LINDA CROCKETT LINGLE
Mayor

CHARLES JENCKS
Director

DAVID C. GOODE
Deputy Director

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration

EASSIE MILLER, P.E.
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.
Engineering Division

Solid Waste Division

BRIAN HASHIRO, P.E.
Highways Division

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

August 22, 1997

Mr. Gary Gill
Director
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

SUBJECT: CONSTRUCTION OF ROAD "C" AND NORTH-SOUTH COLLECTOR ROAD
FEDERAL AID PROJECT NO. STP-0900(42)

Dear Mr. Gill:

The County of Maui Department of Public Works and Waste Management has reviewed the comments received during the 30-day public comment period for the Draft Environmental Assessment which began on July 8, 1997. The agency has determined that the subject project will not have significant environmental effects and has issued a finding of no significant impact. Please publish this notice in the September 8, 1997 edition of "The Environmental Notice".

We have enclosed a completed OEQC Bulletin Publication Form and four (4) copies of the Final EA.

Please contact Lloyd Lee, Engineering Division Chief at 243-7745 if you have any questions.

Very truly yours,

Charles Jencks
Director of Public Works and Waste Management

JK:mku(ED97-1113)
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1997-09-08-MA-FEA- Kihei Road "C" & North-South Collector Road Construction

SEP - 8 1997

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OFC. OF ENVIRONMENTAL QUALITY CONTROL

Final Environmental Assessment

Construction of Road "C" and North-South Collector Road STP-0900 (42)

Prepared for

County of Maui
Department of Public
Works and Waste Management

August 1997

MUNEKIYO & ARAKAWA, INC.

Final
Environmental Assessment

Construction of Road "C" and North-South Collector Road STP-0900 (42)

Prepared for

County of Maui
Department of Public
Works and Waste Management

August 1997

MUNEKIYO & ARAKAWA, INC.

2150

Construction of "C" and North-South Collector Road
Federal Aid Project Number STP-0900(42)
Kihei District, Maui County, Hawaii

'97 JUN 24 P1:43

Environmental Assessment

Submitted Pursuant to the National
Environmental Policy Act (NEPA),
42 U.S.C. 4332(2)(c), 49 U.S.C. 303 and
Chapter 343, Hawaii Revised Statutes (HRS)

U.S. Department of Transportation
Federal Highway Administration
and
State of Hawaii Department of Transportation
Highways Division

6/23/97
Date of Approval

Kazu Hayashida, Director
Department of Transportation

6/24/97
Date of Approval

for Abraham Wong, Division Administrator
Federal Highway Administration

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

Mr. Abraham Wong
Division Administrator
Federal Highway Administration
U.S. Department of Transportation
Box 50206
300 Ala Moana Boulevard
Honolulu, Hawaii 96850
Telephone Number (808) 541-2700

Mr. Kazu Hayashida
Director
State of Hawaii Department of
Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813
Telephone Number (808) 548-3205

The proposed improvements which are the subject of this Environmental Assessment include: (1) the construction of Road "C" from its existing terminus near South Kihei Road to Piilani Highway; (2) the construction of a segment of the North-South Collector Road from a point approximately 700 feet north of Road "C" extending south to Halekuai Street; and (3) associated drainage and waterline improvements.

Road "C" is a proposed new east-west connector roadway which provides capacity intended to aid in the mitigation of traffic circulation constraints in the Lipoa business district while

Improving traffic flow along South Kihei Road and Piilani Highway. The segment of the North-South Collector Road implemented as part of this project provides additional access to properties without direct connections to east-west connector roads, serves to divert some of the traffic utilizing South Kihei Road, and increases traffic access to Kihei Elementary and Lokelani Intermediate Schools.

The project involves Federal participating and Federal non-participating portions. The Federal participating portion involves a two lane, two way section of Road "C" and the segment of the North-South Collector Road, from Road "C" to Halekuai Street. Because a private commercial development on an abutting property is imminent, additional non-participating improvements are being proposed so that construction can occur concurrently rather than sequentially in order to minimize construction impacts. The non-participating portion of the Environmental Assessment includes an additional two (2) lanes on Road "C", from the North-South Collector Road to Piilani Highway, two (2) lanes (plus a turning lane) along the segment of the North-South Collector Road extending approximately 700 feet north of Road "C", and associated drainage and waterline improvements.

CONTENTS

LIST OF FIGURES

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT
PROPOSED CONSTRUCTION OF ROAD "C" AND NORTH-SOUTH COLLECTOR ROAD

AGENCY: County of Maui, Department of Public Works and Waste Management

PROJECT DESCRIPTION: The Department of Public Works and Waste Management (DPWWM), a subdivision of the County of Maui, proposes to construct Road "C" and a segment of the North-South Collector Road in Kihei, Maui, Hawaii.

Road "C" is proposed to be perpendicular to South Kihei Road and extend generally in a straight line toward the east. Road "C" curves slightly to the north before intersecting with Piilani Highway. A segment of the North-South Collector Road, from a point approximately 700 feet north of Road "C" extending south to Halekuai Street, is also proposed.

The project involves Federal participating and Federal non-participating portions. The Federal participating portion involves a two lane, two way section of Road "C" and the segment of the North-South Collector Road, from Road "C" to Halekuai Street. Because a private commercial development on an abutting property is imminent, non-participating improvements are being proposed so that construction can occur concurrently rather than sequentially in order to minimize construction impacts. The non-participating portion includes an additional two (2) lanes on Road "C", from the North-South Collector Road to Piilani Highway, the segment of the North-South Collector Road extending approximately 700 feet north of Road "C", and associated drainage and waterline improvements.

Total project cost is estimated at $4.95 million. The cost of the Federal participating portion is estimated at $2.75 million with funding provided through the Federal Intermodal Surface Transportation Efficiency Act (ISTEA) and the County of Maui. The Federal non-participating portion, estimated at $2.2 million, will be borne by the developer of the abutting Piilani Commercial Center Project.

The DPWWM has prepared the present Draft Environmental Assessment (EA) pursuant to the National Environmental Policy Act (NEPA), 42 U.S.C. 4332(2)(c), 49 U.S.C. 303 and Chapter 343, Hawaii Revised Statutes. In the Draft EA, three (3) alternatives were considered: (1) Alternative A, representing the no-build alternative; (2) Alternative B, representing the proposed improvements; and (3) Alternative C, representing the curvilinear alignment of Road "C".

PROJECT SUMMARY: Access to the Kihei region is provided by South Kihei Road and Piilani Highway. South Kihei Road is a heavily traveled, two-lane, two-way road with an alignment that generally follows the coastline. Piilani Highway is an underutilized, two-lane, two-way highway with an alignment generally parallel to and east of South Kihei Road.

CORRECTION

THE PRECEDING DOCUMENT(S) HAS BEEN REPHOTOGRAPHED TO ASSURE LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

LIST OF FIGURES

Preface

The County of Maui, Department of Public Works and Waste Management (DPWWM), proposes to construct roadway improvements for Road "C" and a portion of the North-South Collector Road in Kihei, Maui, Hawaii (TMK 3-9-2:por.30 and por.76; 2-2-2:por.42, por.43, por.66 and por.67). Pursuant to 23 CFR 771, U.S. Department of Transportation, Federal Highway Administration, Environmental Impact and Related Procedures; Chapter 343, Hawaii Revised Statutes and Chapter 200 of Title 11, Hawaii Administrative Rules; this Environmental Assessment documents the project's technical characteristics, environmental impacts and alternatives, and advances findings and conclusions relative to the project.

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT
PROPOSED CONSTRUCTION OF ROAD "C" AND NORTH-SOUTH COLLECTOR ROAD

AGENCY: County of Maui, Department of Public Works and Waste Management

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Road "C" is proposed to be perpendicular to South Kihei Road and extend generally in a straight line toward the east. Road "C" curves slightly to the north before intersecting with Piilani Highway. A segment of the North-South Collector Road, from a point approximately 700 feet north of Road "C" extending south to Halekuai Street, is also proposed.

The project involves Federal participating and Federal non-participating portions. The Federal participating portion involves a two lane, two way section of Road "C" and the segment of the North-South Collector Road, from Road "C" to Halekuai Street. Because a private commercial development on an abutting property is imminent, non-participating improvements are being proposed so that construction can occur concurrently rather than sequentially in order to minimize construction impacts. The non-participating portion includes an additional two (2) lanes on Road "C", from the North-South Collector Road to Piilani Highway, the segment of the North-South Collector Road extending approximately 700 feet north of Road "C", and associated drainage and waterline improvements.

Total project cost is estimated at $4.95 million. The cost of the Federal participating portion is estimated at $2.75 million with funding provided through the Federal Intermodal Surface Transportation Efficiency Act (ISTEA) and the County of Maui. The Federal non-participating portion, estimated at $2.2 million, will be borne by the developer of the abutting Piilani Commercial Center Project.

The DPWWM has prepared the present Draft Environmental Assessment (EA) pursuant to the National Environmental Policy Act (NEPA), 42 U.S.C. 4332(2)(c), 49 U.S.C. 303 and Chapter 343, Hawaii Revised Statutes. In the Draft EA, three (3) alternatives were considered: (1) Alternative A, representing the no-build alternative; (2) Alternative B, representing the proposed improvements; and (3) Alternative C, representing the curvilinear alignment of Road "C".

PROJECT SUMMARY: Access to the Kihei region is provided by South Kihei Road and Piilani Highway. South Kihei Road is a heavily traveled, two-lane, two-way road with an alignment that generally follows the coastline. Piilani Highway is an underutilized, two-lane, two-way highway with an alignment generally parallel to and east of South Kihei Road.

The existing roadway system in Kihei focuses on South Kihei Road as the primary arterial. Motorists traveling along South Kihei Road regularly encounter heavy traffic conditions which are further aggravated during peak visitor season.

From a transportation perspective, there are insufficient connector roads between Piilani Highway and South Kihei Road to collect and distribute traffic to and from Piilani Highway.

Road "C" is intended to provide additional capacity to move east-west traffic within the district. This is intended to aid in mitigating traffic impacts in the Lipoa Business District while improving traffic flow along South Kihei Road and Piilani Highway. The North-South Collector Road segment provides additional access to properties without direct connections to east-west connector roads, serves to divert some of the traffic utilizing South Kihei Road, and increases transportation access to Kihei Elementary and Lokelani Intermediate Schools.

Based on the EA and supporting analyses, the DPWWM is satisfied that potential development and long-term impacts have been identified and addressed.

FOR FURTHER INFORMATION CONTACT: Charles Jencks, Director, County of Maui, Department of Public Works and Waste Management, 200 South High Street, Wailuku, Hawaii 96793; telephone (808) 243-7845.

6-20-97
Date

for Charles Jencks, Director
Department of Public Works
and Waste Management

Chapter I

Project Overview

I. PROJECT OVERVIEW

A. PROPERTY LOCATION AND LAND OWNERSHIP

The applicant, the Department of Public Works and Waste Management (DPWWM), proposes the construction of Road "C" and a segment of the North-South Collector Road in Kihei, Maui, Hawaii.

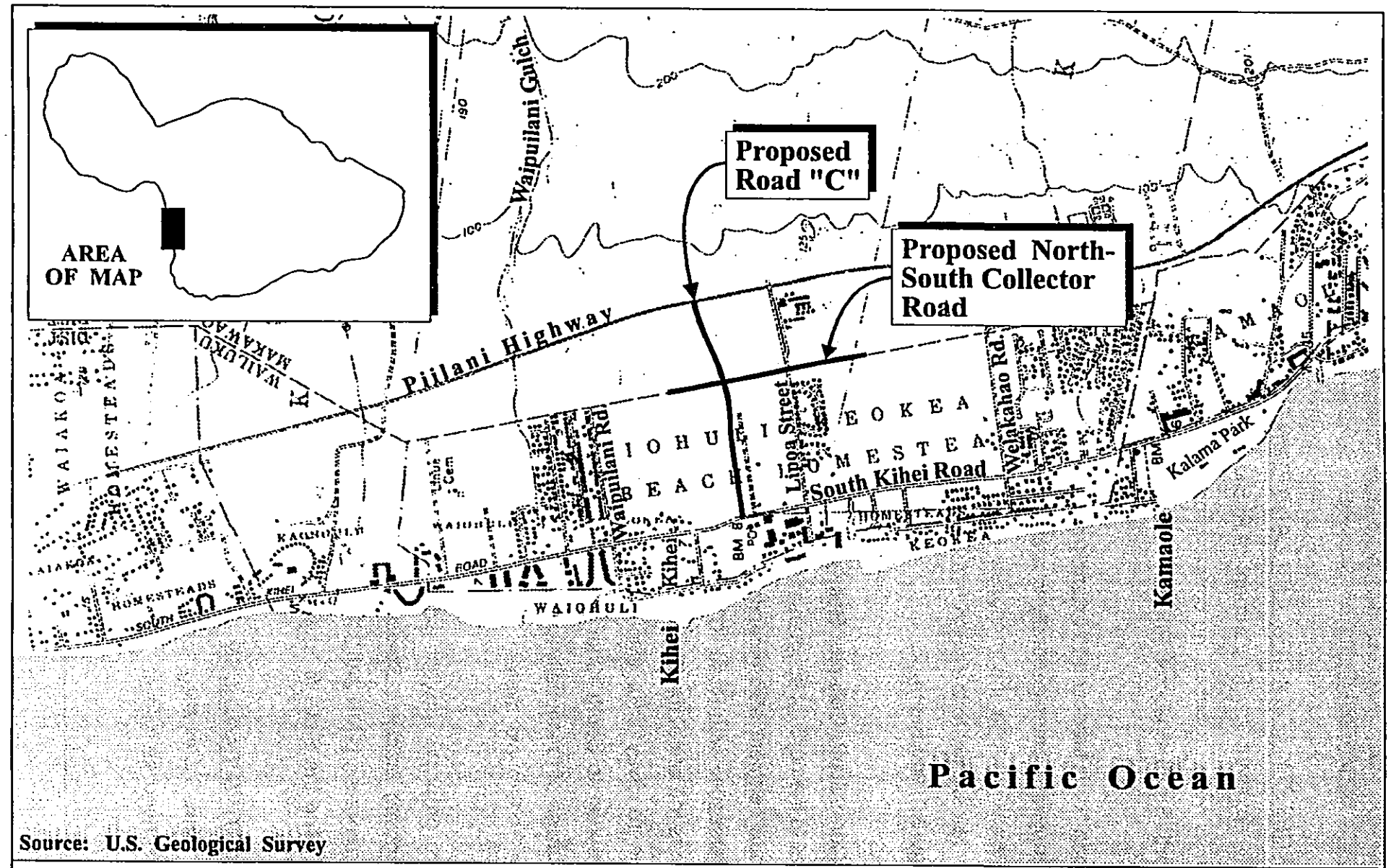
Road "C" is proposed to extend from its existing terminus near the Long's Shopping Center generally in a straight line to the east. As the roadway extends through the proposed Piilani Village project district, Road "C" curves slightly to the north before intersecting with Piilani Highway. See Figure 1 and Figure 2.

A North-South Collector Road segment extends approximately 700 lineal feet to the north of its intersection with Road "C". A North-South Collector Road segment also extends approximately 2,050 feet to the south of its intersection with Road "C". This segment extends past Lipoa Street and abuts the site of the Kihei Elementary and Lokelani Intermediate Schools. The roadway links with Halekuai Street which extends in a westerly direction to South Kihei Road. The County of Maui is currently in the process of functionally classifying the North-South Collector Road within the Federal-aid system.

The proposed project extends over portions of parcels owned by the following entities: Stewart Fern Trust (TMK 3-9-2:30), Azeka Building Corporation (TMK 3-9-2:76), and Baldwin Malama (TMK 2-2-2:42, 66 and 67) and the State of Hawaii (TMK 2-2-2:43).

B. EXISTING LAND USE

In terms of existing land use, the proposed roadway corridor can be described as follows.



