D

CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2007 PEAK HOUR TRAFFIC
ANALYSIS WITHOUT PROJECT

HCS2000: Signalized Intersections Release 4.1e

Analyst: GMT
Agency:
Date: 2/3/05
Period: AM PEAK
Project ID:
E/W St: Lahainaluna Road

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2007 Without Project

N/S St: Honoapiilani Highway

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	1	1	2	0	1	2	0
LGConfig	L	TR		L	T	R	L	TR		L	TR	
Volume	48	253	25	149	195	477	77	758	75	291	764	53
Lane Width	12.0	12.0		12.0	12.0	12.0	12.0	12.0		12.0	12.0	
RTOR Vol			3			119			8			5

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A	A			NB	Left	A			
Thru		A				Thru		A		
Right		A				Right		A		
Peds						Peds				
WB Left	A	A			SB	Left	A			
Thru		A				Thru		A		
Right		A				Right		A		
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	5.5	46.0					33.5	40.0		
Yellow	0.0	4.0					4.0	4.0		
All Red	0.0	1.0					1.0	1.0		

Cycle Length: 140.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	330	1770	0.18	0.37	29.9	C		
TR	605	1840	0.56	0.33	39.7	D	38.3	D
Westbound								
L	251	1770	0.72	0.37	55.2	E		
T	612	1863	0.38	0.33	36.5	D	50.0	D
R	520	1583	0.83	0.33	55.2	E		
Northbound								
L	468	1956	0.19	0.24	42.6	D		
TR	1106	3872	0.85	0.29	53.8	D	52.9	D
Southbound								
L	468	1956	0.72	0.24	54.6	D		
TR	1110	3885	0.85	0.29	54.1	D	54.2	D

Intersection Delay = 51.0 (sec/veh) Intersection LOS = D

HCS2000: Signalized Intersections Release 4.1e

Analyst: GMT
Agency:
Date: 2/3/05
Period: PM PEAK
Project ID:
E/W St: Lahainaluna Road

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2007 Without Project

N/S St: Honoapiilani Highway

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	1	1	2	0	1	2	0
LGConfig	L	TR		L	T	R	L	TR		L	TR	
Volume	146	210	47	98	93	184	63	731	37	284	1026	92
Lane Width	12.0	12.0		12.0	12.0	12.0	12.0	12.0		12.0	12.0	
RTOR Vol			5			46			4			9

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	A	A			NB	Left	A			
	Thru		A				Thru		A		
	Right		A				Right		A		
	Peds						Peds				
WB	Left	A	A			SB	Left	A			
	Thru		A				Thru		A		
	Right		A				Right		A		
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right				
Green		6.0	26.5					28.5	44.0		
Yellow		0.0	4.0					4.0	4.0		
All Red		0.0	1.0					1.0	1.0		

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	308	1770	0.52	0.27	39.9	D		
TR	401	1816	0.69	0.22	48.1	D	45.1	D
Westbound								
L	176	1770	0.65	0.27	47.6	D		
T	411	1863	0.26	0.22	39.0	D	42.6	D
R	350	1583	0.46	0.22	41.5	D		
Northbound								
L	465	1956	0.14	0.24	36.3	D		
TR	1428	3895	0.57	0.37	31.0	C	31.4	C
Southbound								
L	465	1956	0.72	0.24	47.5	D		
TR	1421	3876	0.92	0.37	47.8	D	47.8	D

Intersection Delay = 42.5 (sec/veh) Intersection LOS = D

HCS2000: Signalized Intersections Release 4.1e

Analyst: GMT
Agency:
Date: 2/3/05
Period: AM PEAK
Project ID:
E/W St: Keawe Street

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2007 Without Project

N/S St: Honoapiilani Highway

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	0	1	1	1	2	0	1	2	0
LGConfig		LT	R		LT	R	L	TR		L	TR	
Volume	12	13	66	15	3	34	49	1290	47	36	1314	29
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0		12.0	12.0	
RTOR Vol			7			3			5			3

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A				NB	Left	A			
Thru	A					Thru		A		
Right	A					Right		A		
Peds						Peds				
WB Left	A				SB	Left	A			
Thru	A					Thru		A		
Right	A					Right		A		
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	22.0						22.0	51.0		
Yellow	4.0						4.0	4.0		
All Red	1.0						1.0	1.0		

Cycle Length: 110.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LT	335	1673	0.09	0.20	36.0	D	36.9	D
R	317	1583	0.23	0.20	37.3	D		
Westbound								
LT	310	1552	0.06	0.20	35.7	D	36.0	D
R	317	1583	0.10	0.20	36.1	D		
Northbound								
L	391	1956	0.14	0.20	36.4	D		
TR	1809	3901	0.84	0.46	29.6	C	29.9	C
Southbound								
L	391	1956	0.11	0.20	36.1	D		
TR	1812	3909	0.91	0.46	36.0	D	36.0	D

Intersection Delay = 33.2 (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1e

Analyst: GMT
Agency:
Date: 2/3/05
Period: PM PEAK
Project ID:
E/W St: Keawe Street

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2007 Without Project

N/S St: Honoapiilani Highway

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	0	1	1	1	2	0	1	2	0
LGConfig		LT	R		LT	R	L	TR		L	TR	
Volume	78	10	155	34	6	29	112	1270	17	15	1464	50
Lane Width		12.0	12.0		12.0	12.0	12.0	12.0		12.0	12.0	
RTOR Vol			16			3			2			5

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	A				NB Left	A			
Thru	A				Thru		A		
Right	A				Right		A		
Peds					Peds				
WB Left	A				SB Left	A			
Thru	A				Thru		A		
Right	A				Right		A		
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green	24.5					20.5	50.0		
Yellow	4.0					4.0	4.0		
All Red	1.0					1.0	1.0		

Cycle Length: 110.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LT	294	1319	0.37	0.22	37.0	D	37.8	D
R	353	1583	0.49	0.22	38.3	D		
Westbound								
LT	298	1338	0.19	0.22	35.1	D	34.7	C
R	353	1583	0.11	0.22	34.2	C		
Northbound								
L	365	1956	0.33	0.19	39.4	D		
TR	1779	3913	0.78	0.45	27.9	C	28.8	C
Southbound								
L	365	1956	0.04	0.19	36.8	D		
TR	1774	3902	0.92	0.45	38.4	D	38.4	D

Intersection Delay = 34.1 (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1e

Analyst: GMT
Agency:
Date: 2/3/05
Period: AM PEAK
Project ID:
E/W St: Kapunakea Road

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2007 Without Project

N/S St: Honoapiilani Highway

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	1	1	0	1	2	0	1	2	0
LGConfig		LT	R	L	TR		L	TR		L	TR	
Volume	125	35	35	162	36	49	29	1164	81	31	1179	72
Lane Width		12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			4			5			8			7

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left		A			NB Left	A			
Thru		A			Thru		A		
Right		A			Right		A		
Peds					Peds				
WB Left	A	A			SB Left	A			
Thru	A	A			Thru		A		
Right	A	A			Right		A		
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green	9.5	26.0				14.0	45.5		
Yellow	0.0	4.0				4.0	4.0		
All Red	0.0	1.0				1.0	1.0		

Cycle Length: 110.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LT	307	1299	0.65	0.24	42.9	D	41.3	D
R	374	1583	0.10	0.24	33.0	C		
Westbound								
L	319	1770	0.74	0.32	43.4	D		
TR	552	1709	0.21	0.32	27.3	C	38.1	D
Northbound								
L	249	1956	0.13	0.13	42.9	D		
TR	1607	3885	0.88	0.41	36.7	D	36.8	D
Southbound								
L	249	1956	0.15	0.13	43.0	D		
TR	1609	3889	0.93	0.41	43.0	D	43.0	D

Intersection Delay = 39.9 (sec/veh) Intersection LOS = D

HCS2000: Signalized Intersections Release 4.1e

Analyst: GMT
Agency:
Date: 2/3/05
Period: PM PEAK
Project ID:
E/W St: Kapunakea Road

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2007 Without Project

N/S St: Honoapiilani Highway

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	1	1	0	1	2	0	1	2	0
LGConfig		LT	R	L	TR		L	TR		L	TR	
Volume	179	68	31	114	44	46	49	1120	110	45	1396	118
Lane Width		12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			3			5			11			12

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	A				NB	Left	A			
	Thru	A					Thru		A		
	Right	A					Right		A		
	Peds						Peds				
WB	Left	A				SB	Left	A			
	Thru	A					Thru		A		
	Right	A					Right		A		
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right				
Green		32.0						13.0	50.0		
Yellow		4.0						4.0	4.0		
All Red		1.0						1.0	1.0		

Cycle Length: 110.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LT	385	1325	0.76	0.29	44.9	D	43.2	D
R	461	1583	0.07	0.29	28.3	C		
Westbound								
L	214	735	0.70	0.29	45.1	D		
TR	503	1728	0.22	0.29	29.8	C	38.5	D
Northbound								
L	231	1956	0.24	0.12	44.6	D		
TR	1760	3872	0.79	0.45	28.0	C	28.6	C
Southbound								
L	231	1956	0.22	0.12	44.4	D		
TR	1763	3878	0.95	0.45	43.2	D	43.2	D

Intersection Delay = 37.3 (sec/veh) Intersection LOS = D

APPENDIX E

CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2007 PEAK HOUR TRAFFIC
ANALYSIS WITH PROJECT

HCS2000: Signalized Intersections Release 4.1e

Analyst: GMT
Agency:
Date: 2/3/05
Period: AM PEAK
Project ID:
E/W St: Lahainaluna Road

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2007 With Project

N/S St: Honoapiilani Highway

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	1	1	2	0	1	2	0
LGConfig	L	TR		L	T	R	L	TR		L	TR	
Volume	48	253	25	89	195	286	77	758	75	175	824	53
Lane Width	12.0	12.0		12.0	12.0	12.0	12.0	12.0		12.0	12.0	
RTOR Vol			3			72			8			5

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	A	A			NB	Left	A			
Thru		A				Thru		A		
Right		A				Right		A		
Peds						Peds				
WB Left	A	A			SB	Left	A			
Thru		A				Thru		A		
Right		A				Right		A		
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	5.0	41.0					32.5	46.5		
Yellow	0.0	4.0					4.0	4.0		
All Red	0.0	1.0					1.0	1.0		

Cycle Length: 140.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	276	1770	0.21	0.33	33.9	C		
TR	539	1840	0.62	0.29	45.1	D	43.4	D
Westbound								
L	199	1770	0.54	0.33	45.9	D		
T	546	1863	0.43	0.29	40.6	D	42.7	D
R	464	1583	0.56	0.29	43.3	D		
Northbound								
L	454	1956	0.19	0.23	43.4	D		
TR	1286	3872	0.73	0.33	43.3	D	43.4	D
Southbound								
L	454	1956	0.45	0.23	46.8	D		
TR	1291	3888	0.79	0.33	45.6	D	45.8	D

Intersection Delay = 44.2 (sec/veh) Intersection LOS = D

HCS2000: Signalized Intersections Release 4.1e

Analyst: GMT
Agency:
Date: 2/3/05
Period: PM PEAK
Project ID:
E/W St: Lahainaluna Road

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2007 With Project
N/S St: Honoapiilani Highway

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	1	1	0	1	1	1	1	2	0	1	2	0
LGConfig	L	TR		L	T	R	L	TR		L	TR	
Volume	146	210	47	59	93	110	63	731	37	170	1065	92
Lane Width	12.0	12.0		12.0	12.0	12.0	12.0	12.0		12.0	12.0	
RTOR Vol			5			28			4			9

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	A	A			NB	Left	A			
	Thru		A				Thru		A		
	Right		A				Right		A		
	Peds						Peds				
WB	Left	A	A			SB	Left	A			
	Thru		A				Thru		A		
	Right		A				Right		A		
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right				
Green		5.0	29.0					24.5	46.5		
Yellow		0.0	4.0					4.0	4.0		
All Red		0.0	1.0					1.0	1.0		

Cycle Length: 120.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	321	1770	0.50	0.28	38.7	D		
TR	439	1816	0.63	0.24	43.7	D	41.9	D
Westbound								
L	188	1770	0.37	0.28	34.5	C		
T	450	1863	0.24	0.24	36.9	D	36.3	D
R	383	1583	0.25	0.24	37.0	D		
Northbound								
L	399	1956	0.17	0.20	39.6	D		
TR	1509	3895	0.54	0.39	28.8	C	29.7	C
Southbound								
L	399	1956	0.50	0.20	43.3	D		
TR	1502	3877	0.90	0.39	43.2	D	43.2	D

Intersection Delay = 38.6 (sec/veh) Intersection LOS = D

HCS2000: Signalized Intersections Release 4.1e

Analyst: GMT
Agency:
Date: 2/3/05
Period: AM PEAK
Project ID:
E/W St: Keawe Street

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2007 With Project
N/S St: Honoapiilani Highway

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	1	1	1	1	2	0	1	2	0
LGConfig		LT	R	L	T	R	L	TR		L	TR	
Volume	12	13	66	75	3	225	49	1099	47	152	1198	29
Lane Width		12.0	12.0	12.0	12.0	12.0	12.0	12.0		12.0	12.0	
RTOR Vol			7			23			5			3

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	A				NB Left	A			
Thru	A				Thru		A		
Right	A				Right		A		
Peds					Peds				
WB Left	A				SB Left	A			
Thru	A				Thru		A		
Right	A				Right		A		
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right				
Green	26.0					22.5	46.5		
Yellow	4.0					4.0	4.0		
All Red	1.0					1.0	1.0		

Cycle Length: 110.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LT	400	1693	0.08	0.24	32.8	C	33.5	C
R	374	1583	0.20	0.24	33.9	C		
Westbound								
L	325	1373	0.25	0.24	34.5	C		
T	440	1863	0.01	0.24	32.1	C	38.0	D
R	374	1583	0.58	0.24	39.5	D		
Northbound								
L	400	1956	0.14	0.20	36.0	D		
TR	1648	3898	0.79	0.42	30.1	C	30.4	C
Southbound								
L	400	1956	0.47	0.20	39.4	D		
TR	1652	3908	0.91	0.42	39.4	D	39.4	D

Intersection Delay = 35.6 (sec/veh) Intersection LOS = D

HCS2000: Signalized Intersections Release 4.1e

Analyst: GMT
Agency:
Date: 2/3/05
Period: PM PEAK
Project ID:
E/W St: Keawe Street

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2007 With Project

N/S St: Honoapiilani Highway

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	1	1	1	1	2	0	1	2	0
LGConfig		LT	R	L	T	R	L	TR		L	TR	
Volume	78	10	155	73	6	103	112	1196	17	129	1350	50
Lane Width		12.0	12.0	12.0	12.0	12.0	12.0	12.0		12.0	12.0	
RTOR Vol			16			10			2			5

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4	5	6	7	8
EB Left	A				NB Left	A		
Thru	A				Thru		A	
Right	A				Right		A	
Peds					Peds			
WB Left	A				SB Left	A		
Thru	A				Thru		A	
Right	A				Right		A	
Peds					Peds			
NB Right					EB Right			
SB Right					WB Right			
Green	25.0					23.0	47.0	
Yellow	4.0					4.0	4.0	
All Red	1.0					1.0	1.0	

Cycle Length: 110.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LT	315	1385	0.34	0.23	36.3	D	37.2	D
R	360	1583	0.48	0.23	37.8	D		
Westbound								
L	286	1259	0.37	0.23	36.7	D		
T	423	1863	0.02	0.23	33.0	C	36.5	D
R	360	1583	0.38	0.23	36.6	D		
Northbound								
L	409	1956	0.30	0.21	37.1	D		
TR	1672	3913	0.79	0.43	29.8	C	30.4	C
Southbound								
L	409	1956	0.34	0.21	37.6	D		
TR	1667	3901	0.91	0.43	38.3	D	38.3	D

Intersection Delay = 35.0- (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1e

Analyst: GMT
Agency:
Date: 2/3/05
Period: AM PEAK
Project ID:
E/W St: Kapunakea Road

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2007 With Project

N/S St: Honoapiilani Highway

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	1	1	0	1	2	0	1	2	0
LGConfig		LT	R	L	TR		L	TR		L	TR	
Volume	125	35	35	162	36	49	29	1164	81	31	1179	72
Lane Width		12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			4			5			8			7

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left		A			NB	Left	A			
	Thru		A				Thru		A		
	Right		A				Right		A		
	Peds						Peds				
WB	Left	A	A			SB	Left	A			
	Thru	A	A				Thru		A		
	Right	A	A				Right		A		
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right				
Green		9.5	26.0					14.0	45.5		
Yellow		0.0	4.0					4.0	4.0		
All Red		0.0	1.0					1.0	1.0		

Cycle Length: 110.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LT	307	1299	0.65	0.24	42.9	D	41.3	D
R	374	1583	0.10	0.24	33.0	C		
Westbound								
L	319	1770	0.74	0.32	43.4	D		
TR	552	1709	0.21	0.32	27.3	C	38.1	D
Northbound								
L	249	1956	0.13	0.13	42.9	D		
TR	1607	3885	0.88	0.41	36.7	D	36.8	D
Southbound								
L	249	1956	0.15	0.13	43.0	D		
TR	1609	3889	0.93	0.41	43.0	D	43.0	D

Intersection Delay = 39.9 (sec/veh) Intersection LOS = D

HCS2000: Signalized Intersections Release 4.1e

Analyst: GMT
Agency:
Date: 2/3/05
Period: PM PEAK
Project ID:
E/W St: Kapunakea Road

Inter.:
Area Type: All other areas
Jurisd:
Year : Year 2007 With Project

N/S St: Honoapiilani Highway

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	1	1	1	0	1	2	0	1	2	0
LGConfig		LT	R	L	TR		L	TR		L	TR	
Volume	179	68	31	114	44	46	49	1120	110	45	1396	118
Lane Width		12.0	12.0	12.0	12.0		12.0	12.0		12.0	12.0	
RTOR Vol			3			5			11			12

Duration 1.00 Area Type: All other areas

Signal Operations

Phase Combination		1	2	3	4			5	6	7	8
EB	Left	A				NB	Left	A			
	Thru	A					Thru		A		
	Right	A					Right		A		
	Peds						Peds				
WB	Left	A				SB	Left	A			
	Thru	A					Thru		A		
	Right	A					Right		A		
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right				
Green		32.0						13.0	50.0		
Yellow		4.0						4.0	4.0		
All Red		1.0						1.0	1.0		

Cycle Length: 110.0 secs

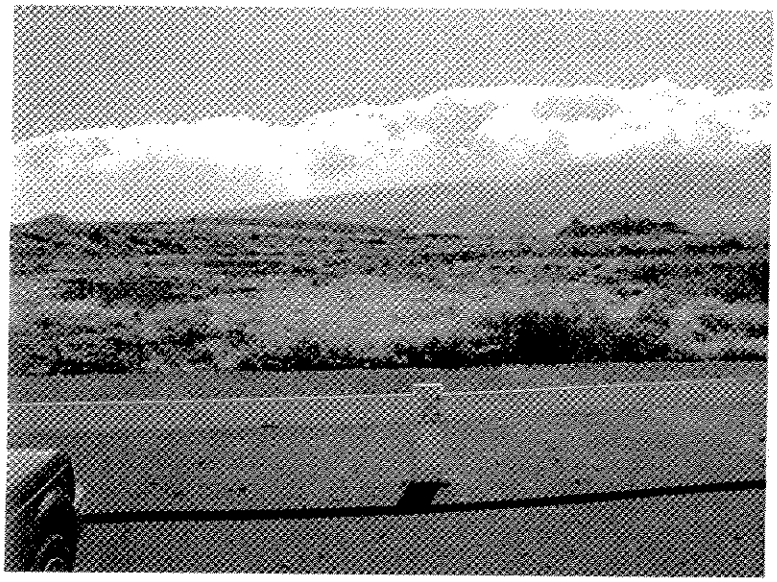
Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
LT	385	1325	0.76	0.29	44.9	D	43.2	D
R	461	1583	0.07	0.29	28.3	C		
Westbound								
L	214	735	0.70	0.29	45.1	D		
TR	503	1728	0.22	0.29	29.8	C	38.5	D
Northbound								
L	231	1956	0.24	0.12	44.6	D		
TR	1760	3872	0.79	0.45	28.0	C	28.6	C
Southbound								
L	231	1956	0.22	0.12	44.4	D		
TR	1763	3878	0.95	0.45	43.2	D	43.2	D

Intersection Delay = 37.3 (sec/veh) Intersection LOS = D

APPENDIX C.
PRELIMINARY
DRAINAGE REPORT

DRAINAGE STUDY
FOR
KEAWE STREET EXTENSION
LAHAINA, MAUI, HAWAII



Prepared For

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS AND
WASTE MANAGEMENT
Engineering Division

Prepared by

Shimabukuro, Endo & Yoshizaki, Inc.
1126 12th Avenue, Room 309
Honolulu, Hawaii 96816

JULY 2005

TABLE OF CONTENTS

SECTION		PAGE
1.	INTRODUCTION	1
2.	EXISTING CONDITIONS AND DRAINAGE SYSTEM	4
3.	PROPOSED IMPROVEMENTS	4
4.	HYDRAULIC CRITERIA AND COMPUTATIONS	8
5.	HYDRAULIC ANALYSIS	9
6.	REFERENCES	9
7.	APPENDICES	
	APPENDIX A - EXISITNG DRAINAGE CONDITION	
	APPENDIX B - PROPOSED DRAINAGE SYSTEM	

LIST OF FIGURES

FIGURE		PAGE
FIGURE 1	LOCATION PLAN	2
FIGURE 2	TYPICAL EXCAVATED AND EMBANKED SECTIONS	3
FIGURE 3	EXISTING DRAINAGE SYSTEM	5
FIGURE 4	NEW SYSTEM	6
FIGURE 5	NEW SYSTEM	7

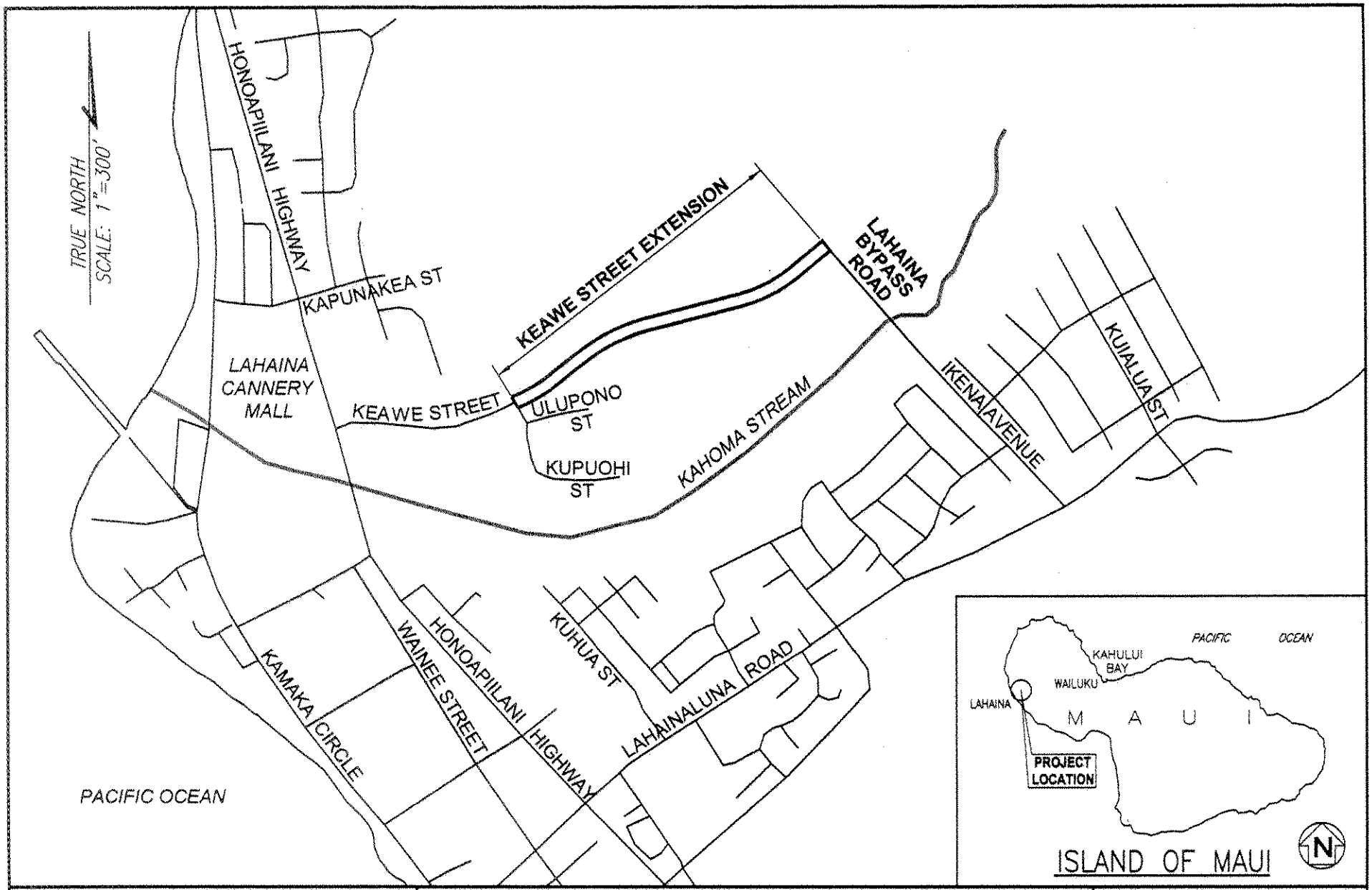
1. Introduction

This Drainage Study is prepared for the County of Maui, Department of Public Works and Waste Management. The study is required as part of the County's proposal to extend the existing Keawe Street to the Future Honoapiilani Highway Realignment, Phase 1A (aka Lahaina Bypass Road). Keawe Street is located at the eastside of Lahaina Town on the Island of Maui, see Figure 1. The intention of this study is to analyze the impact of the project on the existing drainage system and prepare recommendations for proposed storm drainage improvements required as part of the project.

Currently, Keawe Street is a dead end road that provides access to the Lahaina Business Park from the existing Honoapiilani Highway. The roadway extension is to begin at the existing end of Keawe Street and will terminate at the proposed western end of the Lahaina Bypass Road project. The proposed roadway extension is approximately 2,470 linear feet. The project will also include improvements to existing Keawe Street at its intersection with Honoapiilani Highway. The intersection improvements include adding a separate left turn lane from Keawe Street into Honoapiilani Highway.

The typical roadway section will be 60 feet wide and will differ between excavated and embanked portions of the roadway profile. The typical excavated section, generally the lower part of the project, is planned to have a 36 foot wide a.c. pavement section (two 12 foot wide travel lanes and two 6 foot wide paved shoulders). A 12 foot wide grassed shoulder will be provided from the edge of pavement to the right-of-way (r/w) boundary. The grassed shoulder will slope at -6.25 percent for 6 feet then slope at 16.7 percent to the r/w boundary. This will create a swale in the grassed shoulder area for drainage purposes. The typical embanked roadway section will also have a 36 foot wide a.c. pavement section and a 12 foot wide grassed shoulder from the edge of pavement to the right-of-way (r/w) boundary. The grassed shoulder will have a constant slope at -5.00 percent to the r/w boundary, see Figure 2. This will allow storm water runoff to sheet flow from the roadway to the existing ground surrounding the roadway.

This study estimates peak runoff quantities for a 10 and 50 year recurrence interval storm and compares the quantities between existing and proposed conditions. Runoff quantity estimates were computed in accordance with the Highway Drainage Design Criteria for the State of Hawaii, Department of Transportation, Highways Division (DOT-H) dated 12/5/85 and Rules for the Design of Storm Drainage Facilities in the County of Maui dated November 12, 1995.

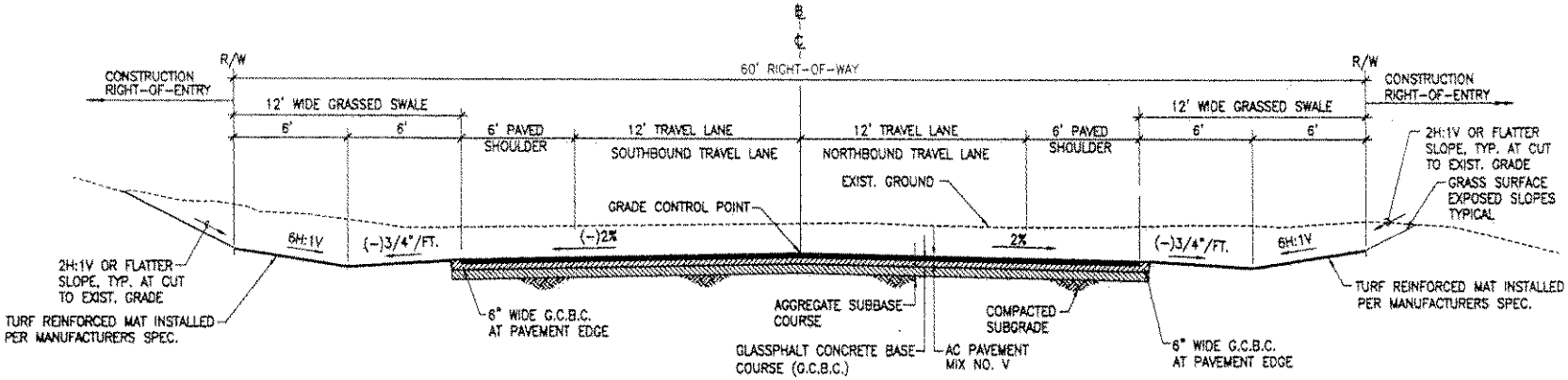


PREPARED FOR:
COUNTY OF MAUI
DPW and WM
ENGINEERING DIVISION

KEAWE STREET EXTENSION
Lahaina, Maui, Hawaii

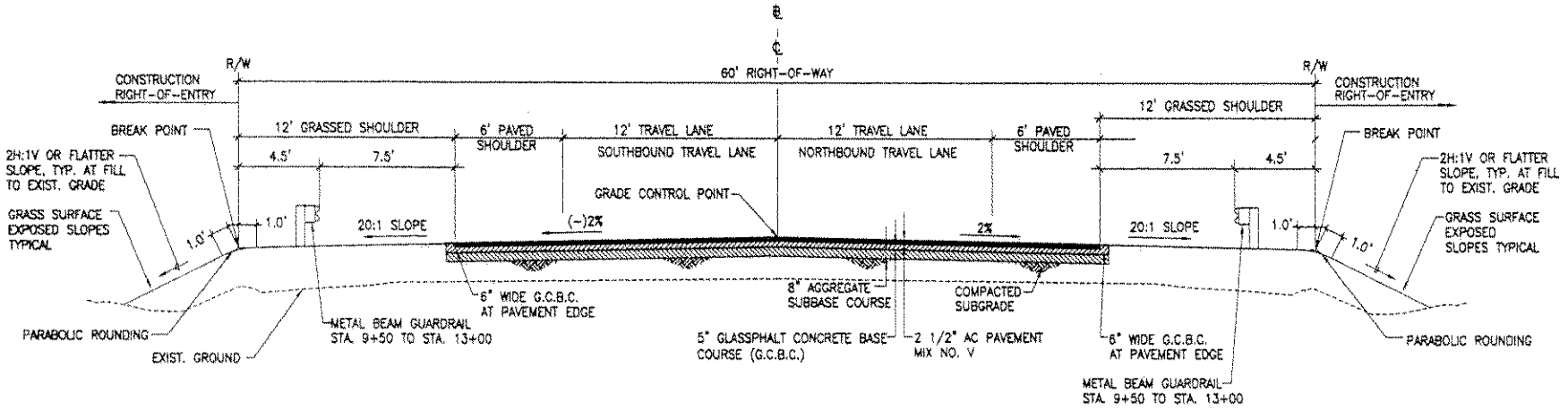
FIGURE 1
LOCATION MAP AND VICINITY MAP

Shimabukuro, Endo & Yoshizaki, Inc.
Civil & Structural Engineers



TYPICAL EXCAVATED ROADWAY SECTION

NOT TO SCALE



TYPICAL EMBANKED ROADWAY SECTION

NOT TO SCALE

PREPARED FOR:
COUNTY OF MAUI
DPW and WM
ENGINEERING DIVISION

KEAWE STREET EXTENSION
Lahaina, Maui, Hawaii

FIGURE 2
TYPICAL ROADWAY SECTIONS

Shimabukuro, Endo & Yoshizaki, Inc.
Civil & Structural Engineers

2. Existing Conditions and Drainage System

The roadway extension alignment traverses through abandoned cane fields. The land is currently heavily vegetated with short brush that covers a rocky soil. The terrain has a fairly steep slope from northwest to southeast.