Source: U.S. Geological Survey

Figure 1

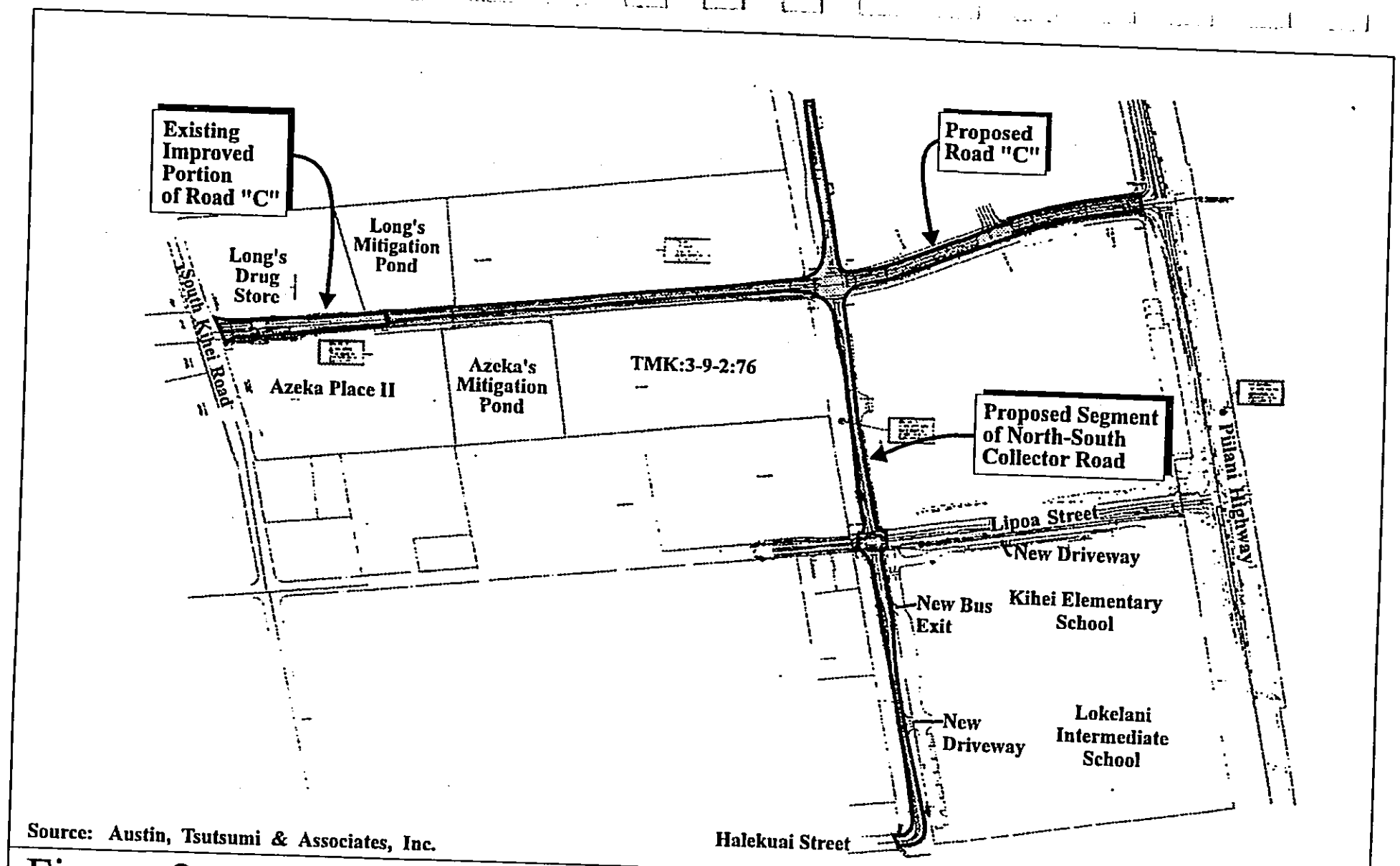
Construction of Road "C" and North-South Collector Road

Regional Location Map

1000 0 2000 4000 Feet

MUNEKIYO & ARAKAWA, INC.

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



Source: Austin, Tsutsumi & Associates, Inc.

Figure 2

Construction of Road "C" and North-South Collector Road

Site Plan

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

MUNEKIYO & ARAKAWA, INC.

NOT TO SCALE

1. ***Existing Fully Improved Segment in Vicinity of South Kihei Road.*** A segment of Road "C", between South Kihei Road and the eastern boundary of the Long's Drugs Store and Azeka Place II, has been fully improved to County standards. This paved and striped segment, approximately 550 lineal feet in length, includes four (4) travel lanes and provides access to both shopping areas.

2. ***Unimproved Roadway in Vicinity of Existing Wetland Mitigation Ponds.*** Immediately mauka or east of the Long's Drugs Store and Azeka Place II are two (2) wetland mitigation ponds which are secured by chainlink fencing. Refer to Figure 2. The proposed Road "C" right-of-way falls between these secured wetland areas. This segment of the proposed Road "C" is presently an unimproved access road which extends in an easterly direction approximately 1,400 lineal feet. It is noted that the wetland areas within the chainlink fencing will not be encroached upon by the proposed roadway improvements.

3. ***Undeveloped Area Extending to Piilani Highway.*** The remainder of the Road "C" alignment traverses land designated as TMK 2-2-2:66. The roadway curves slightly to the north and intersects with Piilani Highway. This segment of Road "C" will extend approximately 1,200 lineal feet through vacant, undeveloped lands.

4. ***Unimproved Roadway Extending North from Road "C" (Segment of North-South Collector Road).*** This approximately 700 lineal foot segment consists primarily of an unimproved dirt road.

5. ***Unimproved Roadway Located between Road "C" and Lipoa Street (Segment of North-South Collector Road).*** Included in the project scope is a portion of the North-South Collector Road, between Road "C" and Lipoa Street. This approximately 900 lineal foot segment consists primarily of an unimproved dirt road which links with Lipoa Street. A construction field office is located approximately 450 lineal feet north of Lipoa Street. Community recycling bins are located near the Lipoa Street intersection.

6. ***Unimproved Roadway Extending 1,150 Feet South of Lipoa Street (Segment of North-South Collector Road).*** This unimproved dirt road extends from Lipoa Street in a southerly direction linking with Halekuai Street which is oriented in an east-west direction connecting to South Kihei Road. Access to this segment is blocked by a chainlink fence along Lipoa Street.

However, the dirt road continues in a southerly direction extending beyond the project area. The eastern terminus of Halekuai Street is blocked by concrete barriers.

C. ***PROJECT NEED***

The existing development pattern and roadway system in Kihei focuses on South Kihei Road as the primary arterial. Motorists traveling along South Kihei Road regularly encounter heavy traffic conditions. In certain areas, traffic volume on South Kihei Road is occasionally heavier than Piilani Highway. From a roadway system perspective, there are insufficient connector roads between Piilani Highway and South Kihei Road to collect and distribute traffic to and from Piilani Highway. The need for additional east-west connectors is evidenced by a two (2) mile separation between Ohukai Street and Lipoa Street. In addition, Lipoa Street, Welakahao Road, and Kanani Road (the other east-west connectors in the project vicinity), are spaced approximately one (1) mile apart from each other. This condition, coupled with the limited traffic capacity of these connector roads and the greater difficulty experienced by turning onto a high speed roadway, has resulted in traffic traveling on South Kihei Road instead of utilizing the higher capacity Piilani Highway.

Numerous driveways and long cul-de-sac roads, located between the existing connector roads, access directly onto South Kihei Road and further increase the traffic volume on this roadway. Consequently, South Kihei Road continues to support local as well as through traffic.

It is further noted that some of the existing connector roads between Piilani Highway and South Kihei Road have not been adequately upgraded since the construction of Piilani Highway. Several connector roads, such as Ohukai Street, Lipoa Street, Keonekai Road, and Kilohana Drive, are adequate for local traffic but lack the carrying capacity to

function as part of the collector-distributor system between Piilani Highway and South Kihei Road.

Additional capacity as it relates to east-west connector roadways would aid in improving traffic circulation patterns in the Kihei region. Road "C" is a proposed new connector road which provides capacity intended to aid in the mitigation of traffic circulation constraints in the Lipoa business district while improving traffic flow along South Kihei Road and Piilani Highway.

The North-South Collector Road is planned to be located between and parallel to Piilani Highway and South Kihei Road. In the long term, the intent of the County of Maui is to implement the road from North Kihei to South Kihei. However, only a small portion of the North-South Collector Road is proposed as part of this project.

The North-South Collector Road would serve several purposes. First, the road provides access to properties without direct connections to east-west connector roads. Since Piilani Highway is a limited access highway, the only access to these properties is South Kihei Road. As noted previously, this results in numerous driveways and cul-de-sac connections which increase demand on South Kihei Road.

The North-South Collector Road would also divert some of the local traffic currently utilizing South Kihei Road. Motorists making short trips, such as between residences and the Kihei Elementary and Lokelani Intermediate Schools, may use the North-South Collector Road as an alternate route and reduce traffic demand on South Kihei Road.

Lastly, the North-South Collector Road would provide a bicycle route, school bus route and pedestrian facilities, between the Kihei Elementary and Lokelani Intermediate Schools, and the surrounding residential areas. (Austin, Tsutsumi & Associates, Inc., Kihei Traffic Master Plan, 1989).

The portion of the North-South Collector Road included within the subject project is desirable in terms of providing additional traffic access to the schools. The lone school access is from Lipoa Street, a two-way, two-lane, east-west connector roadway. Because of the normal weekday surge in school traffic, there is congestion at the Piilani Highway and South Kihei Road intersections of Lipoa Street. The segment of the North-South Collector Road joins with Road "C" and provides an additional linkage with Piilani Highway and South Kihei Road. Also, the North-South Collector Road links with Halekuai Street which provides a secondary linkage with South Kihei Road.

A forecast of traffic conditions to the Year 2005 was based on the Draft Kihei Traffic Master Plan (KTMP) prepared by Kaku Associates, Inc. The County of Maui Long Range Land Transportation Plan done by Kaku Associates, Inc. in March 1996, serves as the primary reference for the KTMP. The KTMP traffic forecast includes projected changes in land use within Kihei up to the year 2005 as well as expected general growth in traffic outside Kihei. The adjacent Piilani Project District Development was included as part of the Kihei traffic generation figures.

Planned roadway improvements within the vicinity of the project which are taken into consideration by the analysis include the following:

1. A two-lane North-South Collector Road between Waipuilani Road and Halekuai Street;

2. Waipuilani Road Extension to Piilani Highway;

3. Widening of South Kihei Road to five (5) lanes between Lipoa Street and the Longs Drug Store/McDonald's driveway; and

4. Other roadway improvements such as bicycle facilities and pedestrian facilities mainly along South Kihei Road and selected connecting roadways between Piilani Highway and South Kihei Road.

With Road "C" and the North-South Collector Road in the Year 2005, existing and proposed intersections in the general vicinity of the project are anticipated to operate at acceptable levels of service (LOS). LOS is a qualitative measure used to describe the conditions of traffic flow, ranging from free-flow conditions at LOS "A" to congested conditions at LOS "F". The 1994 Highway Capacity Manual - Special Report 209 methods for calculating volume to capacity ratios, delays and corresponding levels of service were utilized. The traffic analysis includes the following existing and new intersections:

1. Piilani Highway and Lipoa Street (existing);
2. South Kihei Road and Lipoa Street (existing);
3. South Kihei Road and Waipuilani Road (existing);
4. South Kihei Road and Road "C" (existing);
5. Waipuilani Road and North-South Collector Road (existing);
6. Piilani Highway and Waipuilani Road (new);
7. Road "C" and North-South Collector Road (new);
8. Road "C" and Piilani North Driveways (new);
9. Piilani Highway and Road "C" (new); and
10. Lipoa Street and North-South Collector Road (new).

With the planned roadway improvements, most intersection movements are anticipated to operate at LOS "A" or "B" in the AM and PM peak hour. The only exceptions are (1) the South Kihei Road-Waipuilani Road intersection which has a LOS of "D" in the PM peak hour; (2) the east bound right turn movement on Piilani Highway and Waipuilani Road has a LOS of "C" in the AM and PM peak hour; and (3) the northbound

approach to the intersection of Lipoa Street and the North-South Collector Road which has a LOS of "C".

It is noted that the proposed roadway improvements are being done in response to planned and projected growth in the area and region. The population of the Kihei-Makena region is projected to increase over time. The current resident population of the region is estimated at 15,365. Resident population projections for the Years 2000 and 2010 are 20,092 and 24,846, respectively (Community Resources, Inc., January 1994).

The Kihei-Makena Community Plan is the County of Maui's guide for sequencing, patterns, and characteristics pertaining to future land use in the region. The 1985 version of the Community Plan recognizes that a major commercial center is clustered around the South Kihei Road/Lipoa Street intersection. In the comprehensive Ten Year Update of the Community Plan currently undergoing review, the Plan recognizes a central business and commercial center clustered about the South Kihei Road/Road "C" intersection.

Existing and planned single family and multi-family residential areas are located in North, Central and South Kihei, primarily between Piilani Highway and South Kihei Road. Based on the projected residential growth of the district, and commercial concentration in the South Kihei Road/Lipoa Street and South Kihei Road/Road "C" vicinity, there is a need for regional transportation improvements to service these land uses.

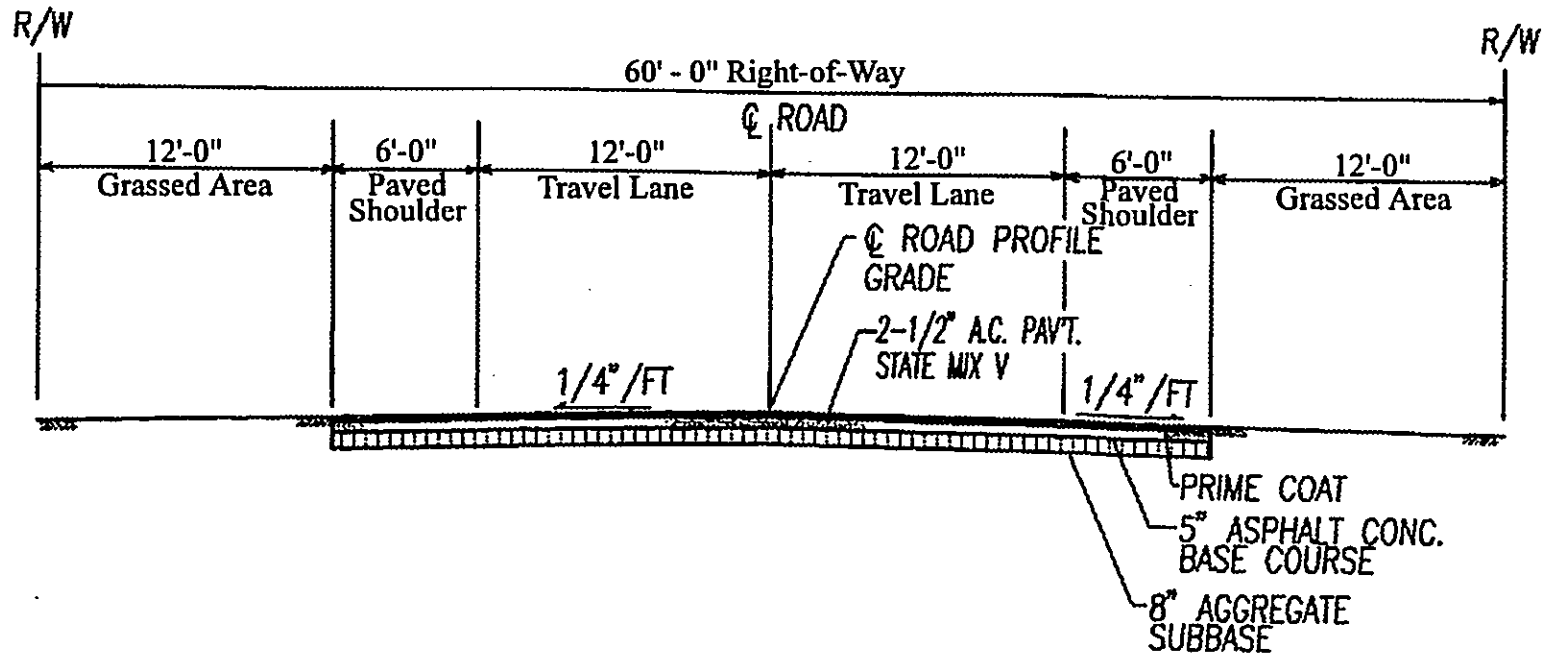
Nearby the proposed Road "C" and North-South Collector Road segment is the Piilani Project District. This planned development covers approximately 188 acres of single family residential, multi-family residential, commercial and park uses. Construction of these uses in the

project district, originally approved by the County in 1988, would also complement Road "C" and the North-South Collector Road.