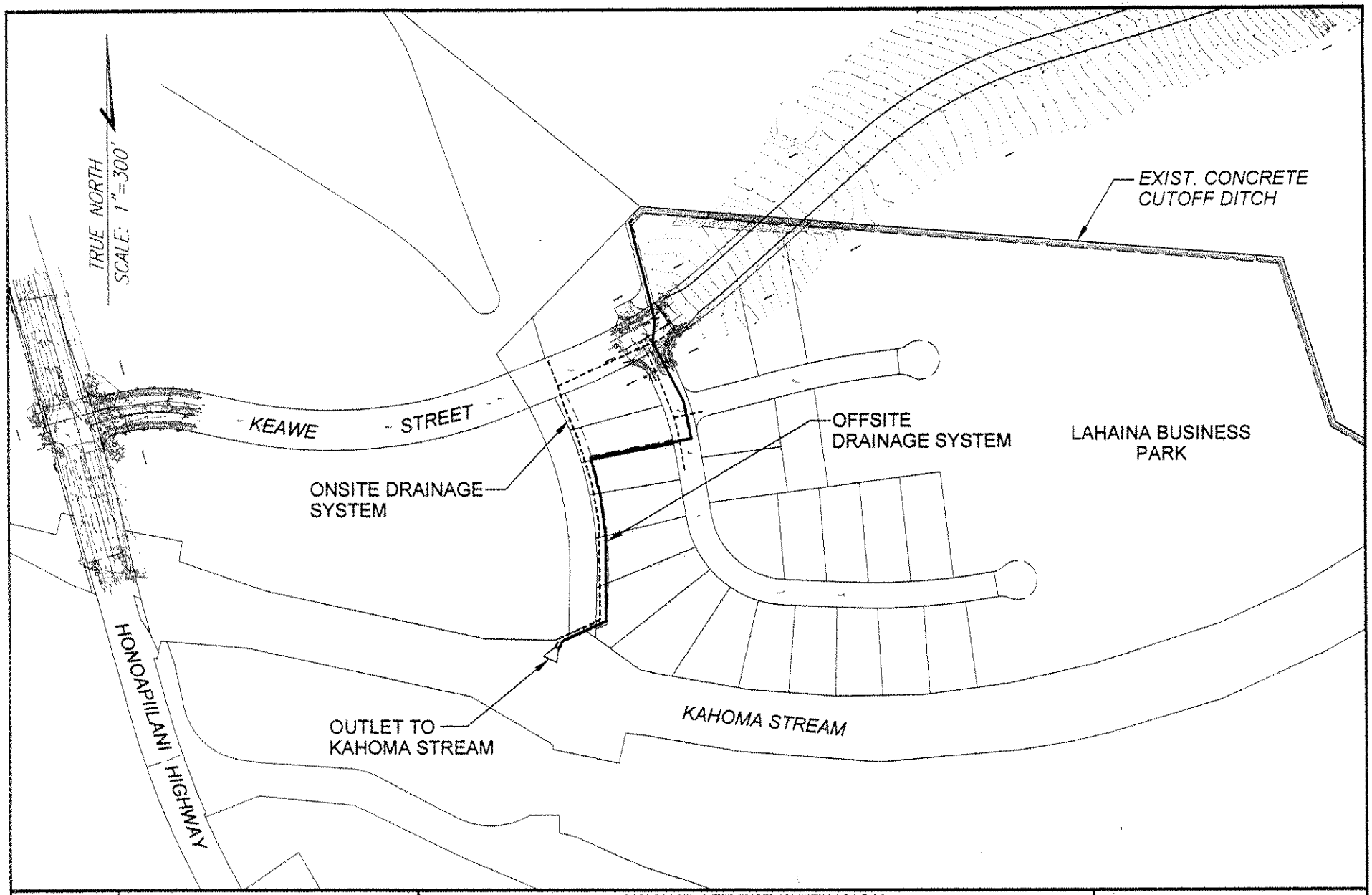
Storm water runoff from the project site enters an existing concrete cutoff ditch in the northern (mauka) portion of the Lahaina Business Park. The cutoff ditch flows from east to west into an underground storm drainage system that traverses the business park and outlets into Kahoma Stream, see Figure 3. For the purpose of this report, this drainage system shall be called the "offsite drainage system". The "offsite drainage system" was constructed as part of the Lahaina Business Park improvements. The business park also has a separate storm drainage system that intercepts and conveys storm runoff from within the business park to Kahoma Stream. Also for the purpose of this report, this system shall be called the "onsite drainage system". The offsite and onsite drainage systems for the business park discharges to the bank of Kahoma Stream at a common outlet structure but the systems are not interconnected prior to the outlet.

3. Proposed Improvements

Proposed drainage improvements for the project includes a new concrete cutoff ditch along a portion of the western bank of the roadway; grass swales, inlets and an underground drainage system within the roadway; and a detention basin along the existing concrete cutoff ditch. The new drainage system will connect into the "offsite drainage system", see Figures 4 & 5.

As part of the project, the newly installed drainage system will include storm drain inlets and underground storm drain piping. The inlets will be placed approximately 250 feet apart in the grass swale portion of the typical excavated roadway section. The inlets will be connected with underground drain pipes that will connect the new drainage system to an existing catch basin on Keawe Street. The existing catch basin will be disconnected from the existing "onsite drainage system" and connected into the "offsite drainage system". A new drain inlet will be connected to the "onsite drainage system" in order to replace the flows diverted from the existing catch basin.

An 860 foot long concrete cutoff ditch along a portion of the western toe of slope is proposed along the embanked section of the new roadway. The cutoff ditch is proposed to collect runoff that will concentrate along the toe of the new roadway embankment. The ditch will help prevent erosion along the toe of the embankment which is anticipated to be severe due to the steep longitudinal slope of the existing ground (approximately 15 percent). The concrete ditch will be diverted into the new drainage system at the end of the embankment slope. The concrete ditch will require approval of a drainage easement from the adjacent property owner.

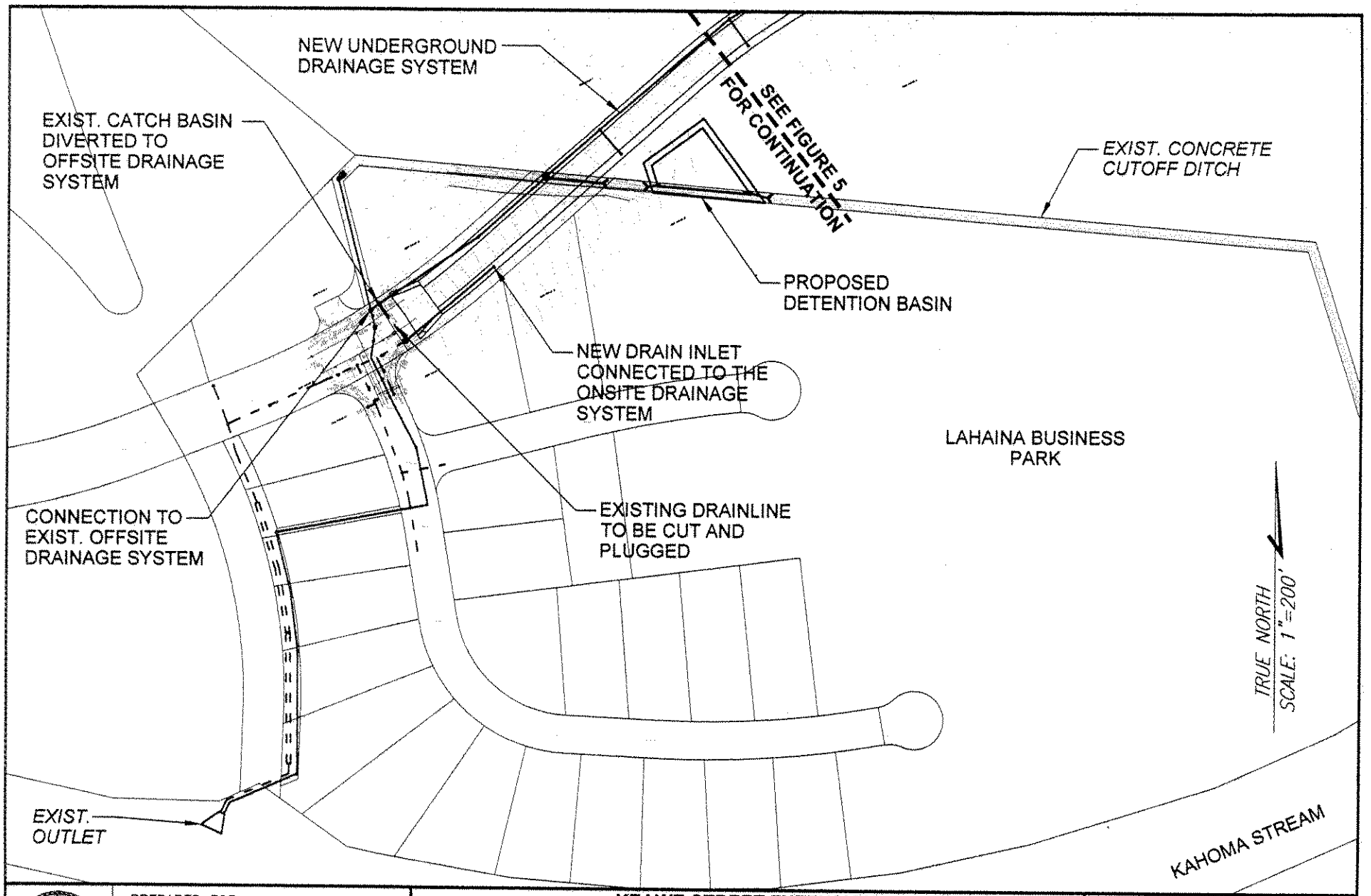


PREPARED FOR:
COUNTY OF MAUI
DPW and WM
ENGINEERING DIVISION

KEAWE STREET EXTENSION
Lahaina, Maui, Hawaii

FIGURE 3
EXISTING DRAINAGE SYSTEM

Shimabukuro, Endo & Yoshizaki, Inc.
Civil & Structural Engineers

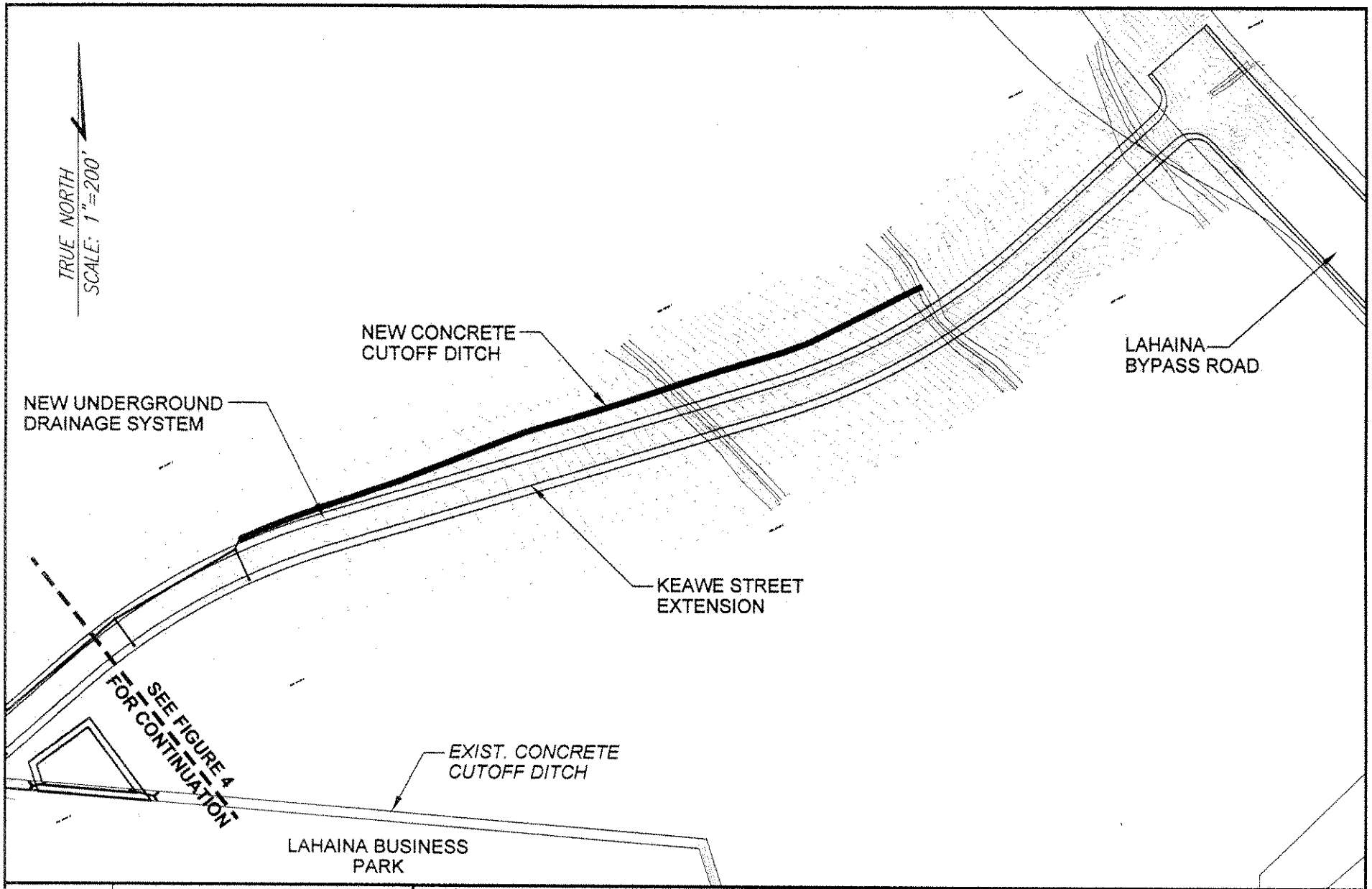


PREPARED FOR:
COUNTY OF MAUI
DPW and WM
ENGINEERING DIVISION

KEAWE STREET EXTENSION
Lahaina, Maui, Hawaii

FIGURE 4
PROPOSED DRAINAGE SYSTEM

Shimabukuro, Endo & Yoshizaki, Inc.
Civil & Structural Engineers



PREPARED FOR:
COUNTY OF MAUI
DPW and WM
ENGINEERING DIVISION

KEAWE STREET EXTENSION
Lahaina, Maui, Hawaii

FIGURE 5
PROPOSED DRAINAGE SYSTEM

Shimabukuro, Endo & Yoshizaki, Inc.
Civil & Structural Engineers

The existing concrete cutoff ditch will be intersected by the proposed roadway. The upper (eastern) portion of the ditch will be intercepted by the new roadway drainage system. The lower (western) portion of the ditch, after the roadway, will remain in its existing condition and flow into the existing "offsite drainage system".

Increases in the peak flow runoff rate (12.9 cfs) due to the project are proposed to be stored and discharged at a slower rate by installing a detention basin. The basin is proposed to be located along the upper portion of the existing concrete cutoff ditch. In accordance with the County's storm drainage standards, the basin is designed to accommodate a 50 year recurrence interval storm (Q50 years = 37.36 cfs). The allowable discharge into the drainage system based on downstream capacity and existing peak flow rate is 24.45 cfs. Based on the previously mentioned criteria, the detention basin is required to be 6,000 square feet (s.f.) and 5 feet deep with a 21" outflow pipe.

The detention basin will require acquisition of additional lands for the project. Should obstacles arise in pursuing the land area required for the proposed detention basin, various alternatives could also be pursued. Such alternatives include creating a detention basin in another location agreeable to the adjacent landowner, improving the capacity of the downstream drainage system and conveying the increased flow to Kahoma Stream or over sizing and creating storage within the new and existing drainage systems. These alternatives have been investigated and found to be less desirable due to physical constraints, public safety concerns, construction cost and operation and maintenance issues.

4. Hydrologic Criteria and Computations

The hydrologic criteria for the project are based on a 10 and 50 year recurrence interval storm as required by the storm drainage standards. Runoff quantity was estimated for this project using the Rational Method. The Rational Method is the standard method used to compute peak runoff within the County of Maui's Storm Drainage Standards for smaller drainage areas under 100 acres.

Haestad Method's Stormcad Version 5.5 was the computer program used to compute the peak runoff quantities for the 10 year storm recurrence interval storm. The computed peak runoff quantities were used to size the new storm drainage system.

Storm water runoff routing and detention analysis for the proposed detention basin was performed using the TR-55 modeling software program for small watersheds. The TR-55 program is able to model runoff detention and hydrologic routing for small basins. In accordance with County design standards, the detention basin was sized for a 50 year design storm.

Drainage Area Boundary Maps and computations for peak runoff quantities are shown in Appendix A and B.

5. Hydraulic Analysis

Haestad Method's Stormcad Version 5.5 was used to perform the hydraulic analysis of the roadway drainage systems. Hydraulic grade line elevations for the new and existing drainage system were computed using the Stormcad Program.

A complete set of computations done for this phase of the project are shown in Appendices.

6. References

1. State of Hawaii, Department of Transportation. Design Criteria for Highway Drainage. December 5, 1985.

2. County of Maui, Department of Public Works and Waste Management. Rules for the Design of Storm Drainage Facilities in the County of Maui. November 12, 1995.

3. State of Hawaii, Department of Transportation. Statewide Uniform Design Manual for Streets and Highways. October 1980.

4. Warren S. Unemori Engineering, Inc. Drainage & Soils Erosion Control Report, Lahaina Business Park, Lahaina, Maui, Hawaii. October 1997, Revised May 1998.

5. R.T. Tanaka Engineering, Inc. Drainage & Soils Erosion Control Study for Hawaii Omori Mauka Subdivision, Lahaina, Maui, Hawaii. October 1996, Revised June 1997 & January 1998.

APPENDIX A

EXISTING DRAINAGE CONDITION

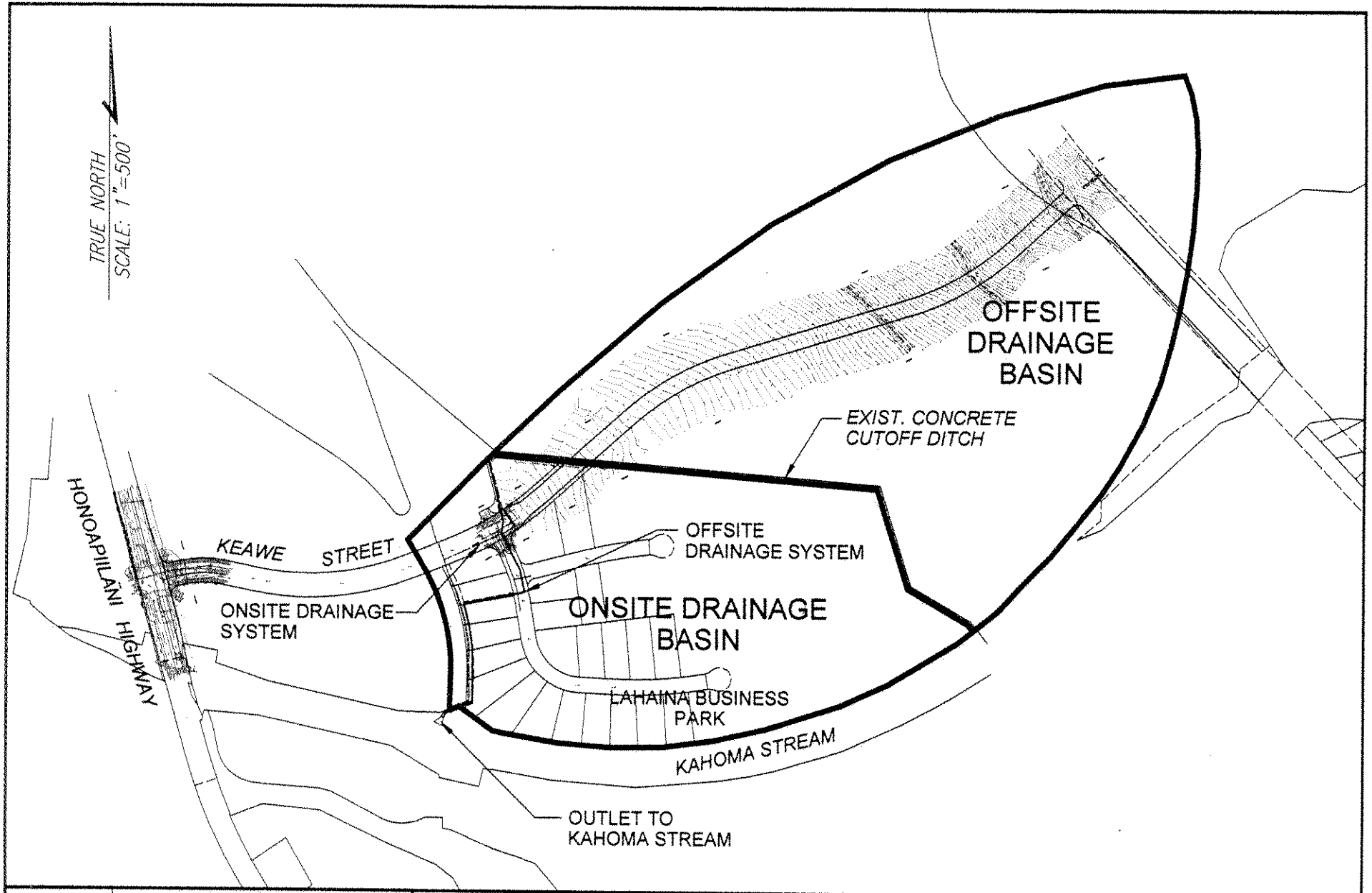
Project: Keawe Street Extension

SUMMARY OF PEAK FLOWS BY DRAINAGE AREAS

Computation of Drainage Runoff by Rational Method

EXISTING DRAINAGE CONDITION

Drainage Area	Q10 Peak (cfs)
Offsite Draiange System - Peak Flow at Outlet (Exisitng Drainage Basins)	48.78
Onsite Draiange System - Peak Flow at Outlet (Exisitng Drainage Basins)	17.95



PREPARED FOR:
COUNTY OF MAUI
DPW and WM
ENGINEERING DIVISION

KEAWE STREET EXTENSION
Lahaina, Maui, Hawaii

MAP OF EXISTING DRAINAGE BASINS

Shimabukuro, Endo & Yoshizaki, Inc.
Civil & Structural Engineers

APPENDIX A.1

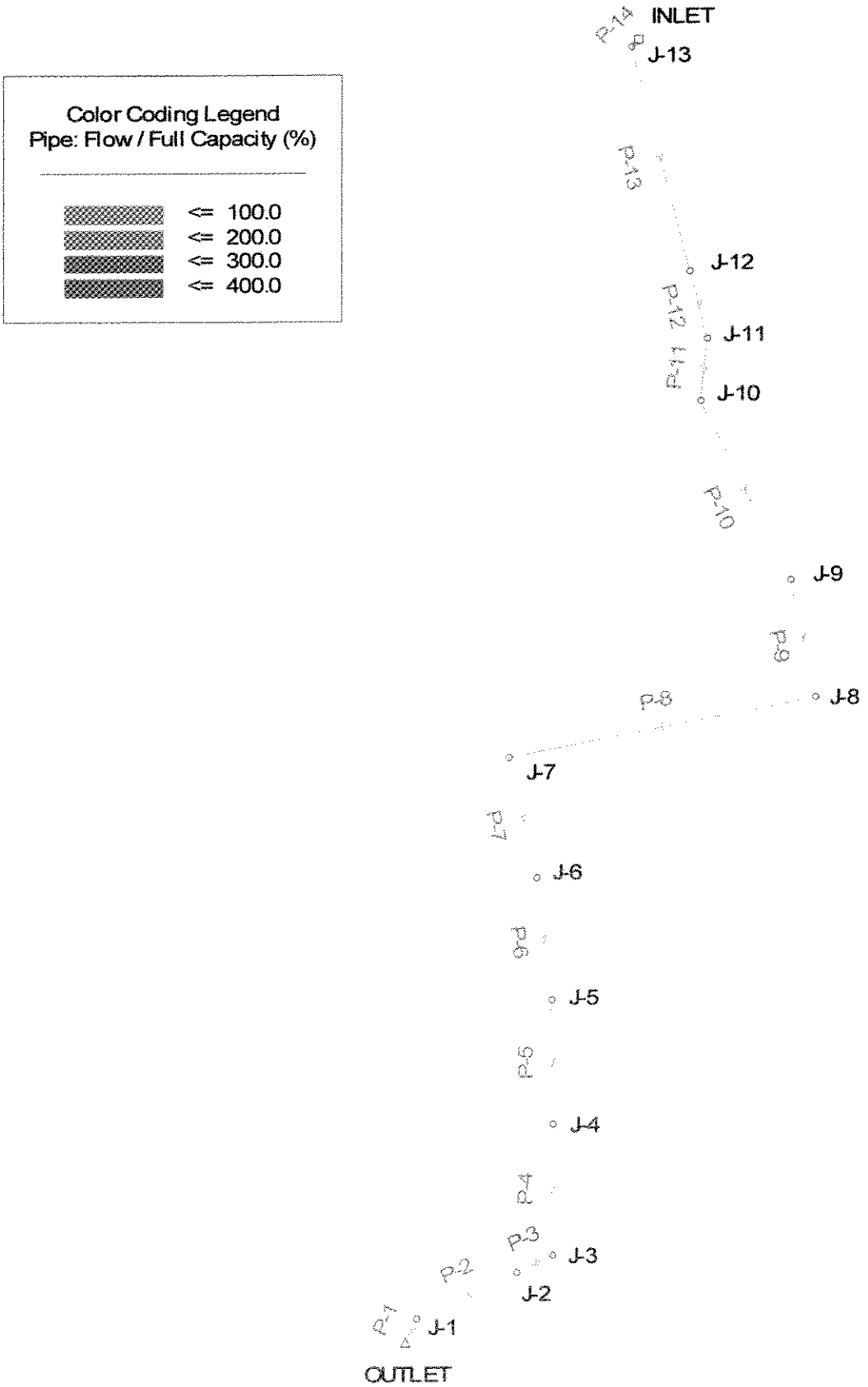
EXISTING DRAINAGE CONDITION

HYDRAULIC ANALYSIS

FOR

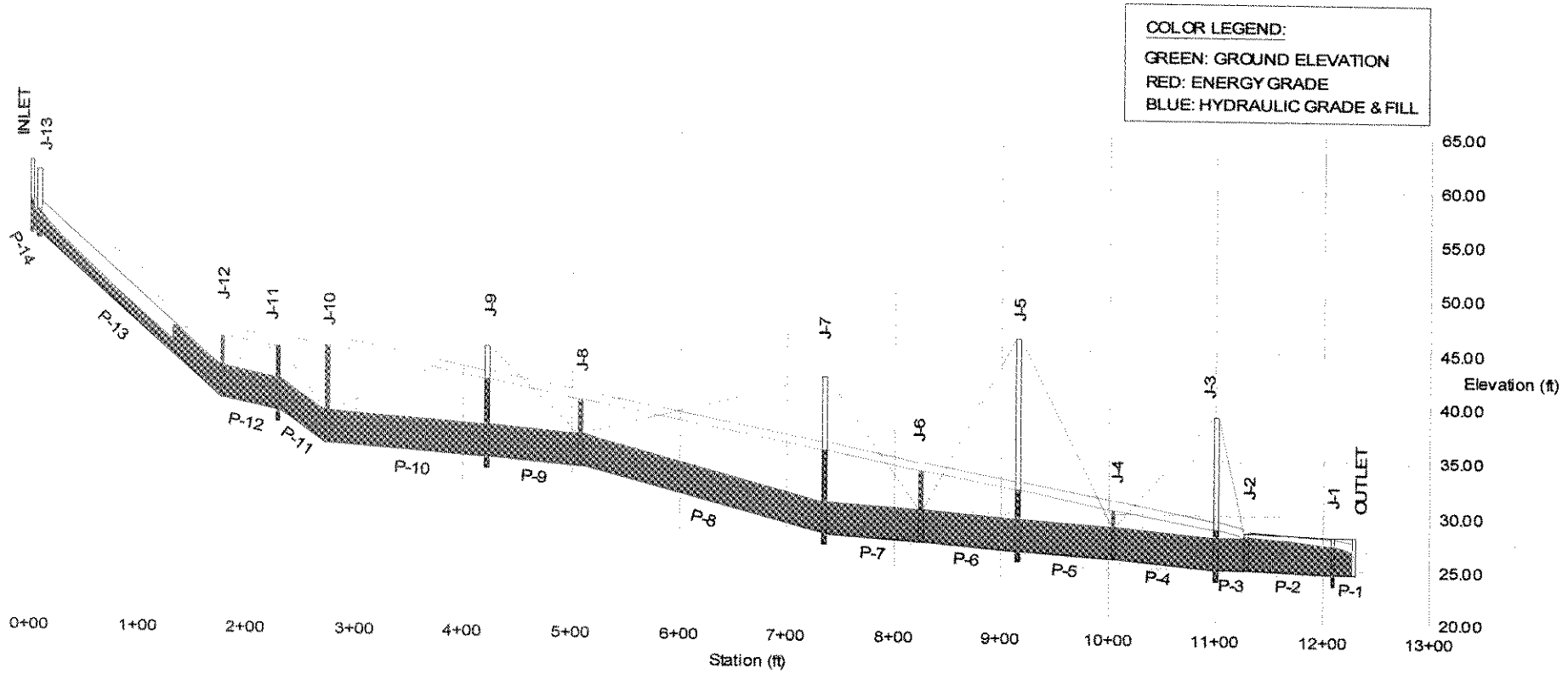
THE OFFSITE DRAINAGE SYSTEM

Scenario: KEAWE STREET - EXISTING OFFSITE DRAINAGE SYSTEM - 10 YR STORM



Profile: Profile - 1

Scenario: KEAWE STREET - EXISTING OFFSITE DRAINAGE SYSTEM - 10 YR STORM



Scenario: KEAWE STREET - EXISTING OFFSITE DRAINAGE SYSTEM - 10 YR STORM

Pipe Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Shape	Section Size	Constructed Slope (ft/ft)	Total System Flow (cfs)	Full Capacity (cfs)	Excess Full Capacity (cfs)	Number of Sections
P-1	J-1	OUTLET	20.00	Circular	42 inch	0.004500	48.84	36.56	-12.29	1
P-2	J-2	J-1	80.00	Circular	42 inch	0.002625	49.10	27.92	-21.18	1
P-3	J-3	J-2	29.00	Circular	36 inch	0.001379	49.16	13.42	-35.75	1
P-4	J-4	J-3	95.00	Circular	36 inch	0.009474	49.38	35.16	-14.22	1
P-5	J-5	J-4	90.00	Circular	36 inch	0.007556	49.59	31.40	-18.19	1
P-6	J-6	J-5	90.00	Circular	36 inch	0.007444	49.80	31.17	-18.63	1
P-7	J-7	J-6	90.00	Circular	36 inch	0.007556	50.00	31.40	-18.60	1
P-8	J-8	J-7	227.00	Circular	36 inch	0.026432	50.52	58.73	8.22	1
P-9	J-9	J-8	87.00	Circular	36 inch	0.007471	50.71	31.23	-19.49	1
P-10	J-10	J-9	147.00	Circular	36 inch	0.007483	51.04	31.25	-19.79	1
P-11	J-11	J-10	46.00	Circular	36 inch	0.065217	51.15	92.26	41.11	1
P-12	J-12	J-11	51.00	Circular	36 inch	0.019608	51.26	50.59	-0.67	1
P-13	J-13	J-12	170.00	Circular	36 inch	0.087882	51.44	107.10	55.65	1
P-14	INLET	J-13	7.00	Circular	36 inch	0.080000	51.45	102.18	50.73	1