D. ***PROPOSED ACTION***

To the east of the existing developed section, Road "C" will be comprised of two (2) 12-foot travel lanes within a 60-foot right-of-way. See Figure 3 and Figure 4. Future sidewalks are to be provided at the time that adjoining lands are developed.

As Road "C" approaches the North-South Collector Road, the right-of-way widens to approximately 75 feet. Traveling in the easterly direction, there is a right turn lane, a through lane, and a left turn lane. Road "C" contains one (1) through lane and one (1) merge lane proceeding in a westerly direction from the North-South Collector Road intersection. See Figure 5.



Source: Austin, Tsutsumi & Associates, Inc.

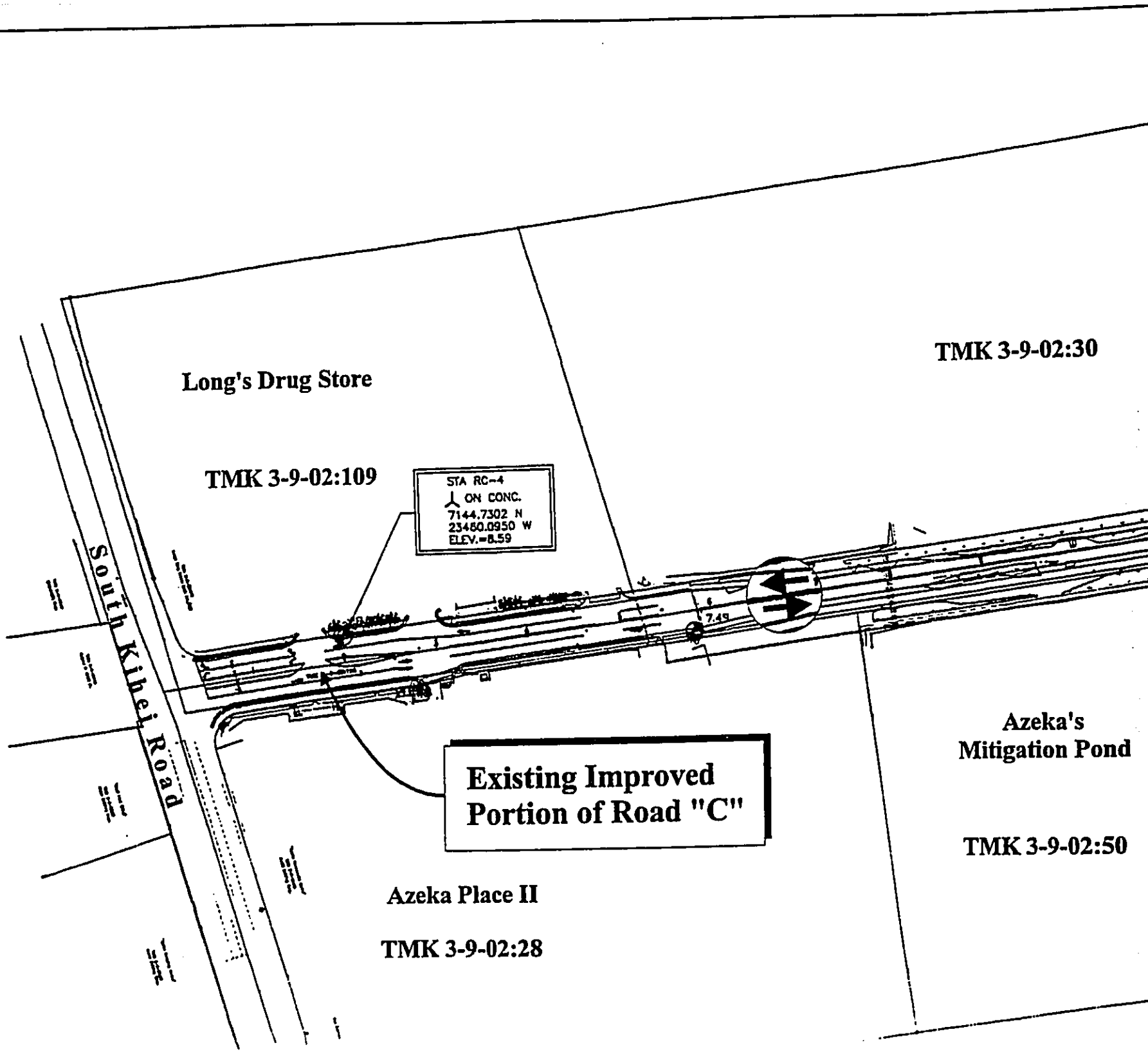
Figure 3

Construction of Road "C" and
North-South Collector Road
Road "C" Typical Section
Within 60-Foot Right-of-Way

0 4 8 16 Feet

MUNEKIYO & ARAKAWA, INC

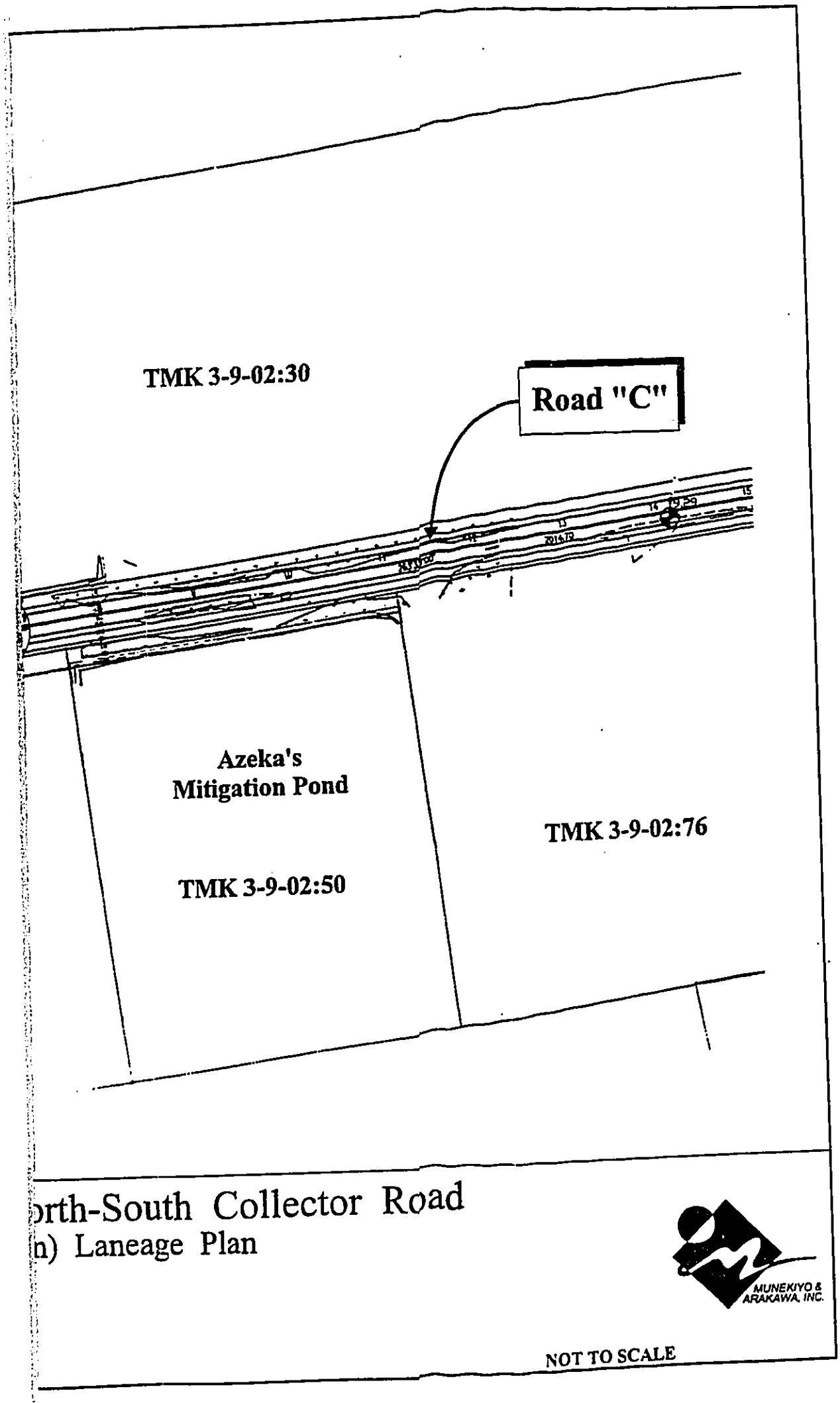
Prepared for: County of Maui, Dept. of Public Works and Waste Management



Source: Austin, Tsutsumi & Associates, Inc.

Figure 4 Construction of Road "C" and North-South Collector
Road "C" (Western Portion) Laneage Plan

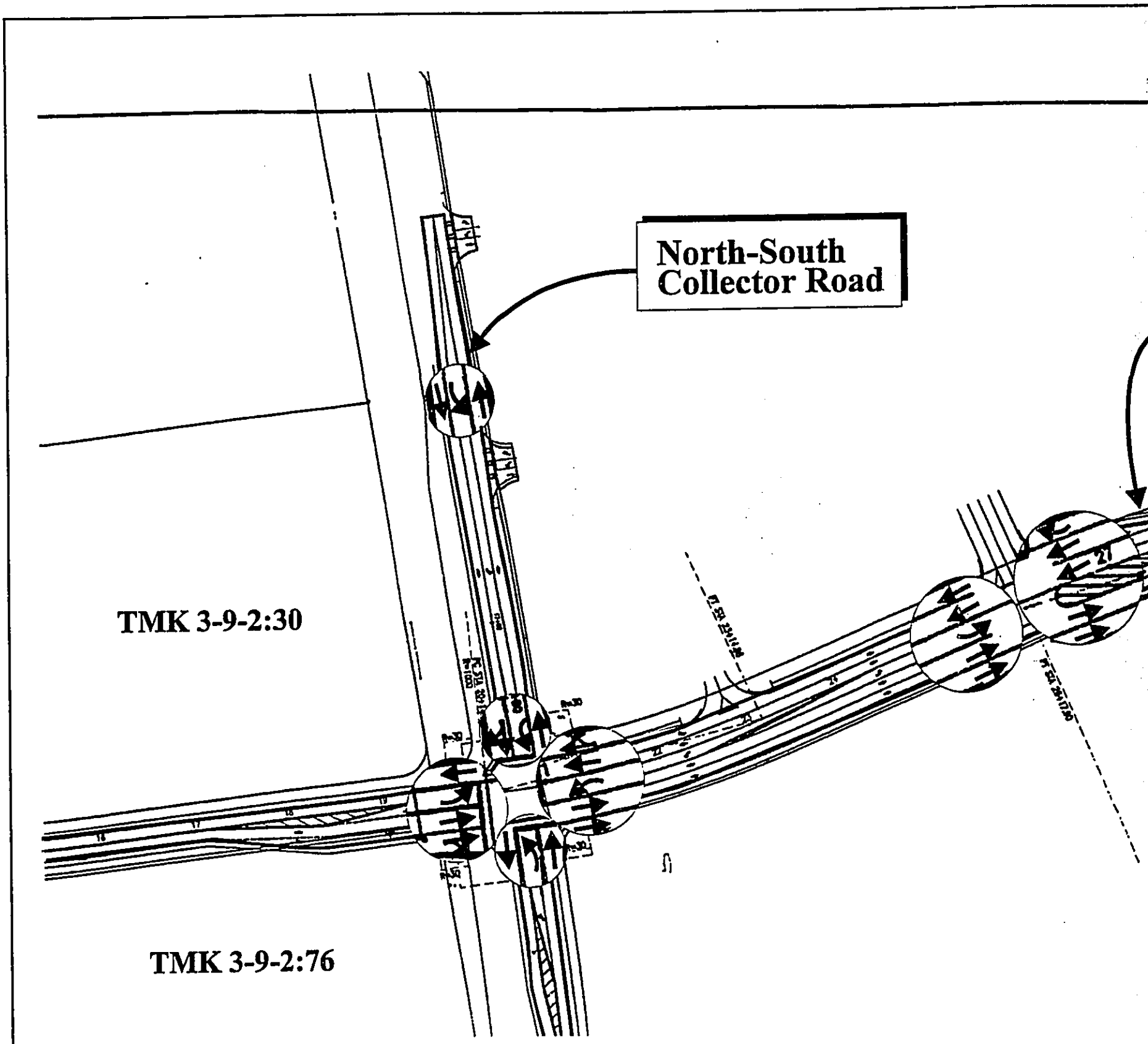
Prepared for: County of Maui, Dept. of Public Works and Waste Management



orth-South Collector Road
n) Laneage Plan

MUNEKIYO & ARAKAWA, INC.

NOT TO SCALE



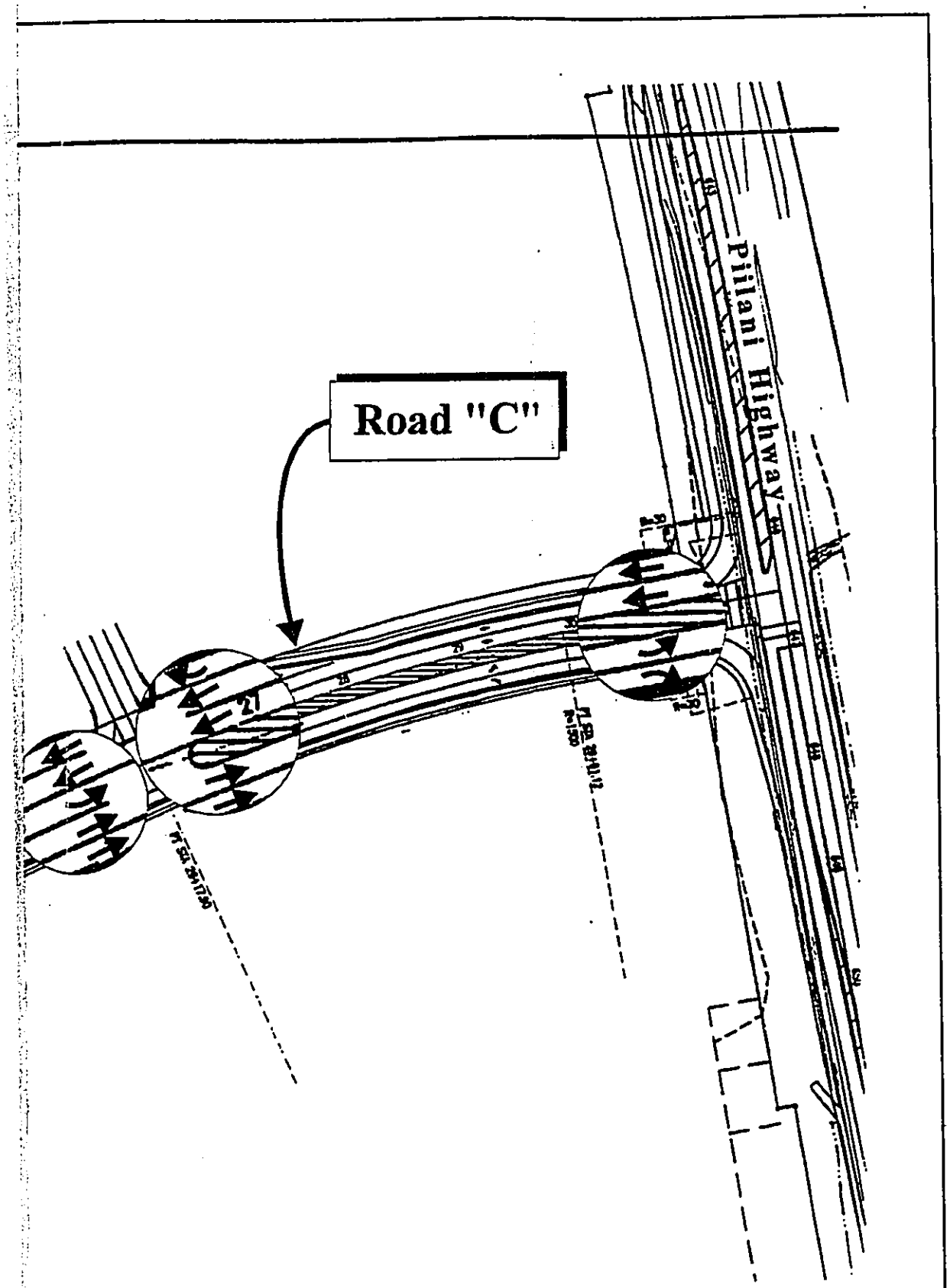
Source: Austin, Tsutsumi & Associates, Inc.