Scenario: KEAWE STREET - EXISTING OFFSITE DRAINAGE SYSTEM - 10 YR STORM

Inlet Report

Label	Ground Elevation (ft)	Sump Elevation (ft)	Time of Concentration (min)	Inlet C	Area (acres)	Local Intensity (in/hr)	Total Flow To Inlet (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
INLET	61.33	54.50	27.00	0.28	61.42	2.97	51.45	51.45	0.00	100.0	57.92	57.33

Scenario: KEAWE STREET - EXISTING OFFSITE DRAINAGE SYSTEM - 10 YR STORM

Outlet Report

Label	Ground Elevation (ft)	Invert Elevation (ft)	Tailwater Condition	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Total Flow (cfs)	Total System Flow (cfs)	Total Lost Surface Flow (cfs)
OUTLET	27.95	24.45	Free Outfall	24.45	24.45	48.78	48.78	0.00

APPENDIX A.2

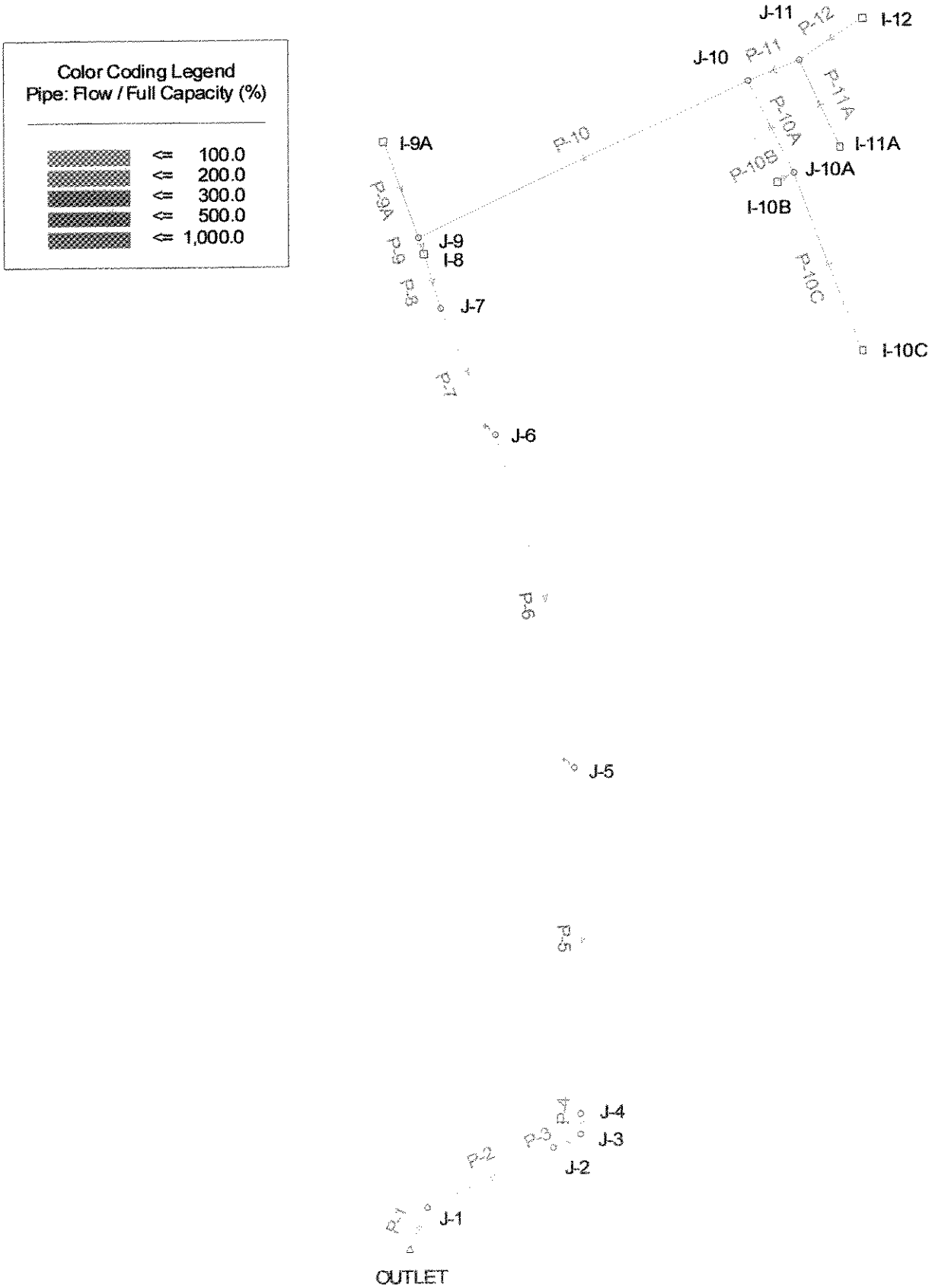
EXISTING DRAINAGE CONDITION

HYDRAULIC ANALYSIS

FOR

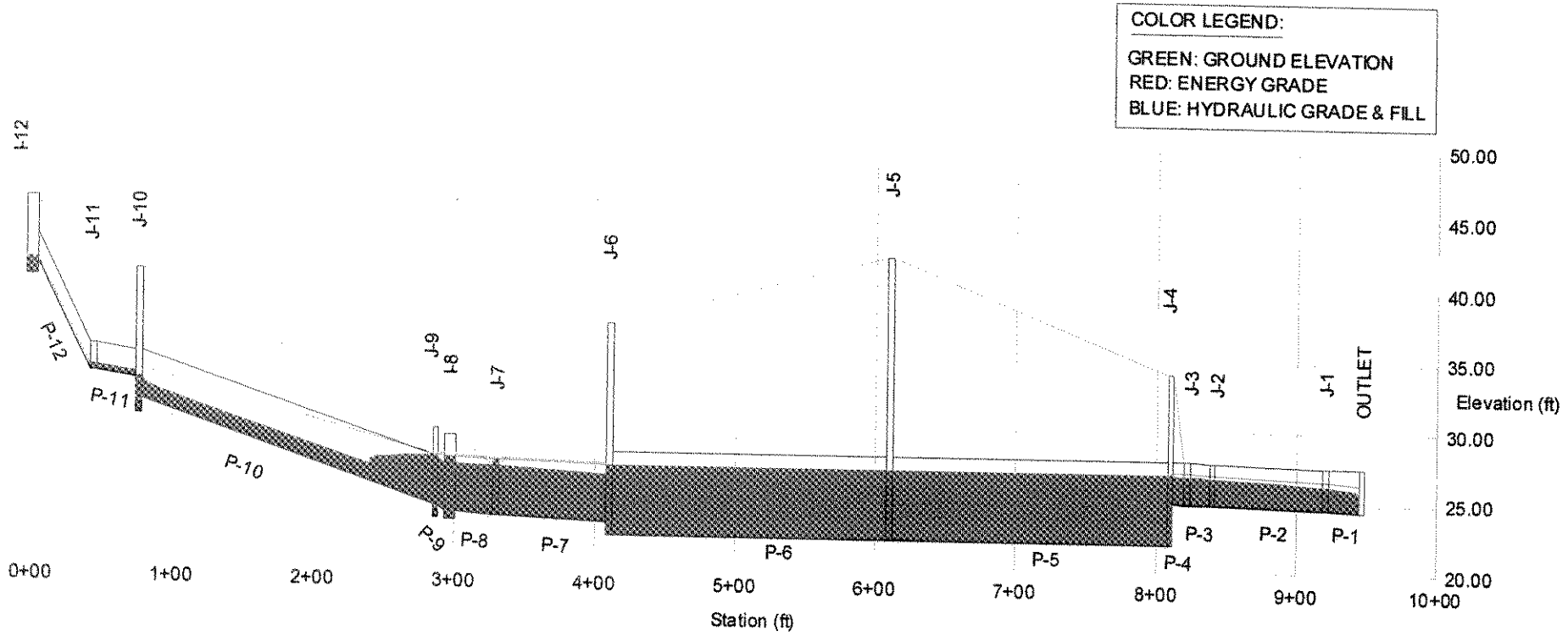
THE ONSITE DRAINAGE SYSTEM

Scenario: KEAWE STREET - EXISTING ONSITE DRAINAGE SYSTEM - 10 YR STORM



Profile: 1

Scenario: KEAWE STREET - EXISTING ONSITE DRAINAGE SYSTEM - 10 YR STORM



Scenario: KEAWE STREET - EXISTING ONSITE DRAINAGE SYSTEM - 10 YR STORM

Pipe Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Shape	Section Size	Constructed Slope (ft/ft)	Total System Flow (cfs)	Full Capacity (cfs)	Excess Full Capacity (cfs)	Number of Sections
P-1	J-1	OUTLET	26.00	Circular	36 inch	0.003462	17.98	21.25	3.28	1
P-2	J-2	J-1	81.00	Circular	36 inch	0.002593	18.07	18.39	0.32	1
P-3	J-3	J-2	18.00	Circular	36 inch	0.002222	18.09	17.03	-1.06	1
P-4	J-4	J-3	12.00	Circular	36 inch	0.002500	18.11	18.06	-0.05	1
P-5	J-5	J-4	200.00	Circular	72 inch	0.000000	19.68	0.00	-19.68	1
P-6	J-6	J-5	200.00	Circular	72 inch	0.000000	24.95	0.00	-24.95	1
P-7	J-7	J-6	80.00	Circular	42 inch	0.005000	29.81	38.53	8.72	1
P-8	I-8	J-7	33.00	Circular	42 inch	0.004848	29.90	37.94	8.04	1
P-9	J-9	I-8	10.00	Circular	42 inch	0.034000	29.26	100.48	71.23	1
P-9A	I-9A	J-9	60.00	Circular	24 inch	0.005000	1.39	8.66	7.27	1
P-10	J-10	J-9	211.00	Circular	42 inch	0.033744	28.15	100.10	71.95	1
P-10A	J-10A	J-10	60.00	Circular	42 inch	0.058333	26.80	131.62	104.81	1
P-10B	I-10B	J-10A	11.00	Circular	24 inch	0.178182	1.32	51.72	50.40	1
P-10C	I-10C	J-10A	111.00	Circular	42 inch	0.036036	25.91	103.45	77.53	1
P-11	J-11	J-10	32.00	Circular	24 inch	0.015625	1.92	15.32	13.40	1
P-11A	I-11A	J-11	56.00	Circular	24 inch	0.079643	1.40	34.58	33.18	1
P-12	I-12	J-11	44.00	Circular	24 inch	0.175909	0.53	51.39	50.86	1

Scenario: KEAWE STREET - EXISTING ONSITE DRAINAGE SYSTEM - 10 YR STORM

Inlet Report

Label	Ground Elevation (ft)	Sump Elevation (ft)	Time of Concentration (min)	Inlet C	Area (acres)	Local Intensity (in/hr)	Total Flow To Inlet (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
I-8	28.82	22.82	22.00	0.42	1.10	3.25	1.51	1.51	0.00	100.0	27.33	27.25
I-9A	28.98	24.48	16.50	0.35	1.10	3.58	1.39	1.39	0.00	100.0	27.37	27.36
I-10B	41.46	36.46	7.50	0.95	0.30	4.60	1.32	1.32	0.00	100.0	36.93	36.86
I-10C	45.68	36.00	18.50	0.33	22.80	3.46	25.91	25.91	0.00	100.0	38.87	38.57
I-11A	41.46	37.46	19.50	0.34	1.20	3.39	1.40	1.40	0.00	100.0	37.94	37.87
I-12	45.38	39.74	19.00	0.22	0.70	3.42	0.53	0.53	0.00	100.0	41.03	40.99

Scenario: KEAWE STREET - EXISTING ONSITE DRAINAGE SYSTEM - 10 YR STORM

Outlet Report

Label	Ground Elevation (ft)	Invert Elevation (ft)	Tailwater Condition	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Total Flow (cfs)	Total System Flow (cfs)	Total Lost Surface Flow (cfs)
OUTLET	27.45	24.45	Free Outfall	24.45	24.45	17.95	17.95	0.00

APPENDIX B

PROPOSED DRAINAGE SYSTEM

Project: Keawe Street Extension

SUMMARY OF PEAK FLOWS BY DRAINAGE AREAS

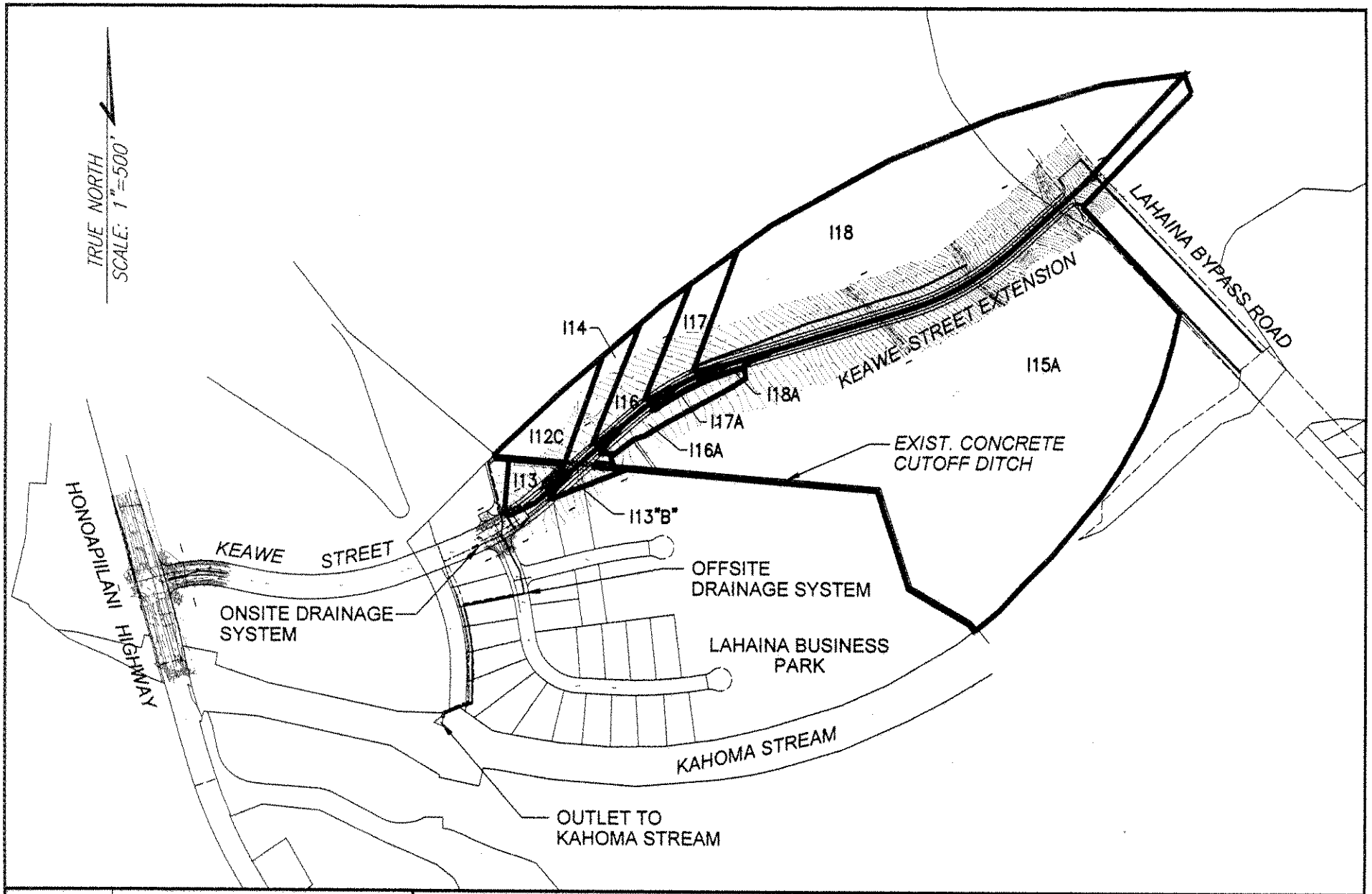
Computation of Drainage Runoff by Rational Method

EXISTING DRAINAGE SYSTEM

Drainage Area	Q10 Peak (cfs)
Offsite Draiange System - Peak Flow at Outlet (Proposed Drainage Basins)	45.60
Onsite Draiange System - Peak Flow at Outlet (Proposed Drainage Basins)	18.42

PROPOSED DRAINAGE IMPROVEMENTS

Drainage Area	Q10 Peak (cfs)
Inlet 12C - Remainder of Exisitng Concrete Ditch	1.32
Inlet 13 - Existing Catch Basin Diverted to Offsite Drainage System	1.02
Inlet 13 "B" - New Drain Inlet Connected to Onsite Drainage System	1.02
Inlet 14 - New Drain Inlet	1.35
Inlet 15A - Cutoff Portion of Concrete Ditch	24.45
Inlet 16 - New Drain Inlet	1.78
Inlet 16A - New Drain Inlet	1.31
Inlet 17 - New Drain Inlet	1.74
Inlet 17A - New Drain Inlet	0.60
Inlet 18A - New Drain Inlet and Cutoff Ditch	18.60
Inlet 18A - New Drain Inlet	0.60



PREPARED FOR:
COUNTY OF MAUI
DPW and WM
ENGINEERING DIVISION

KEAWE STREET EXTENSION
Lahaina, Maui, Hawaii

MAP OF PROPOSED DRAINAGE BASINS

Shimabukuro, Endo & Yoshizaki, Inc.
Civil & Structural Engineers

APPENDIX B.1

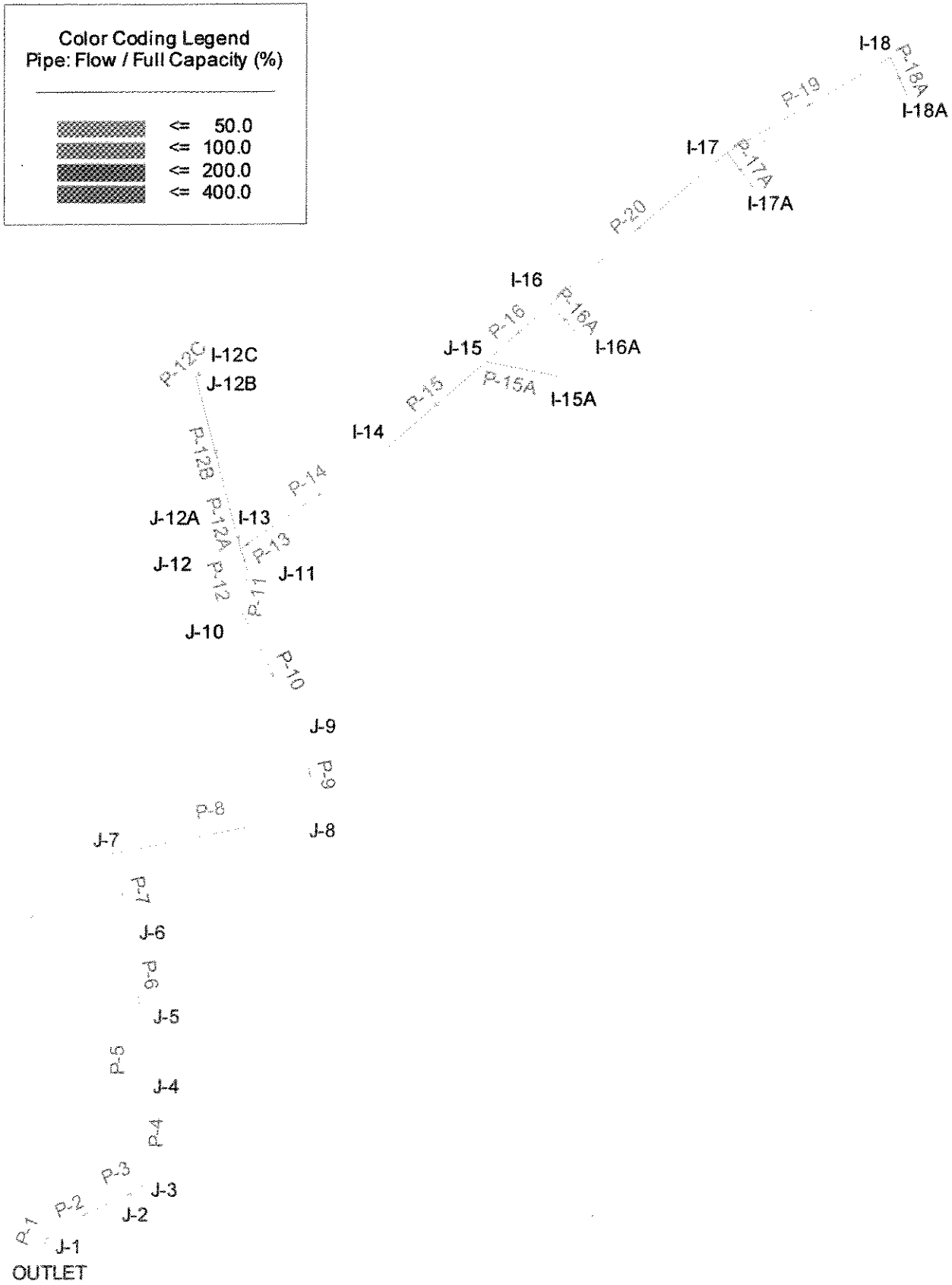
PROPOSED DRAINAGE SYSTEM

HYDRAULIC ANALYSIS

FOR

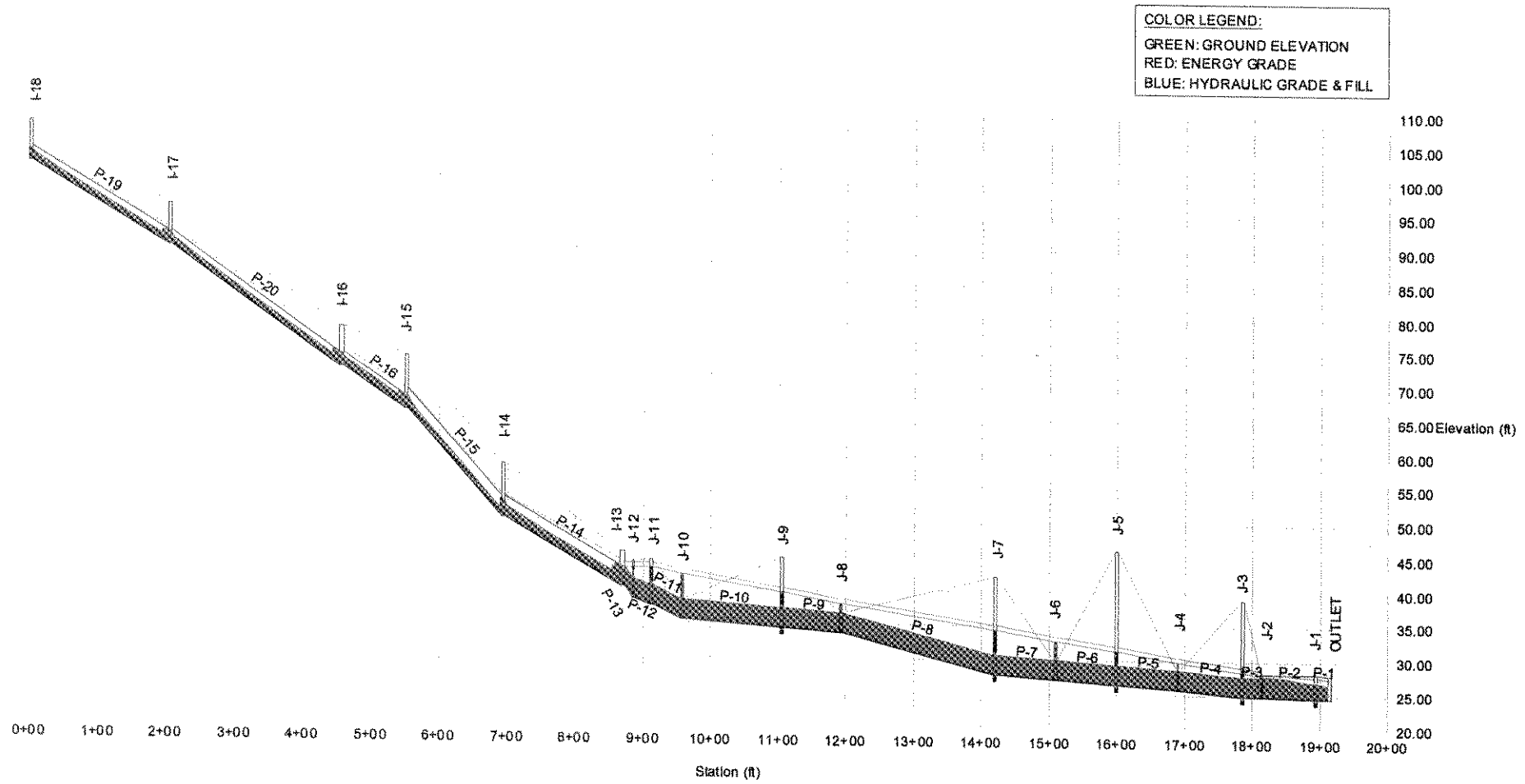
THE OFFSITE DRAINAGE SYSTEM

Scenario: KEAWE STREET - PROPOSED OFFSITE DRAINAGE SYSTEM - 10 YR STORM



Profile
Scenario: KEAWE STREET - PROPOSED OFFSITE DRAINAGE SYSTEM - 10 YR STORM

Profile: 1
Scenario: KEAWE STREET - PROPOSED OFFSITE DRAINAGE SYSTEM - 10 YR STORM



© Haestad Methods, Inc.

Shimabukuro Endo & Yoshizaki Inc
37 Brookside Road Waterbury, CT 06708 USA +1-203-755-1666
Project Engineer: Howard K Endo

Inlet Report

Label	Ground Elevation (ft)	Sump Elevation (ft)	Time of Concentration (min)	Inlet C	Area (acres)	Local Intensity (in/hr)	Total Flow To Inlet (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
I-12C	61.33	54.50	15.71	0.28	1.29	3.63	1.32	1.32	0.00	100.0	55.42	55.36
I-13	45.38	40.38	10.54	0.39	0.64	4.04	1.02	1.02	0.00	100.0	43.46	43.09
I-14	58.02	50.12	17.05	0.39	0.97	3.55	1.35	1.35	0.00	100.0	52.87	52.34
I-15A	81.27	79.27	28.10	0.30	34.16	2.91	24.45	24.45	0.00	100.0	81.18	80.86
I-16	78.08	72.08	17.02	0.36	1.38	3.55	1.78	1.78	0.00	100.0	74.32	73.80
I-16A	78.08	72.56	21.73	0.39	1.02	3.26	1.31	1.31	0.00	100.0	74.32	74.32
I-17	95.70	89.70	15.94	0.34	1.40	3.62	1.74	1.74	0.00	100.0	91.78	91.34
I-17A	95.70	90.18	5.00	0.90	0.13	5.12	0.60	0.60	0.00	100.0	91.78	91.78
I-18	107.66	101.66	20.71	0.33	16.84	3.32	18.60	18.60	0.00	100.0	103.63	103.23
I-18A	107.66	102.14	5.00	0.90	0.13	5.12	0.60	0.60	0.00	100.0	103.63	103.63

Pipe Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Shape	Section Size	Constructed Slope (ft/ft)	Total System Flow (cfs)	Full Capacity (cfs)	Excess Full Capacity (cfs)	Number of Sections
P-1	J-1	OUTLET	20.00	Circular	42 inch	0.004500	45.65	36.56	-9.09	1
P-2	J-2	J-1	80.00	Circular	42 inch	0.002625	45.81	27.92	-17.89	1
P-3	J-3	J-2	29.00	Circular	36 inch	0.001379	45.86	13.42	-32.44	1
P-4	J-4	J-3	95.00	Circular	36 inch	0.009474	46.00	35.16	-10.84	1
P-5	J-5	J-4	90.00	Circular	36 inch	0.007556	46.14	31.40	-14.73	1
P-6	J-6	J-5	90.00	Circular	36 inch	0.007444	46.27	31.17	-15.10	1
P-7	J-7	J-6	90.00	Circular	36 inch	0.007556	46.45	31.40	-15.04	1
P-8	J-8	J-7	227.00	Circular	36 inch	0.026432	47.04	58.73	11.70	1
P-9	J-9	J-8	87.00	Circular	36 inch	0.007471	47.26	31.23	-16.04	1
P-10	J-10	J-9	147.00	Circular	36 inch	0.007483	47.64	31.25	-16.39	1
P-11	J-11	J-10	46.00	Circular	36 inch	0.043478	47.76	75.33	27.57	1
P-12	J-12	J-11	27.00	Circular	36 inch	0.037037	47.83	139.05	91.22	1
P-12A	J-12A	J-12	24.00	Circular	36 inch	0.041667	1.31	147.49	146.18	1
P-12B	J-12B	J-12A	170.00	Circular	36 inch	0.087882	1.32	107.10	105.77	1
P-12C	I-12C	J-12B	7.00	Circular	36 inch	0.080000	1.32	102.18	100.86	1
P-13	I-13	J-12	16.00	Circular	36 inch	0.117500	46.79	247.67	200.88	1
P-14	I-14	I-13	176.00	Circular	36 inch	0.055341	46.30	84.99	38.68	1
P-15	J-15	I-14	143.00	Circular	36 inch	0.110490	45.35	120.08	74.74	1
P-15A	I-15A	J-15	81.00	Circular	36 inch	0.164815	24.45	146.66	122.21	1
P-16	I-16	J-15	95.00	Circular	24 inch	0.064842	23.43	31.20	7.77	1
P-16A	I-16A	I-16	48.00	Circular	24 inch	0.010000	1.31	12.25	10.94	1
P-17A	I-17A	I-17	48.00	Circular	36 inch	0.010000	0.60	36.13	35.52	1
P-18A	I-18A	I-18	48.00	Circular	24 inch	0.010000	0.60	12.25	11.65	1
P-19	I-18	I-17	204.00	Circular	24 inch	0.058627	18.99	29.67	10.68	1
P-20	I-17	I-16	252.00	Circular	24 inch	0.069921	20.86	32.40	11.55	1

Outlet Report

Label	Ground Elevation (ft)	Invert Elevation (ft)	Tailwater Condition	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Total Flow (cfs)	Total System Flow (cfs)	Total Lost Surface Flow (cfs)
OUTLET	27.95	24.45	Free Outfall	24.45	24.45	45.60	45.60	0.00