Figure 5

Construction of Road "C" and North-South C

Road "C" (Eastern Portion) and North-South Coll
(Northern Portion) Laneage Plan

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



North-South Collector Road

North-South Collector Road
Laneage Plan

MUNEKIYO & ARAKAWA, INC.

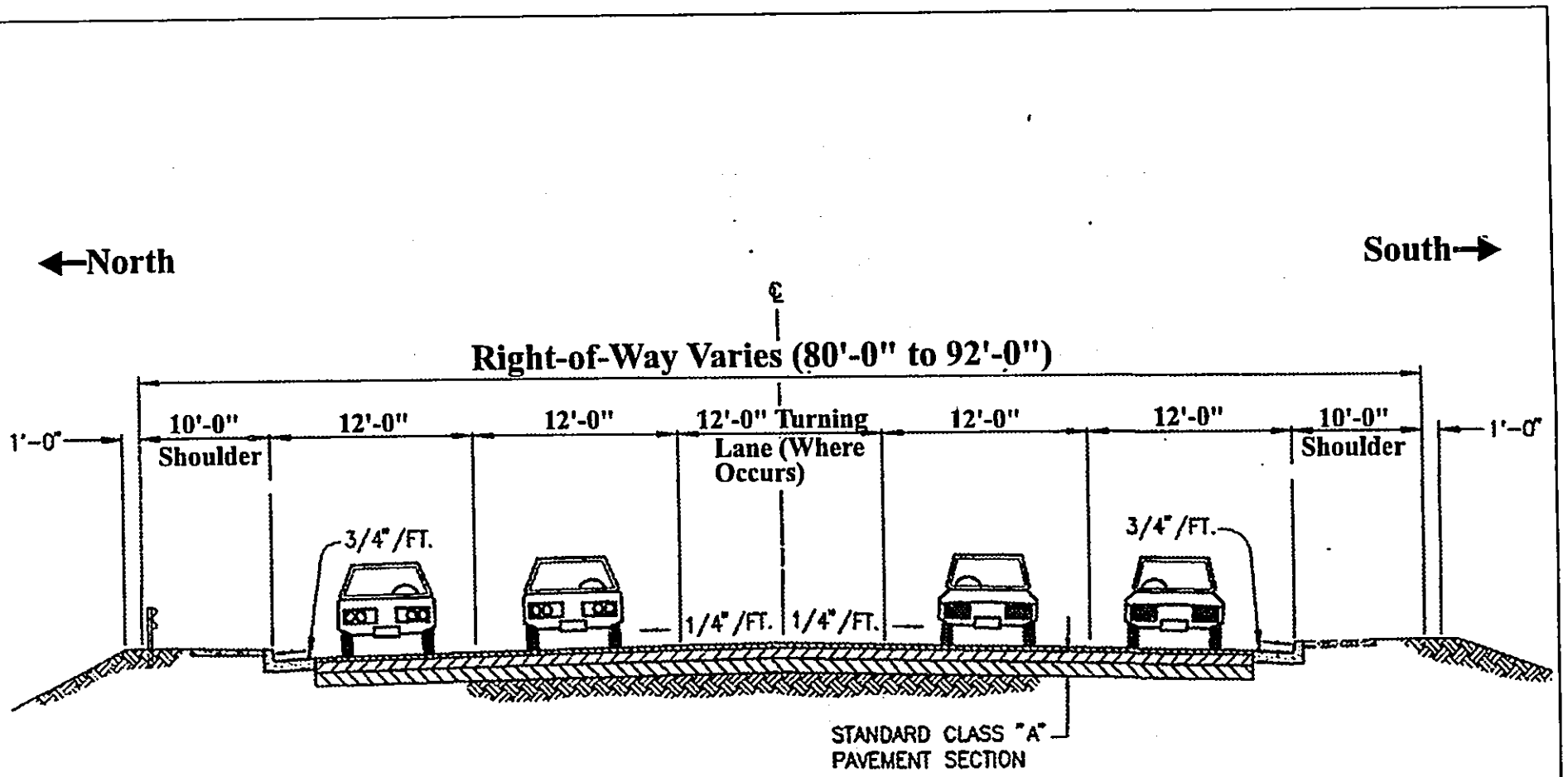
NOT TO SCALE

Between the North-South Collector Road and Piilani Highway, the right-of-way width for Road "C" ranges from 80 feet to 92 feet. See Figure 6. It is noted that a 6-foot wide sidewalk on the north side of the right-of-way will be constructed by the abutting Piilani Commercial Center. On the south edge of the right-of-way, sidewalks are to be constructed at the time the abutting property is developed.

Travelling in an easterly direction from the North-South Collector Road, there are two (2) through lanes. Near the intersection with Piilani Highway, Road "C" contains a left turn lane and a right turn lane. Refer to Figure 5.

On the Piilani southbound approach to Road "C", there is a separate right turn lane. Proceeding in a westerly direction from Piilani Highway, Road "C" contains two (2) travel lanes. Near the driveway into the Piilani Commercial development, a right turn lane is proposed. Near the intersection with the North-South Collector Road, there is a left turn lane, a through lane and a through/right turn lane.

The North-South Collector Road segment located to the north of its intersection with Road "C", is proposed within a 64 to 74 foot right-of-way. From Road "C", a single lane extends in a northerly direction. From the northern terminus, a through lane and a left turn lane extend in a southerly direction. Near the intersection with Road "C", there are a left turn lane and a through/right turn lane. Full shoulder improvements (i.e., curb, gutter, sidewalk) are proposed along the easterly half in conjunction with the Piilani Commercial Center, while a 6-foot wide paved shoulder is proposed on the westerly half. Sidewalks are to be constructed upon development of the property abutting the westerly half of the right-of-way. See Figure 7.



Source: Warren S. Unemori Engineering, Inc.

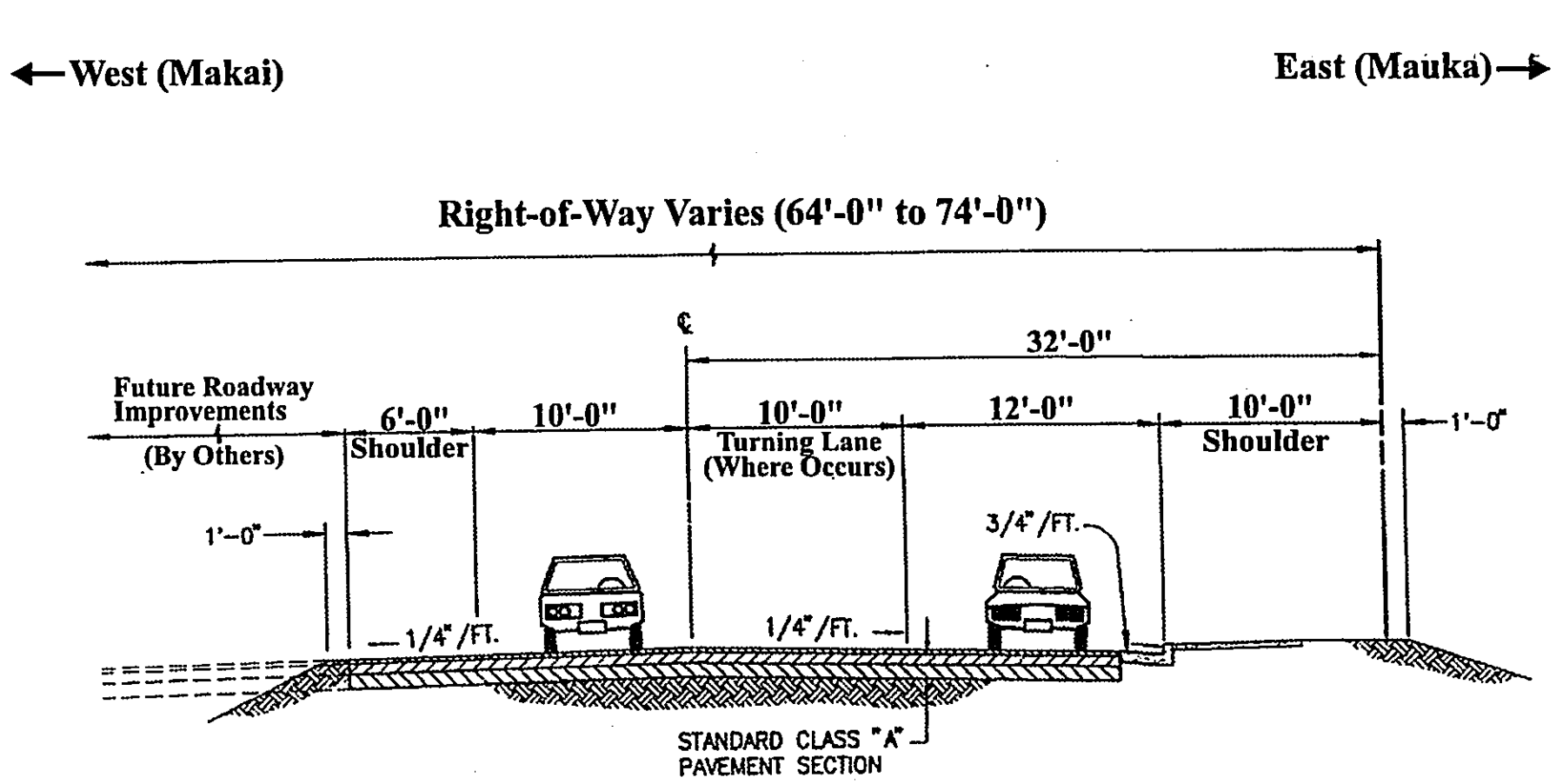
Figure 6

Construction of Road "C" and North-South Collector Road

Road "C" Typical Section Within 80 to 92 Foot Right-of-Way

MUNEKIYO & ARAKAWA, INC

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



Source: Warren S. Unemori Engineering, Inc.

Figure 7

Construction of Road "C" and North-South Collector Road

North-South Collector Road Typical Section Within 64 to 74 Foot Right-of-Way

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

NOT TO SCALE

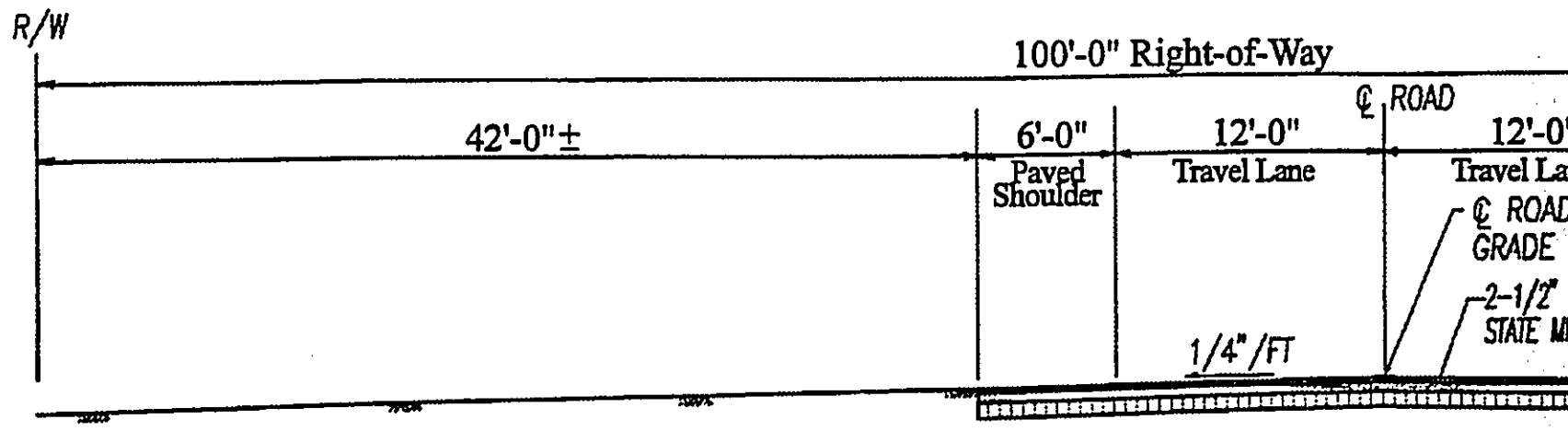
MUNEKIYO & ARAKAWA, INC

To the south of Road "C", the North-South Collector Road segment is proposed within a 100 foot right-of-way which allows for future widening as warranted. See Figure 8. Future sidewalks are anticipated to be built upon construction of abutting properties.

From Road "C", a single through lane proceeds in a southbound direction. Refer to Figure 5. Near the intersection with Lipoa Street, there is a left turn lane and a through lane. See Figure 9. From Lipoa Street, there is a single travel lane proceeding in a northbound direction. Near its intersection with Road "C", there are separate left turn and through lanes. Refer to Figure 5.

Proceeding south of Lipoa Street, there is a single travel lane on the North-South Collector Road which allows turning movements into Kihei Elementary School and Lokelani Intermediate School before linking with Halekuai Street. Refer to Figure 9. The existing driveway for Kihei Elementary School near the Lipoa Street-North-South Collector Road intersection is proposed to be closed for safety reasons. A driveway located approximately midway between Lipoa Street and Halekuai Street will service both schools. See Figure 10. A bus exit along the North-South Collector Road and a service driveway along Lipoa Street are also proposed. From Halekuai Street, there is a single travel lane proceeding north. Near its intersection with Lipoa Street, there is a separate left turn lane and a through/right turn lane. A laneage plan for the entire Road "C" and North-South Collector Road segment is shown in Appendix A.

A stop control is proposed at the intersection of Lipoa Street and the North-South Collector Road. A stop control is also proposed at the Road "C"/North-South Collector Road intersection. A new traffic signal is

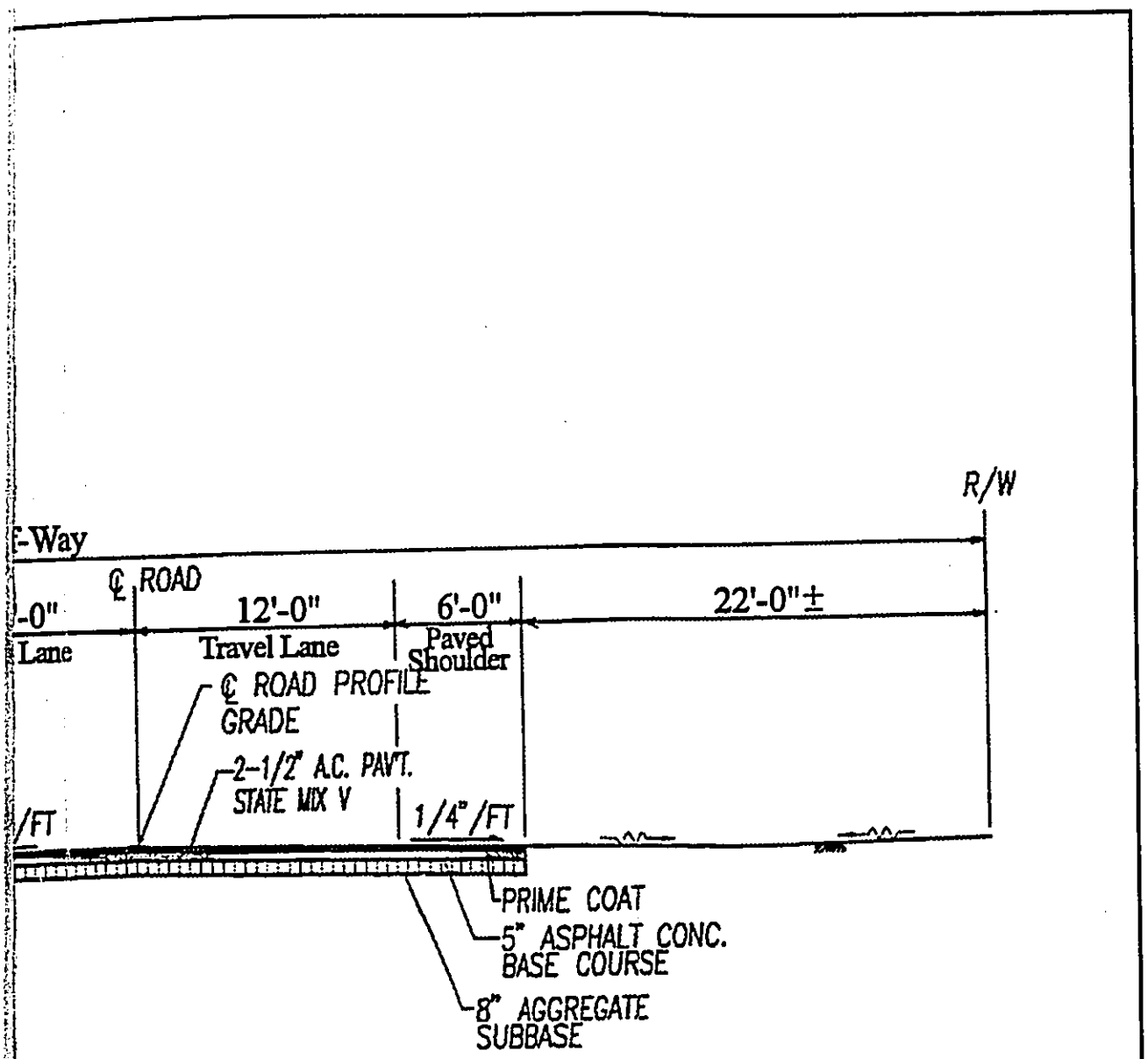


Source: Austin, Tsutsumi & Associates, Inc.

Figure 8 Construction of Road "C" and North-South Coll

North-South Collector Road Typical Section

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

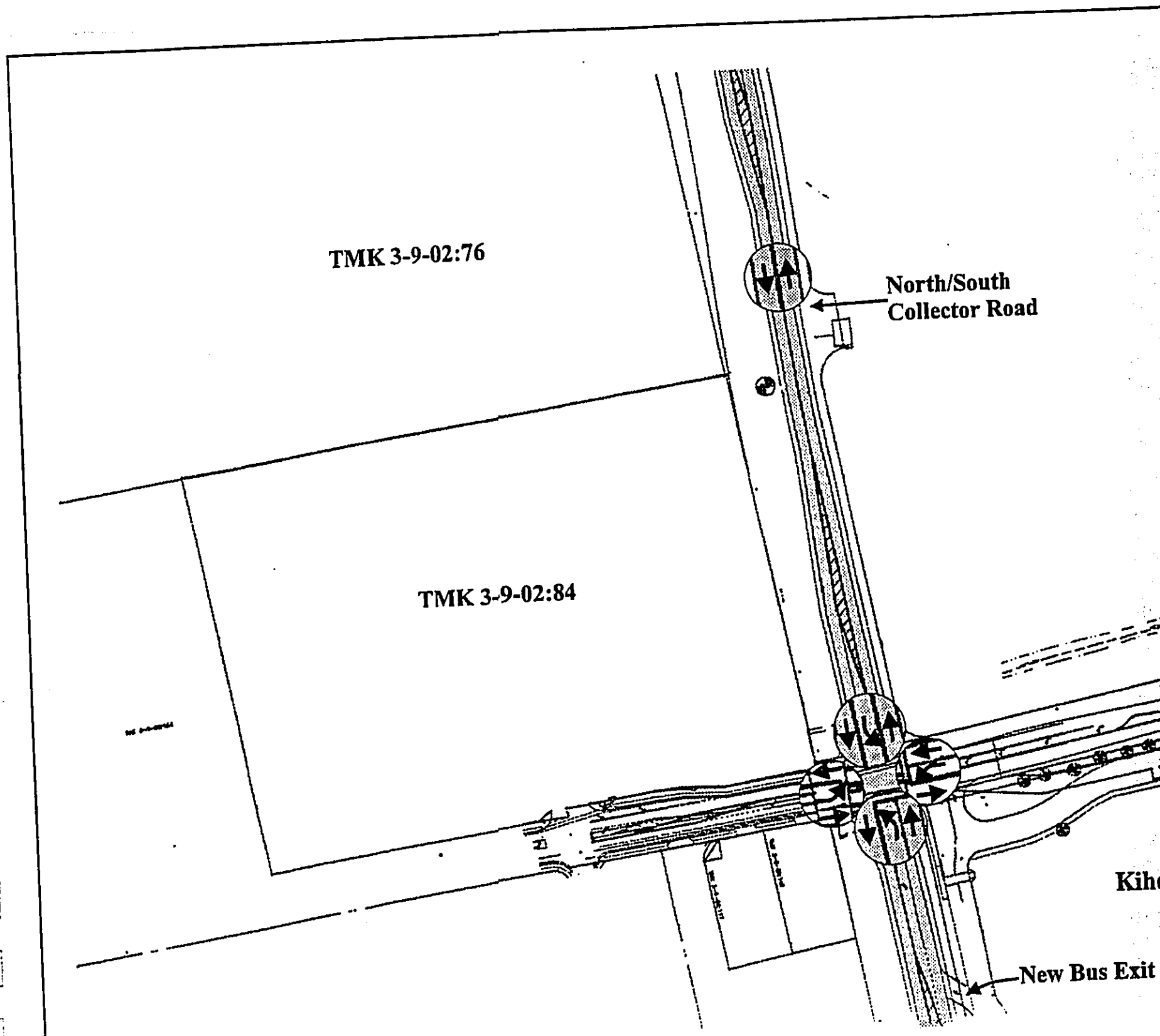


rth-South Collector Road

Typical Section

MUNEKIYO & ARAKAWA, INC.

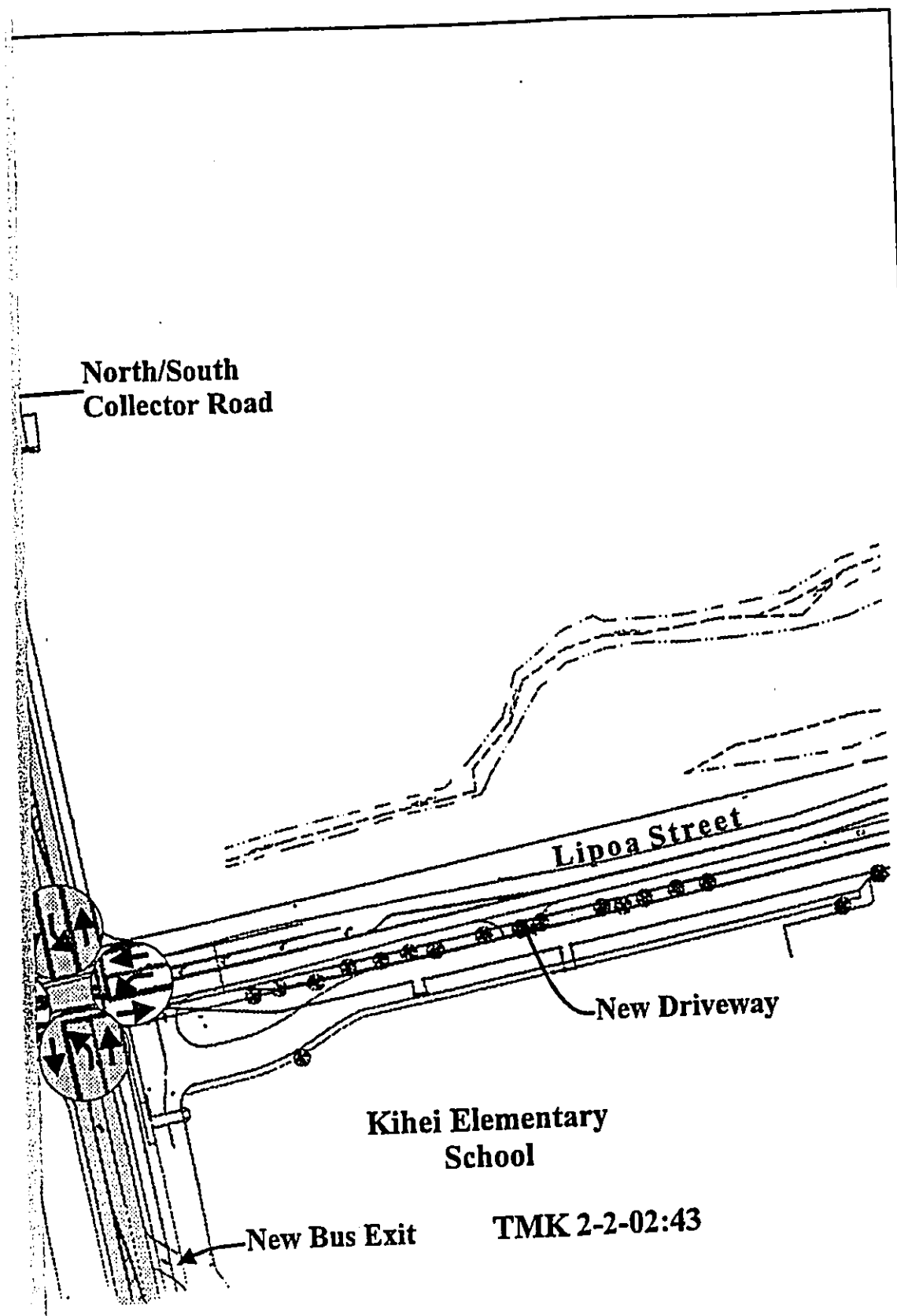
0 4 8 16 Feet



Source: Austin, Tsutsumi & Associates, Inc.

Figure 9 Construction of Road "C" and North-South Collector
North-South Collector Road (Central Portion) Laneage Plan

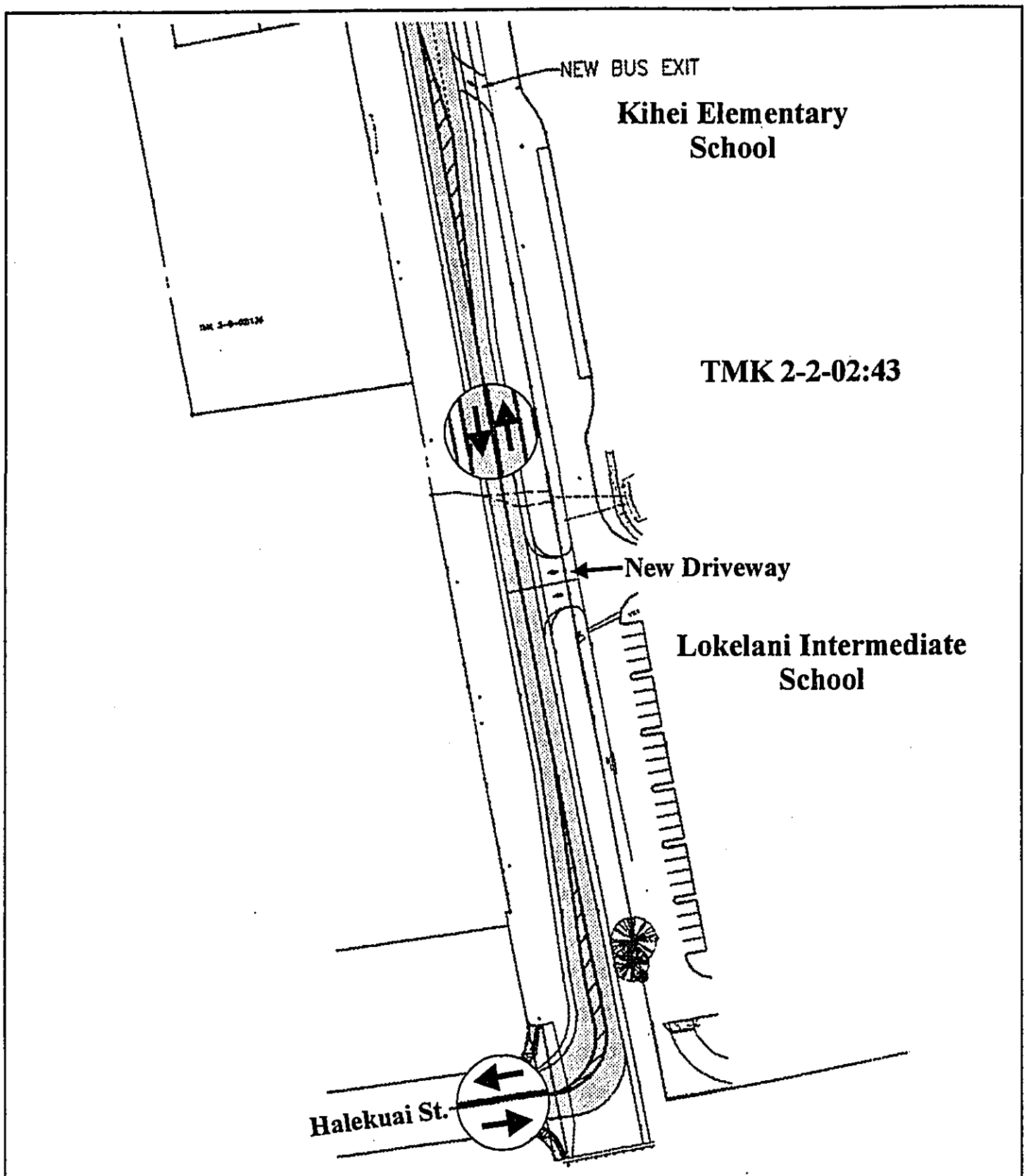
Prepared for: County of Maui, Dept. of Public Works and Waste Management



th-South Collector Road
Portion) Laneage Plan

MUNEKIYO & ARAKAWA, INC

NOT TO SCALE



Source: Austin, Tsutsumi & Associates, Inc.

Figure 10 Construction of Road "C" and North-South Collector Road
North-South Collector Road (Southern Portion) Laneage Plan

MUNEKIYO & ARAKAWA, INC.

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

NOT TO SCALE

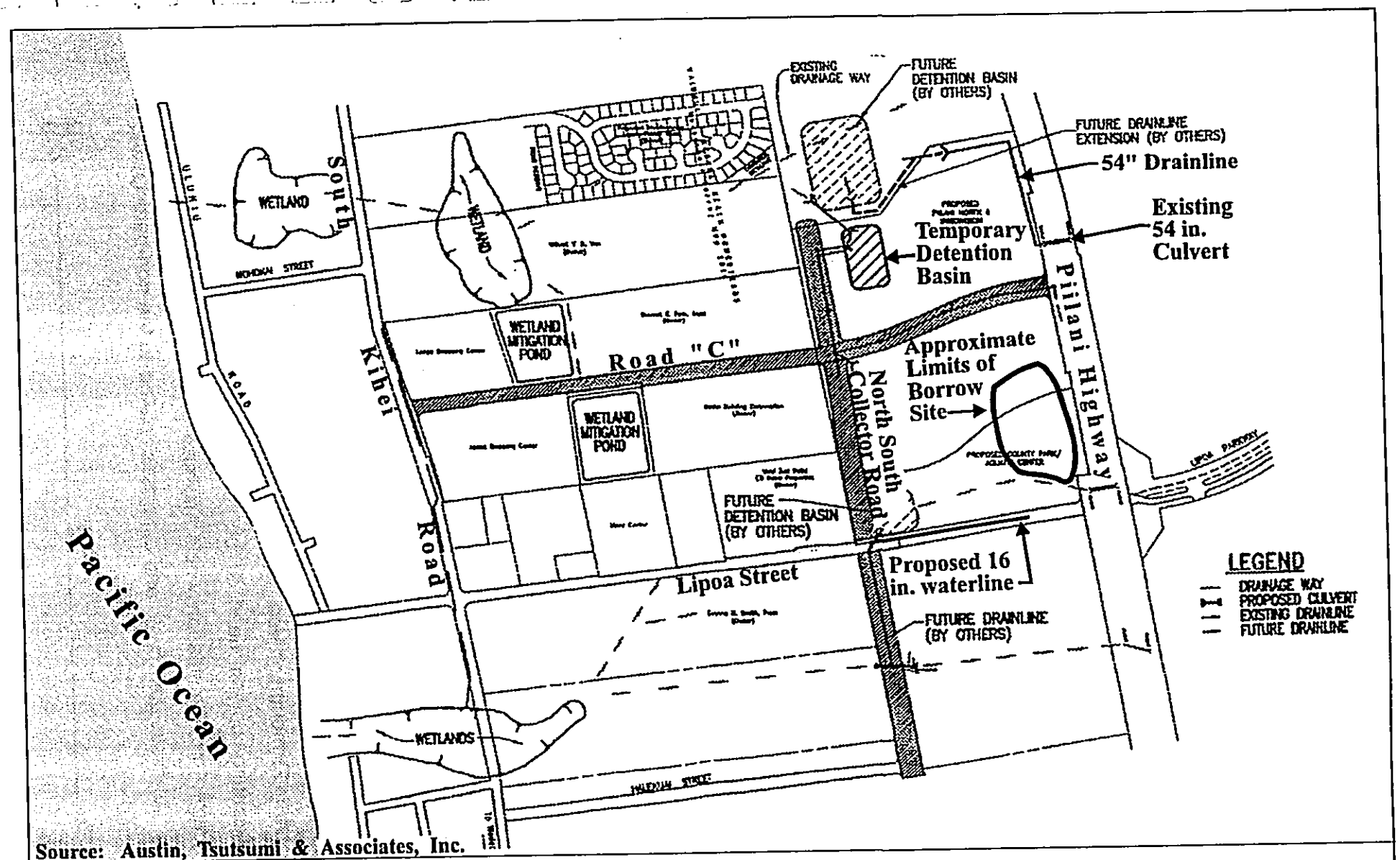
proposed to be installed at the South Kihei Road/Road "C" intersection. The existing traffic signal on South Kihei Road at the McDonald's and Long's Drugs Store driveways is proposed to be removed. Finally, a new traffic signal is also proposed at the Piilani Highway/Road "C" intersection.