APPENDIX B.2

PROPOSED DRAINAGE SYSTEM

DETENTION BASIN ANALYSIS

USING THE TR-55 PROGRAM

DETENTION BASIN DESIGN

Based on County's Storm Drainage Standards, the basin is designed to accommodate a 50 year storm recurrence interval strom (Q50 years = 37.36 cfs). The allowable discharge into the drainage system based on down stream capacity and existing peak flow rate is 24.45 cfs. Based on these criteria, the basin is required to be 6,000 s.f. and 5' deep with a 21" outflow pipe.

th

Keawe Street Ext.
Drainage Report Project Area A1 with detention
Maui County, Hawaii

Structure Description - User Entered

Reach Identifier	Surface Area @ Crest (ac)	Height Above Crest (ft)	Surface Area @ Ht Above (ac)	Pipe Diameter (in)	Head on Pipe (ft)	Weir Length (ft)
Reach1	0.1	5	0.133	21	1	

th

Keawe Street Ext.
Drainage Report Project Area A1 with detention
Maui County, Hawaii

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
A1	Paved; curbs and storm sewers		B	.85	98
	Brush - brush, weed, grass mix	(poor)	B	.87	67
	Brush - brush, weed, grass mix	(fair)	B	32.44	56
	Total Area / Weighted Curve Number			34.16	57

th

Keawe Street Ext.
Drainage Report Project Area A1 with detention
Maui County, Hawaii

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
A1	34.16	0.468	57	Reach1	Existing Land Use

Total Area: 34.16 (ac)

th

Keawe Street Ext.
Drainage Report Project Area A1 with detention
Maui County, Hawaii

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 50-Yr (cfs)
SUBAREAS	
A1	37.36
REACHES	
Reach1	37.36
Down	24.45
OUTLET	24.45

th

Keawe Street Ext.
Drainage Report Project Area A1 with detention
Maui County, Hawaii

Structure Output Table

Reach Identifier / Structure Identifier	Peak Flow (PF), Storage Volume (SV), Stage (STG) by Rainfall Return Period 50-Yr
Reach: Reach1	
Pipe : sb1 21(in)	
PF (cfs)	24.45
SV (ac ft)	.54
STG (ft)	4.54

APPENDIX B.3

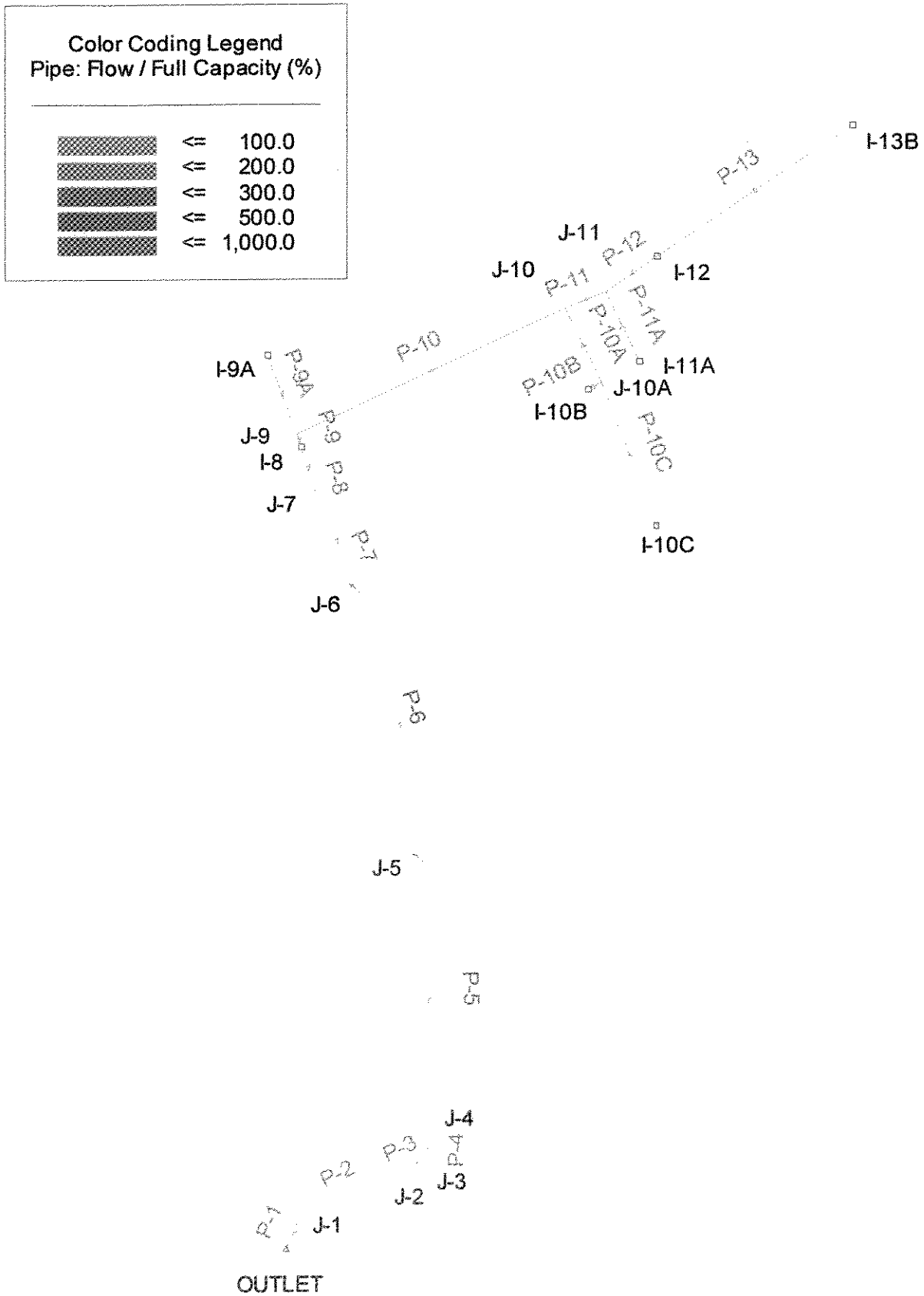
PROPOSED DRAINAGE SYSTEM

HYDRAULIC ANALYSIS

FOR

THE ONSITE DRAINAGE SYSTEM

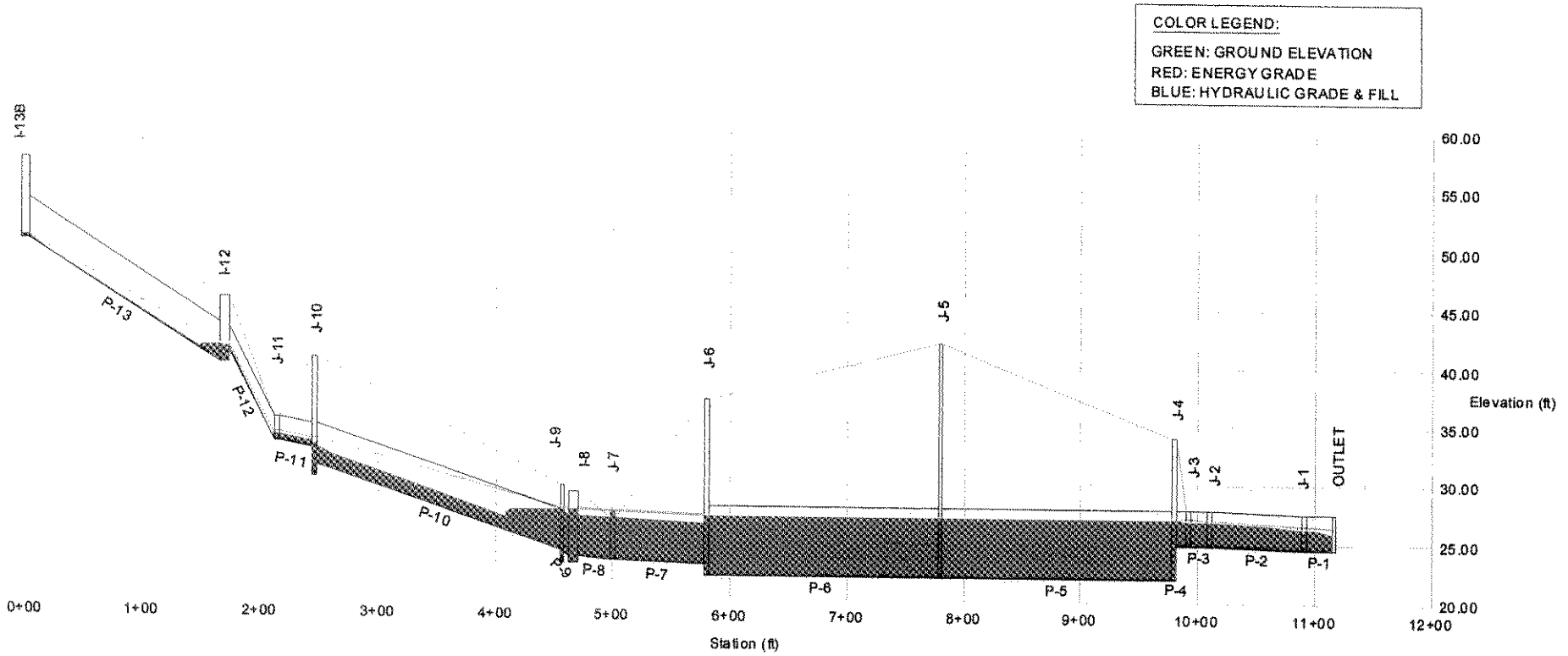
Scenario: KEAWE STREET - PROPOSED ONSITE DRAINAGE SYSTEM - 10 YR STORM



Profile
Scenario: KEAWE STREET - PROPOSED ONSITE DRAINAGE SYSTEM - 10 YR STORM

Profile: 1

Scenario: KEAWE STREET - PROPOSED ONSITE DRAINAGE SYSTEM - 10 YR STORM



© Haestad Methods, Inc.

Shimabukuro Endo & Yoshizaki Inc
37 Brookside Road Waterbury, CT 06708 USA +1-203-755-1666
Project Engineer: Howard K Endo

Scenario: KEAWE STREET - PROPOSED ONSITE DRAINAGE SYSTEM - 10 YR STORM

Inlet Report

Label	Ground Elevation (ft)	Sump Elevation (ft)	Time of Concentration (min)	Inlet C	Area (acres)	Local Intensity (in/hr)	Total Flow To Inlet (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
I-8	28.82	22.82	22.00	0.42	1.10	3.25	1.51	1.51	0.00	100.0	27.38	27.30
I-9A	28.98	24.48	16.50	0.35	1.10	3.58	1.39	1.39	0.00	100.0	27.42	27.42
I-10B	41.46	36.46	7.50	0.95	0.30	4.60	1.32	1.32	0.00	100.0	36.93	36.86
I-10C	45.68	36.00	18.50	0.33	22.80	3.46	25.91	25.91	0.00	100.0	38.87	38.57
I-11A	41.46	37.46	19.50	0.34	1.20	3.39	1.40	1.40	0.00	100.0	37.94	37.87
I-12	45.38	39.74	19.00	0.22	0.70	3.42	0.53	0.53	0.00	100.0	41.20	41.13
I-13B	57.12	50.12	12.38	0.49	0.50	3.89	0.96	0.85	0.11	88.6	50.44	50.39

Pipe Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Shape	Section Size	Constructed Slope (ft/ft)	Total System Flow (cfs)	Full Capacity (cfs)	Excess Full Capacity (cfs)	Number of Sections
P-1	J-1	OUTLET	26.00	Circular	36 inch	0.003462	18.45	21.25	2.81	1
P-2	J-2	J-1	81.00	Circular	36 inch	0.002593	18.54	18.39	-0.15	1
P-3	J-3	J-2	18.00	Circular	36 inch	0.002222	18.57	17.03	-1.54	1
P-4	J-4	J-3	12.00	Circular	36 inch	0.002500	18.58	18.06	-0.52	1
P-5	J-5	J-4	200.00	Circular	72 inch	0.000000	20.18	0.00	-20.18	1
P-6	J-6	J-5	200.00	Circular	72 inch	0.000000	25.55	0.00	-25.55	1
P-7	J-7	J-6	80.00	Circular	42 inch	0.005000	30.52	38.53	8.01	1
P-8	I-8	J-7	33.00	Circular	42 inch	0.004848	30.61	37.94	7.33	1
P-9	J-9	I-8	10.00	Circular	42 inch	0.034000	30.00	100.48	70.48	1
P-9A	I-9A	J-9	60.00	Circular	24 inch	0.005000	1.39	8.66	7.27	1
P-10	J-10	J-9	211.00	Circular	42 inch	0.033744	28.90	100.10	71.20	1
P-10A	J-10A	J-10	60.00	Circular	42 inch	0.058333	26.80	131.62	104.81	1
P-10B	I-10B	J-10A	11.00	Circular	24 inch	0.178182	1.32	51.72	50.40	1
P-10C	I-10C	J-10A	111.00	Circular	42 inch	0.036036	25.91	103.45	77.53	1
P-11	J-11	J-10	32.00	Circular	24 inch	0.015625	2.66	15.32	12.66	1
P-11A	I-11A	J-11	56.00	Circular	24 inch	0.079643	1.40	34.58	33.18	1
P-12	I-12	J-11	44.00	Circular	24 inch	0.175909	1.28	51.39	50.11	1
P-13	I-13B	I-12	170.00	Circular	42 inch	0.061059	0.85	269.31	268.46	1

Outlet Report

Label	Ground Elevation (ft)	Invert Elevation (ft)	Tailwater Condition	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Total Flow (cfs)	Total System Flow (cfs)	Total Lost Surface Flow (cfs)
OUTLET	27.45	24.45	Free Outfall	24.45	24.45	18.42	18.42	0.14

APPENDIX D. LETTER FROM DEPARTMENT OF PLANNING DATED APRIL 1, 2005

ALAN M. ARAKAWA
Mayor

MICHAEL W. FOLEY
Director

VAYNE A. BOTEILHO
Deputy Director

'05 APR -5 P1:25

COUNTY MAUI
PUBLIC WORKS

COUNTY OF MAUI
DEPARTMENT OF PLANNING

April 1, 2005

958 ☐ RUSH

DEPT. OF PUBLIC WORKS

DIRECTOR	✓					
DEP. DIR.						
PERS.						
STAFF OFF.						
LUCA						
WWRPCL						
SOLID W.						
ENGR.	✓					
HWYS.						
SECTY.						

Return to_____ Due_____

Ref. No. _____

By:_____ Date:_____

Mr. Milton Arakawa, Director
Department of Public Works and Environmental Management
200 S. High Street
Wailuku, Hawaii 96793

Attn: Mr. Joe Krueger

Dear Mr Arakawa:

RE: Special Management Area Assessment (SMA) for the Construction of a Left Hand Turn Lane on Keawe Street at its Intersection with Honoapiilani Highway, Lahaina, Island of Maui, Hawaii (SMX 2004/0413) (SM5 2005/0156)

In response to your application received on June 22, 2004, and in accordance with the Special Management Area Rules for the Maui Planning Commission and Chapter 205A, Hawaii Revised Statutes, no development shall be allowed in any county within the Special Management Area (SMA) without obtaining a permit. Please be advised that "Development" does not include:

"Repair or Maintenance of roads and highways within existing right-of-ways..."

Therefore, a Special Management Area Permit is not required.

Thank you for your cooperation. If additional clarification is required, please contact Ms. Robyn Loudermilk, Staff Planner, of this office at 270-7735.