Drainage improvements include a new drainage system constructed within the Road "C" and North-South Collector Road rights-of-way and conveyed to a temporary detention basin located near the northerly end of the North-South Collector Road. See Figure 11.

Runoff from an existing 54-inch drainage culvert across Piilani Highway will be conveyed further downstream by a new 54-inch drainline. Runoff will then be conveyed to the existing drainageway northwest of the terminus of the North-South Collector Road.

Other proposed aspects of the project include a 16-inch waterline and a borrow site for roadway fill material. The proposed 16-inch waterline is located within the Lipoa Street right-of-way. Approximately 850 lineal feet of waterline is anticipated to connect with an existing 12-inch line near the Piilani Highway intersection and link with an existing 18-inch line near the North-South Collector Road intersection.

Roadway fill material may originate from a borrow site located northwest of the Piilani Highway and Lipoa Street intersection. The approximately 3.7 acre Piilani/Lipoa borrow site is located on lands designated for future use as a County park/aquatic center and a multi-family residential development. The excavation at this location serves to prepare these lands for possible future development.



Source: Austin, Tsutsumi & Associates, Inc.

Figure 11

Construction of Road "C" and North-South Collector Road

Proposed Drainline, Waterline and Borrow Site

MUNEKIYO & ARAKAWA, INC.

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

NOT TO SCALE

Total project construction cost is estimated at $4.95 million. Project improvements are proposed to be funded in part through the Year 1997 by Federal Intermodal Surface Transportation Efficiency Act (ISTEA) monies. The project includes a Federal participating portion and a Federal non-participating portion. The participating portion includes two (2) lane sections and required turning lanes along Road "C" as well as a segment of the North-South Collector Road, from Road "C" extending south to Halekuai Street. Estimated cost of the participating portion is $2.75 million.

The Federal non-participating portion includes an additional two (2) lanes on Road "C", from the North-South Collector Road to Piilani Highway, as well as a two (2) lane segment (plus a turning lane) of the North-South Collector Road, from Road "C" extending north approximately 700 feet. Drainage improvements within the Road "C" and North-South Collector Road rights-of-way, the temporary retention basin, 54-inch drainline extending from Piilani Highway, and the 16-inch water line within the Lipoa Street right-of-way are also included within the non-participating portion. Piilani Village Partners is proposing to build the adjacent Piilani Village Commercial Center on 15 acres of property abutting the 700 lineal foot segment of the North-South Collector Road, Road "C" and Piilani Highway. They are proposing inclusion of the non-participating portion in order to proceed with construction on the road and off-site improvements concurrently with the participating portion rather than sequentially. As a matter of policy, the County of Maui would not allow construction within a newly constructed or paved portion of a roadway for a minimum of twelve (12) months. Also, underground utilities not included within the participating portion need to be installed within the roadway. The concurrent implementation would minimize construction disruption in the area. All associated costs and expenses related to the non-participating

portion of the project will be borne by Pillani Village Partners. Estimated cost of the non-participating portion is $2.2 million.

Assuming all applicable permits are obtained, work on the proposed project is scheduled to begin by December 1997 or January 1998. Completion of construction is estimated by late 1998 or early 1999.

Discussions with landowners affected by the project are ongoing and have been generally supportive of the project. Although the County of Maui does not currently own the lands needed for the rights-of-way, it is anticipated that these lands will be dedicated or purchased in a timely manner by the County of Maui from the respective landowners. Any funds expended for purchase of land will not be through Federal monies. Should relocation be required, the County of Maui shall abide by the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended.

Chapter II

Alternatives Analysis

II. ALTERNATIVES ANALYSIS

Alternatives were considered to address the needs of an east-west connector roadway in Central Kihei.

A. ALTERNATIVE A

Alternative A represents the no build alternative. As the only east-west connector road in the Central Kihei area, Lipoa Street is considered to be one of the more heavily travelled collector roads in Kihei. It is anticipated that traffic will continue to increase on this roadway as new residential and commercial projects in the Central Kihei area are developed and general growth in the region occurs.

In order to address future traffic projections to the Year 2005, Lipoa Street needs to be widened and would require land from existing businesses and/or owners of small single-family residential lots. The widening would present difficulty and impacts upon the affected owners.

Moreover, should Lipoa Street be further widened, traffic noise impacts will become more severe. Not only will traffic volumes increase, additional widening will result in traffic being closer to homes and businesses.

Consequently, the no-build alternative does not represent the most beneficial alternative in addressing a Central Kihei east-west connector roadway.

B. ALTERNATIVE B

Alternative B represents the proposed action. Road "C" provides a new east-west connector roadway which lessens traffic congestion at the Lipoa Street-Piilani Highway intersection and the Lipoa Street-South Kihei Road

intersection. Since Lipoa Street is the only east-west connector roadway in this vicinity, Road "C" would provide additional capacity and improved levels of service.

The implementation of the North-South Collector Road from Road "C" to Halekuai Street also aids in distributing school traffic on alternate roadways. Kihei Elementary and Lokelani Intermediate Schools currently access directly onto Lipoa Street. The North-South Collector Road segment joins with Road "C" and provides additional linkage with Piilani Highway and South Kihei Road. The project also provides a secondary link with South Kihei Road via Halekuai Street.

The segment of the North-South Collector Road located north of Road "C" aids in addressing traffic circulation concerns for abutting development as well as implements an incremental addition to the roadway.

For the most part, Alternative B traverses vacant land and affects larger parcels. The relative effect of loss of land for roadway use is minimized with this alignment. Since abutting lands are vacant, future uses can, in fact, be planned around the proposed roadway.

The projected construction cost for this alternative is $2.75 million.

C. ***ALTERNATIVE C***

A variation to the proposed alignment was considered during the preliminary engineering phase of work for the project. This variation involved a curvilinear alignment in which Road "C" merges with Lipoa Street at its Piilani Highway terminus. This alternative alignment, however, was deemed technically and operationally inferior to the "straight" alignment. A primary drawback is the reverse curve of the

roadway which presents undesirable geometric conditions for a major collector road. Although a reverse curve may be implemented should there be physical obstacles (e.g., existing buildings) or environmental constraints (e.g., historic and archaeological sites, wetlands), these factors do not exist in the case of the alternative curvilinear alignment.

The curvilinear alignment also has greater limitations relating to traffic capacity and flexibility for future expansion. For example, the curvilinear alignment presents greater capacity constraints onto Piilani Highway in this area. Based on projected traffic flow in the year 2000, two (2) left turn lanes for east bound traffic on Road "C" to Piilani Highway would be required. This necessitates major improvements to Piilani Highway. Double left turns are not warranted under the straight alignment.

As regional traffic gradually increases over time, the curvilinear alignment also presents additional constraints regarding future widening. Additional lanes such as a 6-lane or 8-lane facility would require more right-of-way from Kihei Elementary School and/or the currently proposed County park/aquatic center, which would impact these uses. This would necessitate further improvements to Piilani Highway as well.

Although, the construction cost of this alternative is $2.0 million which is less than Alternative B, it has additional technical and operational drawbacks.

Chapter III

Description of the Existing Environment

III. DESCRIPTION OF THE EXISTING ENVIRONMENT

A. PHYSICAL ENVIRONMENT

1. Surrounding Environment

The project site is located in Kihei, Maui, within the central portion of the Kihei District. The proposed Road "C" extends in an east-west direction between South Kihei Road and Piilani Highway. At its eastern terminus, Road "C" links with Piilani Highway. At its western terminus, Road "C" links with South Kihei Road. The project also includes a segment of the North-South Collector Road which extends from approximately 700 feet north of Road "C" to Halekuai Street.

Road "C" is bordered by vacant and undeveloped lands to the north. Closer to South Kihei Road, Road "C" is bounded by the Long's Drugs Store and the Long's wetland mitigation pond secured by chainlink fencing.

To the south of Road "C" lies vacant and undeveloped lands, a second wetland mitigation pond secured by a chainlink fence, and Azeka Place II.

To the west of Road "C" across South Kihei Road lies vacant lands, single-family residences, Azeka Place and McDonald's. To the east of the project across Piilani Highway lies the Silversword Golf Course.

To the east of the North-South Collector Road are vacant and undeveloped lands as well as the Kihei Elementary and Lokelani Intermediate Schools. To the immediate west of the road are

vacant and undeveloped lands. Further west are the Haggai Institute, Kauhale Nani residential subdivision and the Kihei Franks business subdivision.

2. *Climate*

The Kihei coast is generally sunny, warm and dry during the entire year. In Kihei Town, the annual high temperature averages in the high 80's, with the low temperature averaging in the high 60's (Atlas of Hawaii, 1983). June through August are historically the warmer months of the year, while the cooler months are January through March.

Average rainfall distribution in the Kihei-Makena region varies from under 10-inches per year to 30-inches per year in the higher elevations. Rainfall in the Kihei-Makena region is highly seasonal, with most of the precipitation occurring in the winter months.

Northeast tradewinds prevail approximately 80 to 85 percent of the time. Winds average 10 to 15 miles per hour during afternoons with slightly lighter winds during mornings and nights. Between October and April, the southerly winds of Kona storms may be felt.

In the absence of tradewinds and of nearby storms, winds may become light and variable. The diurnal heating and cooling of the land mass gives rise to onshore sea breezes during the day and offshore land breezes at night.

3. *Topography and Soils*

The subject site is located makai of Piilani Highway. The improved section of Road "C" between South Kihei Road and the eastern

boundary of the Long's Drugs Store and Azeka Place II is virtually flat. Generally, the eastern half of the project site has an average slope of 2 percent while the western half is relatively flat. On-site elevations range from five (5) feet to 72 feet above sea level.

Underlying the project site is the Pulehu-Ewa-Jaucas soil association which is characterized by deep, nearly level to moderately sloping, well drained and excessively drained soils. The underlying material is moderately fine-textured to coarse-textured subsoil. This soil occurs on alluvial fans and in basins. See Figure 12.

The soil types at the project site are Pulehu clay loam, 0 to 3 percent slopes (PsA), Waiakoa extremely stony silty clay loam (WID2) and Jaucas sand saline, 0 to 12 percent slopes (JcC). See Figure 13.

PsA series soil can be described as having a dark-brown clay loam surface layer about 21-inches thick. Permeability is moderate, runoff is slow, and the erosion hazard is no more than slight. Low areas, however, are subject to flooding.

WID2 soils are eroded and stones cover 3 to 15 percent of the surface. In most areas, about 50 percent of the surface layer has been removed by erosion. Runoff is medium while the erosion hazard is considered severe.

JcC soils occur near the ocean in areas where the watertable is near the surface and salts have accumulated. It is somewhat poorly drained in depressions but excessively drained on knolls.