Sincerely,

MICHAEL W. FOLEY
Planning Director

MWF:RLL:dm
c: Clayton I. Yoshida, AICP, Planning Program Administrator
Aaron Shinmoto, Planning Program Administrator (2)
Robyn L. Loudermilk, Staff Planner
DSA (2)
05/CZM File
05/SM2 Minor Permit File
General File
K:\WP_DOCS\PLANNING\SM5\2005\0156_KeaweStIntersection\exemption.wpd

DETENTION BASIN DESIGN

Based on County's Storm Drainage Standards, the basin is designed to accommodate a 50 year storm recurrence interval strom (Q50 years = 37.36 cfs). The allowable discharge into the drainage system based on down stream capacity and existing peak flow rate is 24.45 cfs. Based on these criteria, the basin is required to be 6,000 s.f. and 5' deep with a 21" outflow pipe.

th

Keawe Street Ext.
Drainage Report Project Area A1 with detention
Maui County, Hawaii

Structure Description - User Entered

Reach Identifier	Surface Area @ Crest (ac)	Height Above Crest (ft)	Surface Area @ Ht Above (ac)	Pipe Diameter (in)	Head on Pipe (ft)	Weir Length (ft)
Reach1	0.1	5	0.133	21	1	

th

Keawe Street Ext.
Drainage Report Project Area A1 with detention
Maui County, Hawaii

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
A1	Paved; curbs and storm sewers		B	.85	98
	Brush - brush, weed, grass mix	(poor)	B	.87	67
	Brush - brush, weed, grass mix	(fair)	B	32.44	56
	Total Area / Weighted Curve Number			34.16	57

th

Keawe Street Ext.
Drainage Report Project Area A1 with detention
Maui County, Hawaii

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
A1	34.16	0.468	57	Reach1	Existing Land Use

Total Area: 34.16 (ac)

th

Keawe Street Ext.
Drainage Report Project Area A1 with detention
Maui County, Hawaii

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 50-Yr (cfs)
SUBAREAS	
A1	37.36
REACHES	
Reach1	37.36
Down	24.45
OUTLET	24.45

th

Keawe Street Ext.
Drainage Report Project Area A1 with detention
Maui County, Hawaii

Structure Output Table

Reach Identifier / Structure Identifier	Peak Flow (PF), Storage Volume (SV), Stage (STG) by Rainfall Return Period 50-Yr
Reach: Reach1	
Pipe : sb1 21(in)	
PF (cfs)	24.45
SV (ac ft)	.54
STG (ft)	4.54

APPENDIX B.3

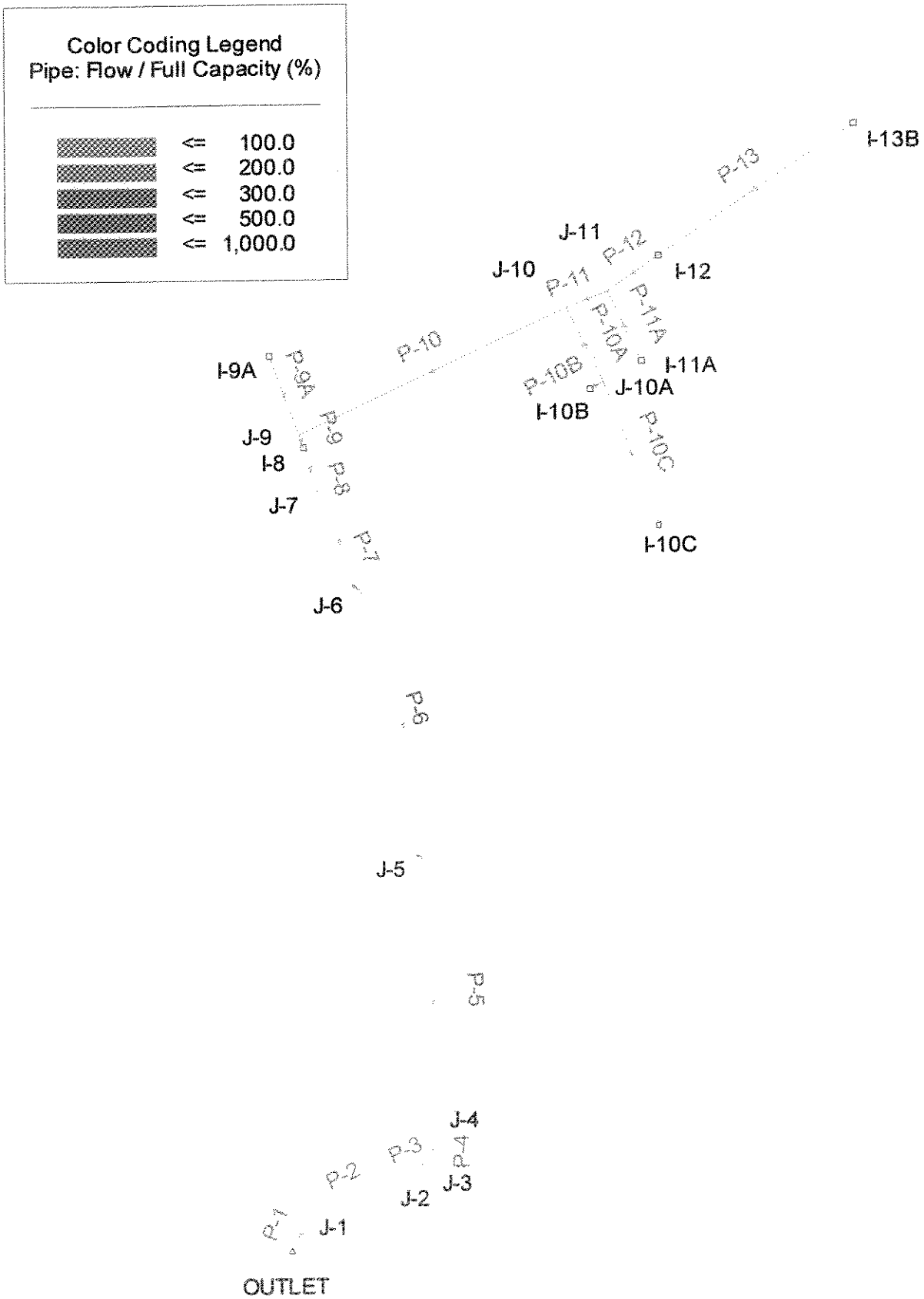
PROPOSED DRAINAGE SYSTEM

HYDRAULIC ANALYSIS

FOR

THE ONSITE DRAINAGE SYSTEM

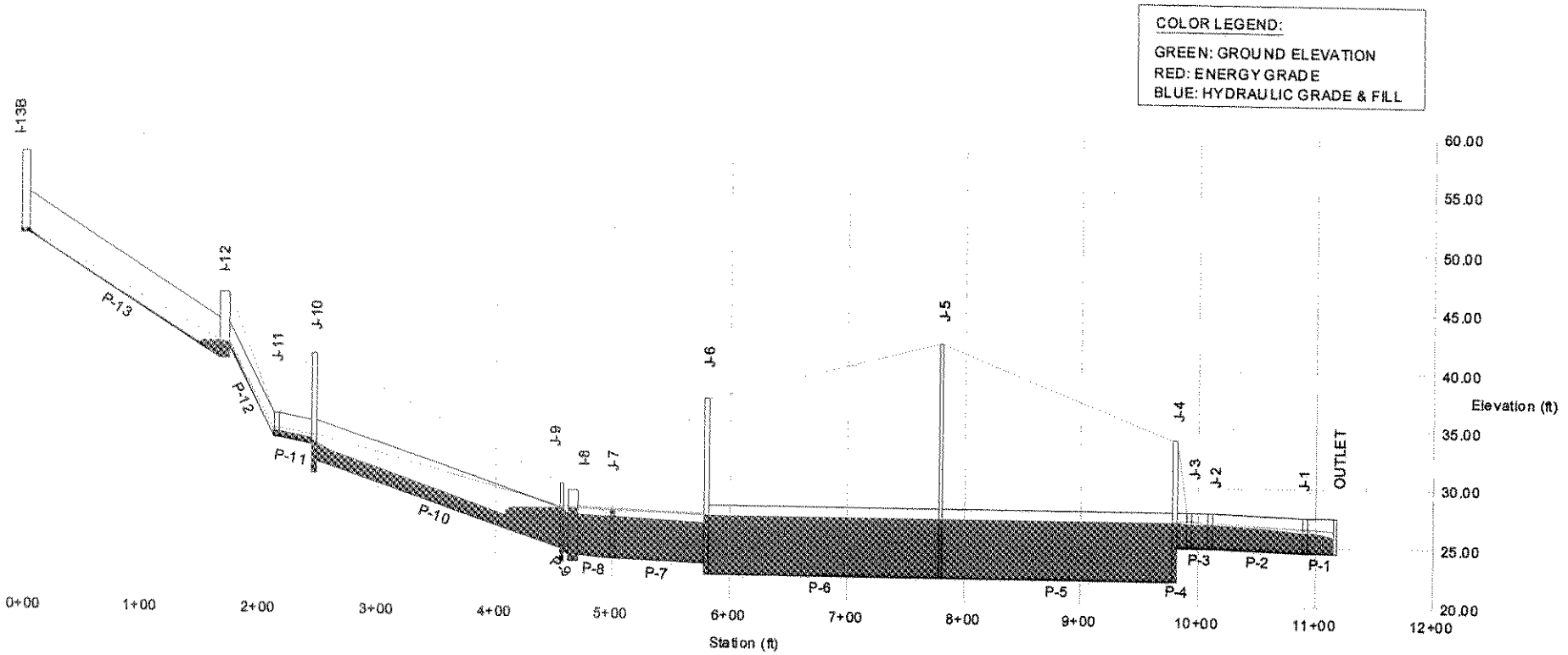
Scenario: KEAWE STREET - PROPOSED ONSITE DRAINAGE SYSTEM - 10 YR STORM



Profile
Scenario: KEAWE STREET - PROPOSED ONSITE DRAINAGE SYSTEM - 10 YR STORM

Profile: 1

Scenario: KEAWE STREET - PROPOSED ONSITE DRAINAGE SYSTEM - 10 YR STORM



© Haestad Methods, Inc.

Shimabukuro Endo & Yoshizaki Inc
37 Brookside Road Waterbury, CT 06708 USA

Scenario: KEAWE STREET - PROPOSED ONSITE DRAINAGE SYSTEM - 10 YR STORM

Inlet Report

Label	Ground Elevation (ft)	Sump Elevation (ft)	Time of Concentration (min)	Inlet C	Area (acres)	Local Intensity (in/hr)	Total Flow To Inlet (cfs)	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Capture Efficiency (%)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
I-8	28.82	22.82	22.00	0.42	1.10	3.25	1.51	1.51	0.00	100.0	27.38	27.30
I-9A	28.98	24.48	16.50	0.35	1.10	3.58	1.39	1.39	0.00	100.0	27.42	27.42
I-10B	41.46	36.46	7.50	0.95	0.30	4.60	1.32	1.32	0.00	100.0	36.93	36.86
I-10C	45.68	36.00	18.50	0.33	22.80	3.46	25.91	25.91	0.00	100.0	38.87	38.57
I-11A	41.46	37.46	19.50	0.34	1.20	3.39	1.40	1.40	0.00	100.0	37.94	37.87
I-12	45.38	39.74	19.00	0.22	0.70	3.42	0.53	0.53	0.00	100.0	41.20	41.13
I-13B	57.12	50.12	12.38	0.49	0.50	3.89	0.96	0.85	0.11	88.6	50.44	50.39

Pipe Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Shape	Section Size	Constructed Slope (ft/ft)	Total System Flow (cfs)	Full Capacity (cfs)	Excess Full Capacity (cfs)	Number of Sections
P-1	J-1	OUTLET	26.00	Circular	36 inch	0.003462	18.45	21.25	2.81	1
P-2	J-2	J-1	81.00	Circular	36 inch	0.002593	18.54	18.39	-0.15	1
P-3	J-3	J-2	18.00	Circular	36 inch	0.002222	18.57	17.03	-1.54	1
P-4	J-4	J-3	12.00	Circular	36 inch	0.002500	18.58	18.06	-0.52	1
P-5	J-5	J-4	200.00	Circular	72 inch	0.000000	20.18	0.00	-20.18	1
P-6	J-6	J-5	200.00	Circular	72 inch	0.000000	25.55	0.00	-25.55	1
P-7	J-7	J-6	80.00	Circular	42 inch	0.005000	30.52	38.53	8.01	1
P-8	I-8	J-7	33.00	Circular	42 inch	0.004848	30.61	37.94	7.33	1
P-9	J-9	I-8	10.00	Circular	42 inch	0.034000	30.00	100.48	70.48	1
P-9A	I-9A	J-9	60.00	Circular	24 inch	0.005000	1.39	8.66	7.27	1
P-10	J-10	J-9	211.00	Circular	42 inch	0.033744	28.90	100.10	71.20	1
P-10A	J-10A	J-10	60.00	Circular	42 inch	0.058333	26.80	131.62	104.81	1
P-10B	I-10B	J-10A	11.00	Circular	24 inch	0.178182	1.32	51.72	50.40	1
P-10C	I-10C	J-10A	111.00	Circular	42 inch	0.036036	25.91	103.45	77.53	1
P-11	J-11	J-10	32.00	Circular	24 inch	0.015625	2.66	15.32	12.66	1
P-11A	I-11A	J-11	56.00	Circular	24 inch	0.079643	1.40	34.58	33.18	1
P-12	I-12	J-11	44.00	Circular	24 inch	0.175909	1.28	51.39	50.11	1
P-13	I-13B	I-12	170.00	Circular	42 inch	0.061059	0.85	269.31	268.46	1

Outlet Report

Label	Ground Elevation (ft)	Invert Elevation (ft)	Tailwater Condition	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Total Flow (cfs)	Total System Flow (cfs)	Total Lost Surface Flow (cfs)
OUTLET	27.45	24.45	Free Outfall	24.45	24.45	18.42	18.42	0.14

APPENDIX D. LETTER FROM DEPARTMENT OF PLANNING DATED APRIL 1, 2005

ALAN M. ARAKAWA
Mayor

MICHAEL W. FOLEY
Director

WAYNE A. BOTEILHO
Deputy Director

'05 APR -5 P1:25

COUNTY OF MAUI
PUBLIC WORKS

958 RUSH

DEPT. OF PUBLIC WORKS

	INFO	ACTION	FILE	COMMENTS	COPY	FILE
DIRECTOR						
DEP. DIR.						
PERS.						
STAFF CE						
LUCA						
WW & FCL.						
SOLID W.						
ENGR.	✓					
HWYS.						
SECTY.						

Return to _____ Due _____

Ref. No. _____

By: _____ Date: _____

COUNTY OF MAUI
DEPARTMENT OF PLANNING

April 1, 2005

Mr. Milton Arakawa, Director
Department of Public Works and Environmental Management
200 S. High Street
Wailuku, Hawaii 96793

Attn: Mr. Joe Krueger

Dear Mr Arakawa:

RE: Special Management Area Assessment (SMA) for the Construction of a Left Hand Turn Lane on Keawe Street at its Intersection with Honoapiilani Highway, Lahaina, Island of Maui, Hawaii (SMX 2004/0413) (SM5 2005/0156)

In response to your application received on June 22, 2004, and in accordance with the Special Management Area Rules for the Maui Planning Commission and Chapter 205A, Hawaii Revised Statutes, no development shall be allowed in any county within the Special Management Area (SMA) without obtaining a permit. Please be advised that "Development" does not include:

"Repair or Maintenance of roads and highways within existing right-of-ways..."

Therefore, a Special Management Area Permit is not required.

Thank you for your cooperation. If additional clarification is required, please contact Ms. Robyn Loudermilk, Staff Planner, of this office at 270-7735.

Sincerely,

M.W. Foley

MICHAEL W. FOLEY
Planning Director

MWF:RLL:dm
c: Clayton I. Yoshida, AICP, Planning Program Administrator
Aaron Shinmoto, Planning Program Administrator (2)
Robyn L. Loudermilk, Staff Planner
DSA (2)
05/CZM File
05/SM2 Minor Permit File
General File
K:\WP_DOCS\PLANNING\SM5\2005\0156_KeaweStIntersection\exemption.wpd