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

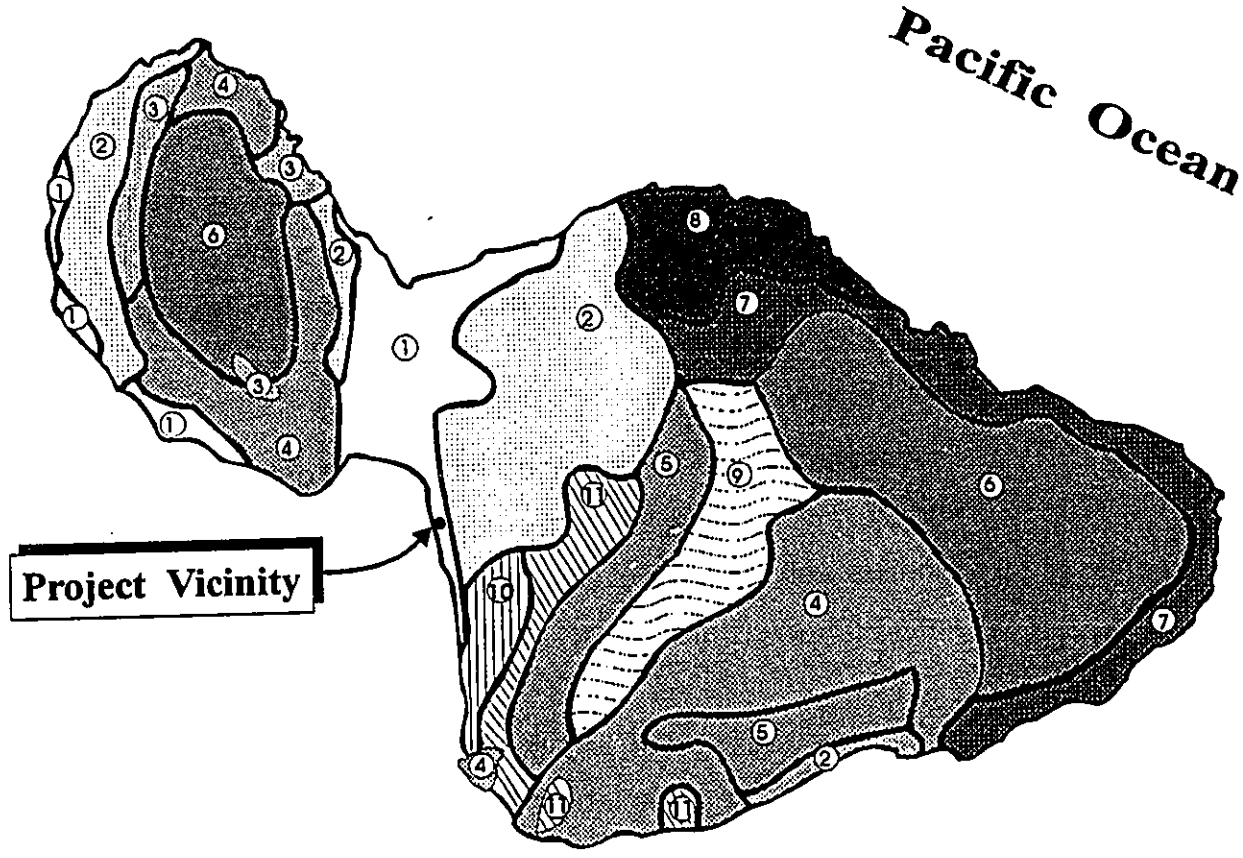
⑦ Hana-Makaalae-Kailua association

⑧ Pauwela-Haiku association

⑨ Laumaia-Kaipoipoi-Olinda association

⑩ Keawakapu-Makena association

⑪ Kamaole-Oanapuka association



Base Map Source: USDA Soil Conservation Service

Figure 12 Construction of Road "C" and North-South Collector Road

Soil Association Map

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

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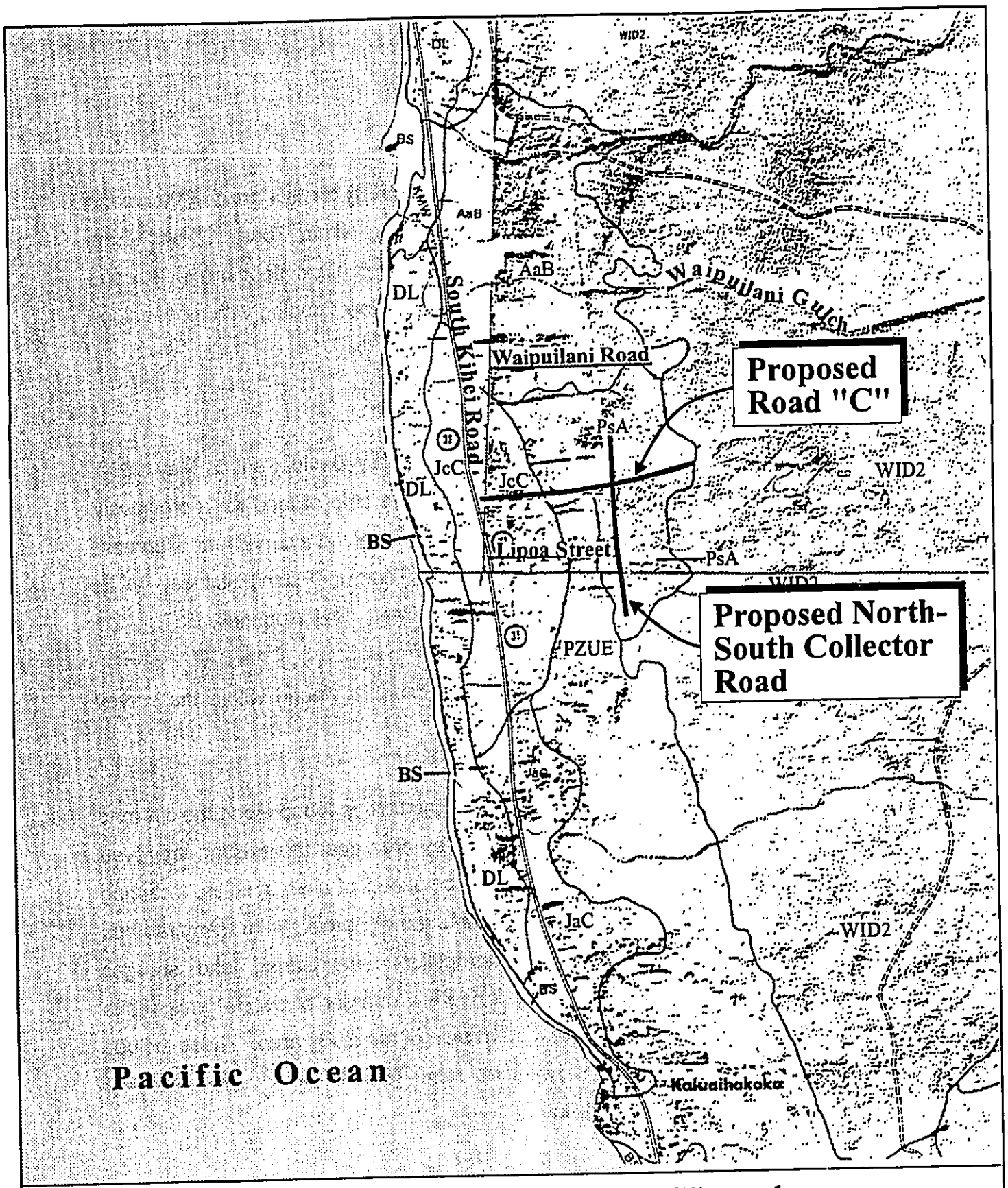


Figure 13 Construction of Road "C" and North-South Collector Road
Soil Classification Map

MUNEKIYO & ARAKAWA, INC.

1000 4000
0 2000 Feet

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

4. ***Flood and Tsunami Hazard***

The Flood Insurance Rate Map (FIRM) for this area of the island designates the project site as being within Zone "C" and Zone "AH". Zone C indicates an area of minimal flooding while Zone "AH" indicates areas of 100-year shallow flooding with a base flood elevation of six (6) feet. See Figure 14.

5. ***Flora and Fauna***

A botanical survey was conducted by David Paul in May 1994. The survey covered a 150-foot wide strip of land for a previously considered Road "C" corridor. This involved a curvilinear alignment from the North-South Collector Road to Piilani Highway at its present intersection with Lipoa Street. See Appendix B.

There are three (3) distinct communities found within the survey area.

First, there were disturbance communities found along the dirt road on the western side of the survey area near the existing improved portion of Road "C". This is comprised of alien species, including khaki weed (Alternanthera pungens), pakai kuku (Amaranthus spinosus), cow pea (Macroptilium lathyroides), and spurges (Chamaesyce spp.) There were a number of coastal indigenous species found in the western side of the study area. These include 'ilie'e (Plumbago zeylanica), nena (Heliotropium currassavicum), and 'ihi (Portaluca lutea).

Second, there is a wetland community located in and around the Long's and Azeka's mitigation ponds. These are dominated by

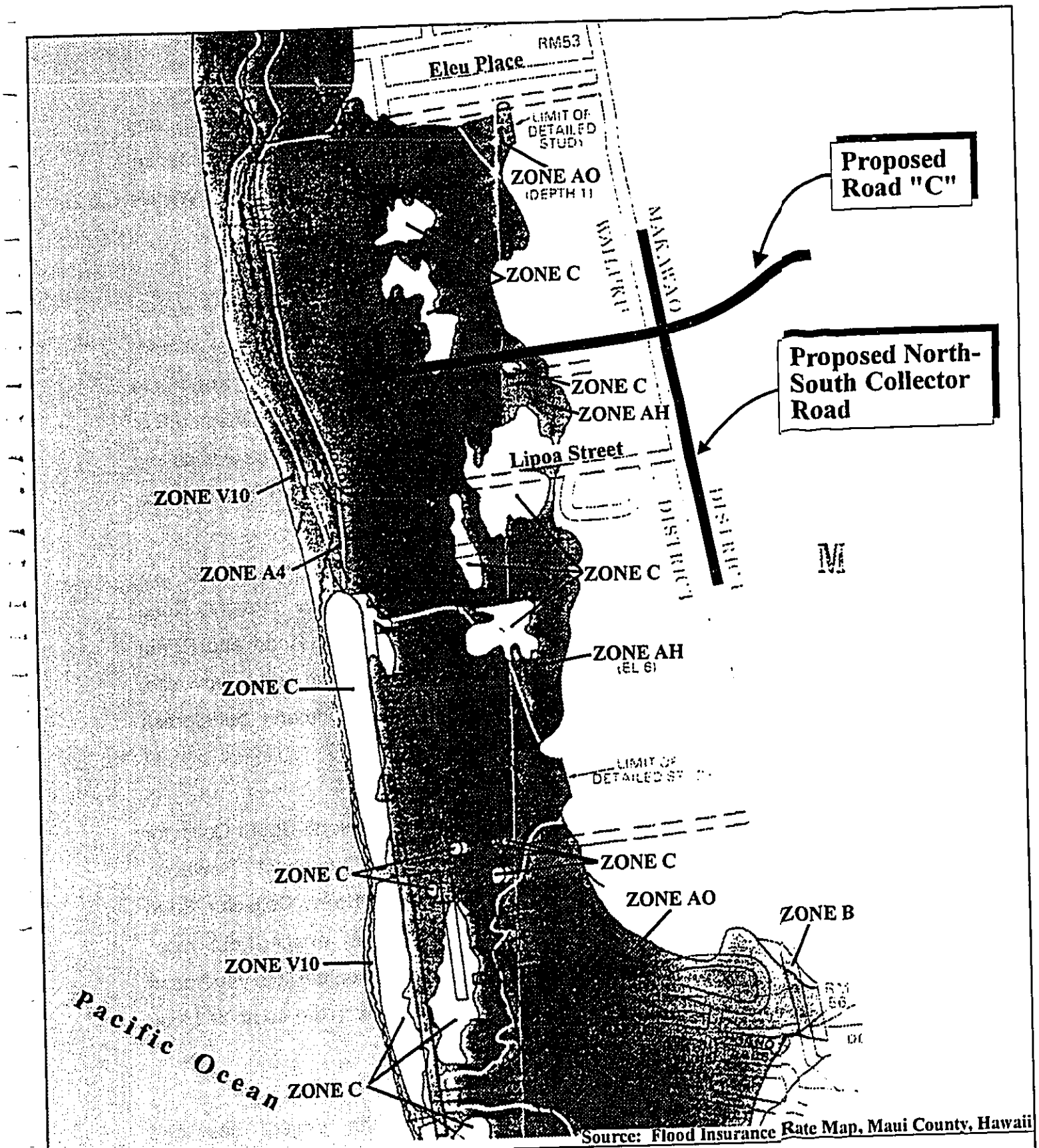


Figure 14 Construction of Road "C" and North-South Collector Road

Flood Insurance Rate Map

MUNEKIYO & ARAKAWA, INC.

0 500 1000 2000 Feet

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

pickleweed (Batis maritima), Indian fleabane (Pluchea indica), and other regional wetland indicator plants. Identification of potential wetland communities was assessed by the U.S. Fish and Wildlife at a site visit on October 6, 1995.

Third, the dry forest community covers the remainder of the survey area. Vegetation is dominated by buffelgrass (Cenchrus ciliaris). There is a dwindling canopy of kiawe (Prosopis pallida). Koa haole (Leucaena leucocephala) and slender mimosa (Desmanthus virgatus) are found scattered across this community, as well as two indigenous species, which are 'ilima (Sida fallax) and 'uhaloa (Waltheria indica).

Although the botanical survey did not include the "straight" Road "C" corridor between the North-South Collector Road and Piilani Highway, as well as areas of the 54-inch drainline and borrow site, the vegetation contained in these areas are primarily buffelgrass with scattered kiawe.

The botanical survey also did not include the North-South Collector Road Segment which is within the scope of the project. However, it is noted that most of the proposed North-South Collector Road alignment north of Lipoa Street follows an existing dirt road. Nearby areas have been previously graded, contain little vegetation and little to no topsoil. A portion of the route to the south of Lipoa Street also follows an existing dirt road.

Avifauna and mammals common to the project site and surrounding areas are also typical of species found in the urbanized Kihei area. Feral mammals typically found in the area

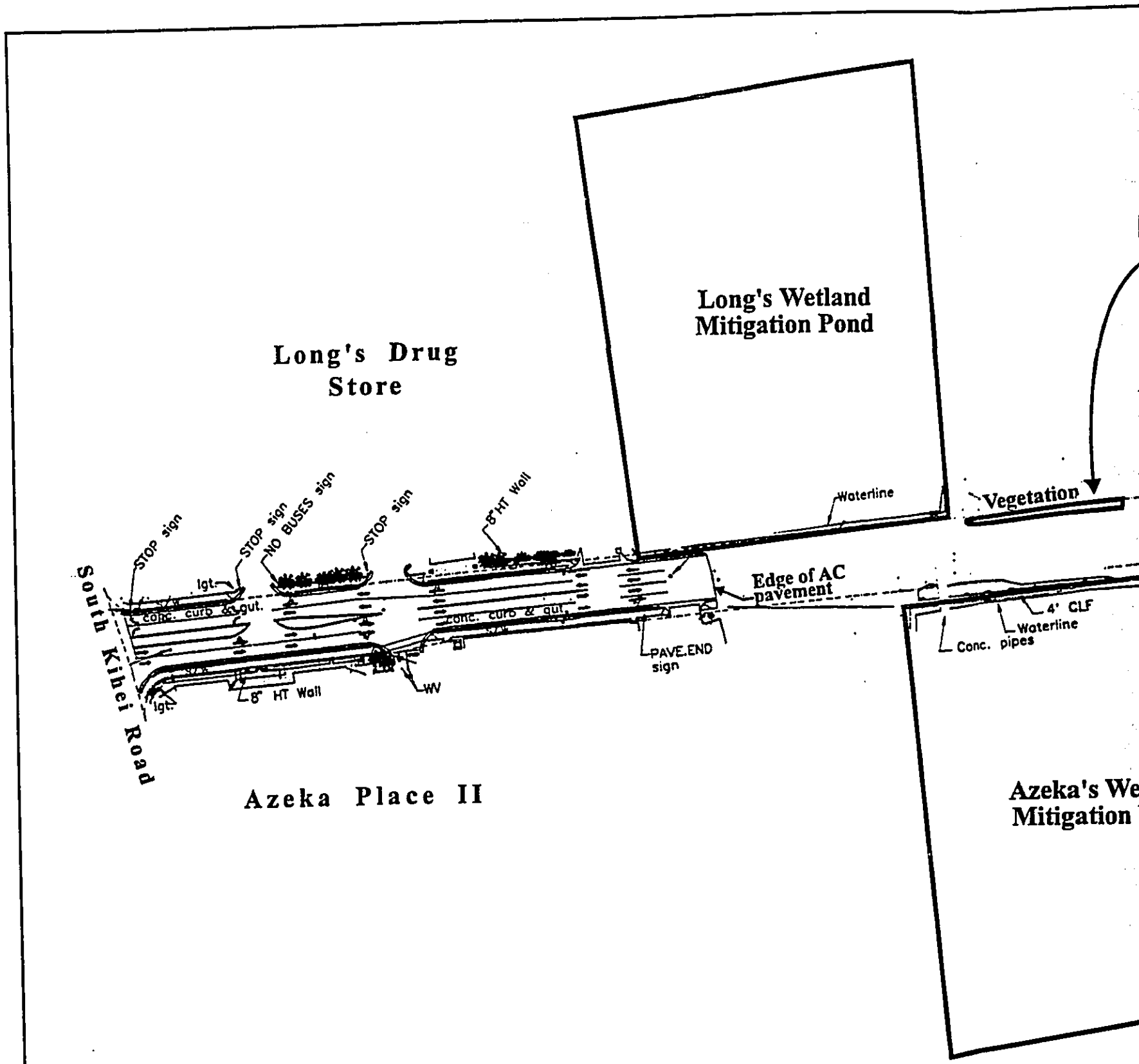
include cats, rats, mice, and mongoose. Exotic species of birds commonly found in this area include the Northern Cardinal, Common Mynah, Golden Plover, Spotted Dove, House Finch, Gray and Black Francolin and the Blue Heron.

It should also be noted that within the mitigation ponds, located to the immediate east of Long's Drugs Store (north of Road "C") and Azeka Place II (south of Road "C"), are the feeding, nesting and resting grounds of the endangered Hawaiian Stilt (Himantopus mexicanus knudseni), Hawaiian Coot (Fulica americana alai) and other migratory waterfowl and shorebirds. The mitigation ponds are not located within the proposed Road "C" alignment. See Figure 15.

6. ***Wetlands***

The Long's 3-acre wetland mitigation pond and the Azeka's 3.5-acre wetland mitigation pond are both secured by chainlink fences. These wetlands were created separately in connection with the Long's Drugs Store and Azeka Place II as part of project mitigation plans for wetland infill. (Both shopping centers are built over former wetland areas.) As noted previously, these enhanced wetland areas are not located within the corridor of the proposed roadway.

It is also noted, however, that a portion of a remnant wetland existed within the Road "C" right-of-way to the east of the Long's mitigation pond. Refer to Figure 15. The remnant wetland was inadvertently filled during maintenance operations by the landowner around November 1994. The fill material consists of soil, sand and construction debris. The area of the fill is approximately 414

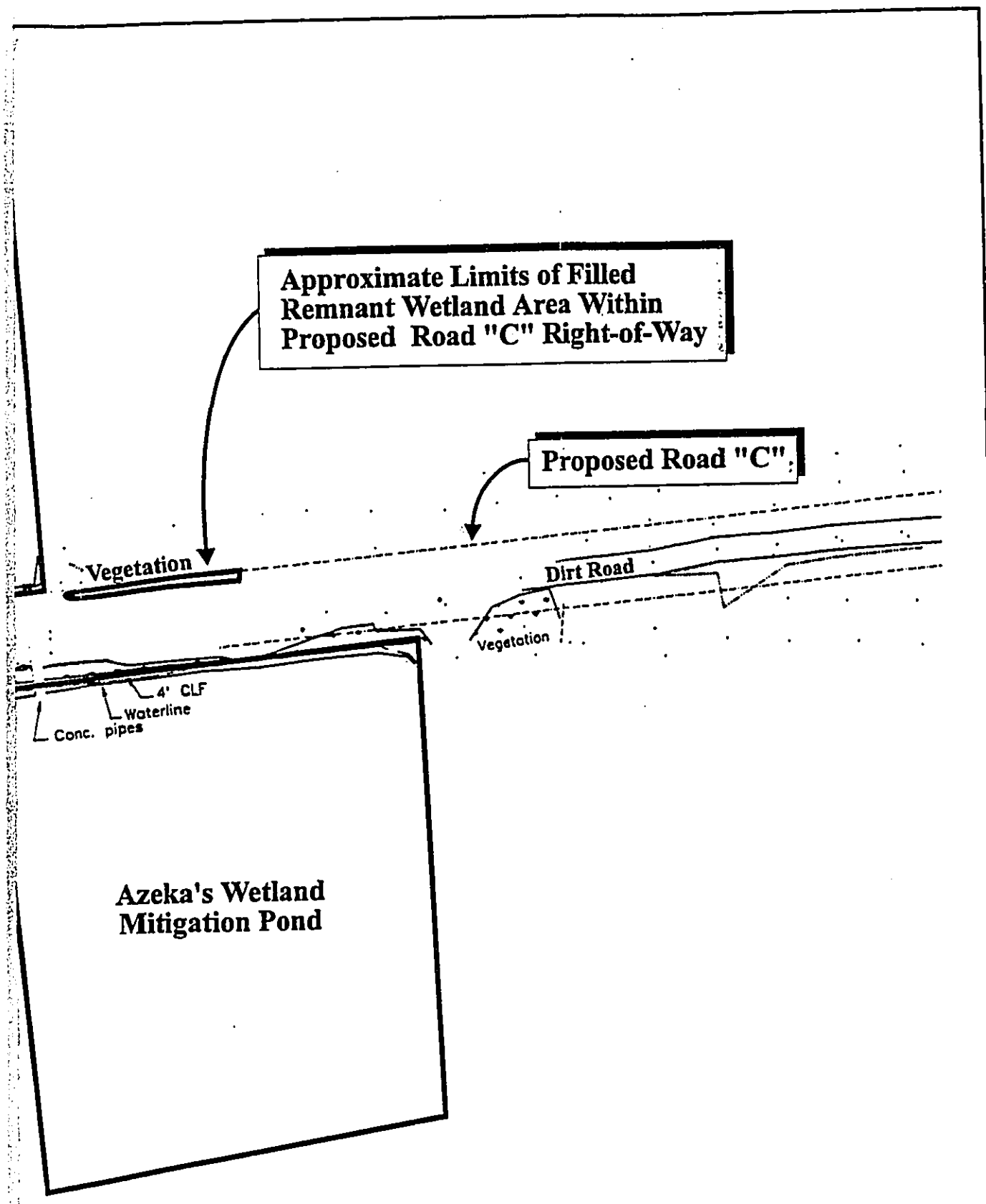


Source: Austin, Tsutsumi & Associates, Inc.

Figure 15

Construction of Road "C" and North-South
Location of Remnant Wetland Area and
Mitigation Ponds in Relation to Roa

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



North-South Collector Road
etland Area and Existing
Relation to Road "C"

MUNEKIYO & ARAKAWA, INC

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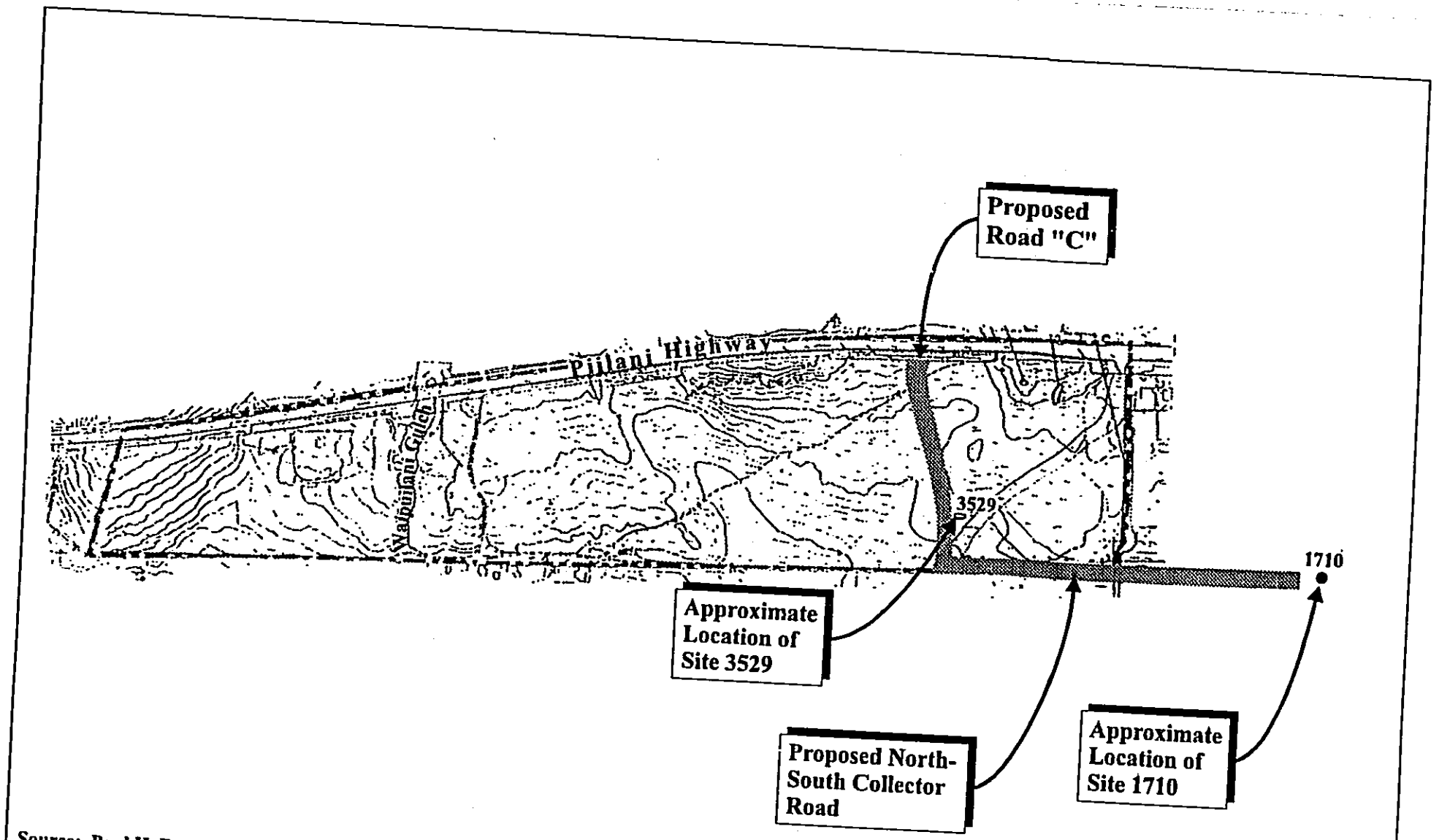
square feet. The volume of unauthorized fill within the remnant wetland is estimated at 23 cubic yards (approximately 138 feet in length by 3 feet in width by 1.5 feet in depth).

7. ***Archaeological Resources***

An archaeological inventory survey for the project site was conducted by Xamanek Researches for the previously considered curvilinear alignment of Road "C". See Appendix A. The scope of the survey included a 150-foot wide corridor along the entire curvilinear Road "C" alignment. The survey resulted in the discovery of a low rock shelter (State of Hawaii Site No.:50-50-10-3529) located in an area of dense buffelgrass cover. See Figure 16. It is noted that the rock shelter is located outside of the current Road "C" alignment and will not be affected by the proposed project.

The State Historic Preservation Division (SHPD) inspected the proposed "straight" Road "C" alignment on September 11, 1996. The inspection included a 200 foot wide roadway corridor (100 feet on each side of the centerline of the alignment) which included the non-participating portion of the Road "C" alignment. Evidence of bulldozing associated with recent fire control was present in the area. No evidence of historic sites were found. See Appendix B-1.

It is noted that the inventory level survey conducted by Xamanek Researches also did not include the North-South Collector Road corridor. The SHPD examined a portion of the corridor, from Road "C" to Halekuai Street, on July 6, 1994. Most of this additional area has already been disturbed by grading and an existing dirt road. The SHPD noted that a known historic site (State of Hawaii



Source: Paul H. Rosendahl, Inc., Archaeological Inventory Survey, 1989; Xamanek Researches, 1994.

Figure 16

Construction of Road "C" and North-South Collector Road
Location of Archaeological Sites in Project Proximity

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

NOT TO SCALE

MUNEKIYO & ARAKAWA, INC.

Site No.: 50-50-10-1710) is located approximately 102 feet south of the Lokelani Intermediate School site and is outside of the project site. See Appendix B-1. Refer to Figure 16.

The land area underlying the North-South Collector Road segment which extends north of Road "C", the detention basin and drainline have also been reviewed by SHPD as part of the Piilani North II-A Large Lot Subdivision. The SHPD, by letter dated September 12, 1996, concluded that the large lot subdivision will have "no effect" on historic sites. See Appendix B-1.

Further, the potential borrow site at the corner of Piilani Highway and Lipoa Street was reviewed by SHPD as part of proposed amendments to the Piilani Village Project District ordinance. Based on previous archaeological reports, SHPD acknowledged by letter dated June 13, 1994 that there are no known archaeological or cultural sites in the project area north of Lipoa Street. See Appendix B-1.

8. ***Air Quality***

There are no point sources of airborne emissions in the immediate vicinity of the project site. The air quality of the Kihei area is considered good with existing airborne pollutants attributed primarily to automobile exhaust from the region's roadways and construction activities. Another source of airborne emissions may include smoke from sugarcane burning which occurs in the Central Maui isthmus. This source is intermittent, however, and prevailing tradewinds quickly disperse particulates which are generated.

9. ***Noise Characteristics***

An acoustic study was done for the previously considered curvilinear alignment of Road "C" . See Appendix C. Noise levels at existing noise sensitive properties along the Road "C" alignment and the North-South Collector Road were measured utilizing the Leq and Ldn descriptors. Leq is the Hourly Equivalent Sound Level. Ldn is the Day-Night Sound Level which represents the 24-hour average sound level for a typical day, with nighttime noise levels (10:00 p.m. to 7:00 a.m.) increased by 10 decibels prior to computation of the 24-hour average. Noise sensitive properties along the project corridor include scattered single family residences, classroom and library buildings at Kihei Elementary School and the Haggai Institute.

The U.S. Federal Highway Administration (FHWA) uses the Leq descriptors rather than the Ldn noise descriptor in assessing highway noise impacts and noise mitigation requirements. In general, a threshold of 67 Leq is applied in the vicinity of these roadway improvement projects. Where use of the 67 Leq threshold would result in a increase in background ambient noise levels at residences which are located in quiet communities, the FHWA 57 Leq criteria can be used as a more conservative noise abatement threshold. For FHWA-sponsored projects, the State of Hawaii Department of Transportation's interim definition of "substantial increase" in traffic noise levels which require noise mitigation measures is an increase greater than 15 decibels.

For schools, where the primary educational activities occur indoors, the FHWA Leq interior noise standard may be used in order to minimize potential traffic noise impacts on classroom activities. For

planning purposes, use of a 60 Leq exterior criteria level at school buildings which are naturally ventilated can be considered to be equivalent to the FHWA 52 Leq interior criteria. For commercial, industrial, and other non-noise sensitive land uses, exterior noise levels as high as 75 Ldn are generally considered acceptable. Exceptions to this occur when naturally ventilated office and other commercial establishments are exposed to exterior noise levels which exceed 65 Ldn.

Existing traffic and background ambient noise levels were measured at five (5) locations in the project environs. These include classroom buildings of Kihei Elementary School, the Haggai Institute building, and scattered dwelling units. Existing background ambient noise levels at these noise sensitive properties range between 58 Leq to 66 Leq, or between 59 to 67 Ldn.

Traffic noise levels outside the existing classroom and library buildings of Kihei Elementary School currently range from approximately 62 to 64 Leq. Inside the naturally ventilated school buildings, existing interior noise levels may exceed the 52 Leq FHWA interior noise criteria for schools if those buildings are within 700 feet of the centerline of Piilani Highway. Current traffic noise levels at the Haggai Institute building are considered to be compatible for instructional uses, and are below the FHWA noise standard of 67 Leq. Existing traffic noise levels at dwelling units in the project environs are also less than the FHWA standard of 67 Leq for residences.

10. Scenic and Open Space Resources

The proposed Road "C" and North-South Collector Road segment are located makai of Piilani Highway. Moving toward the shoreline, there are commercial, single family residential, multi-family residential, and vacant properties. To the north and south of the subject property are vacant lands. Lands to the east of Piilani Highway are in golf course use. The subject property is not considered to be part of a scenic corridor.

B. COMMUNITY SETTING

1. Community Character

The Kihei-Makena Community Plan region includes a diverse range of physical and socio-economic environments. With its dry and mild climate and proximity to recreation-oriented shoreline resources, the visitor-based economy has grown steadily over the past few years. The town of Kihei serves as the commercial and residential center of the region with the master-planned communities of Wailea and Makena serving as the focal point for visitor activities.

The proposed roadway is located within Central Kihei, traversing undeveloped lands to the east and north of the Lipoa business district.

2. Population

The population of the County of Maui has exhibited relatively strong growth over the past decade, with the 1990 population estimated at 100,504, a 41.8 percent increase over the 1980 population of 70,847. Growth in the County is expected to continue, with resident population projections to the Years 2000 and 2010

estimated to be 124,562 and 145,872, respectively (Community Resources, Inc., January, 1994).

Just as the County's population has grown, the resident population of the region has increased dramatically in the last two decades. Population gains were especially pronounced in the 1970's as the rapidly developing visitor industry attracted many new residents. The current resident population of the Kihei-Makena region is estimated at 15,365. A projection of the resident population for the Years 2000 and 2010 are 20,092 and 24,846, respectively (Community Resources, Inc., January, 1994).

3. *Economy*

The economy of Maui County is heavily dependent upon the visitor industry. In 1993, for example, total visitor arrivals numbered 2.5 million (Maui County Data Book, 1994). The dependency on the visitor industry is especially evident in Kihei-Makena, which is one of the State's major resort destination areas. The openings of the Four Seasons Hotel, the Grand Wailea and Kea Lani Hotel have boosted the region's significance as a resort destination.

Support for the visitor industry is found in Kihei, where numerous retail commercial centers are found. New commercial centers in Kihei, such as Azeka's and the Longs Drugs complexes, will lend further support to the regional economy.

4. *Police and Fire Protection*

The Maui Police Department (MPD) consists of five (5) patrol divisions and includes 410 employees. These divisions provide police services through its Hana, Lahaina, Lanai, Molokai, and

Wailuku districts. On Maui, the MPD includes 373 administrative, patrol, and support personnel.

Police services for the Kihei-Makena subdistrict are currently provided by patrol officers on assignment from the Wailuku Patrol Division. Each eight (8) hour watch is staffed by a minimum of four (4) patrol officers (Telephone conversation with Officer Geri Neff, MPD, September 1996).

Fire prevention, protection, and suppression services are provided by the Maui Fire Department's (MFD) Kihei Station. Situated approximately one (1) mile south of the project site, the Kihei Fire Station is equipped with a 1,500 gallon pumper, and is staffed by one (1) captain and five (5) firefighters per twenty-four (24) hour shift (Telephone conversation with Lee Miyabara, MFD, September, 1996).

5. *Medical Facilities*

Maui Memorial Hospital, the only major medical facility on the island, services the Kihei-Makena region. Acute, general and emergency care services are provided by the 185-bed facility which is located in Wailuku. Several Kihei clinics, and dental and medical offices provide local health care services for Kihei-Makena residents and visitors.

6. *Recreational Facilities*

Diverse recreational opportunities are available in the Kihei-Makena region. Over 90 percent of the Kihei-Makena region's parks are either directly on the beach, or across the street from a beach. The Kihei area is served by eleven (11) public parks (R.M. Towill

Corp., August 1992). Additional recreational opportunities are available in the Wailea-Makena area, including several championship golf courses and tennis courts. Shoreline recreation for both areas include swimming, fishing, picnicking, snorkeling, and windsurfing.

7. ***Schools***

The State Department of Education (DOE) operates three (3) schools in the Kihei area. Kihei Elementary School covers grades K to 5, with an enrollment of approximately 911 students. Kamali'i Elementary School, a second elementary school with an enrollment of approximately 580 students, opened in August 1996. Lokelani Intermediate School includes grades 6 to 8, with an enrollment of approximately 660 students. Public school students in grades 9 through 12 attend Maui High School in Kahului (telephone conversation with Department of Education employee, Aileen Shirota, September 1996).

8. ***Solid Waste***

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 are disposed at the County's 55-acre Central Maui Landfill located four miles southeast of the Kahului Airport. In addition to County-collected refuse, the Central Maui Landfill accepts commercial waste from private collection companies.

C. INFRASTRUCTURE

1. Roadway System

A traffic assessment was conducted for the subject project. See Appendix D. The study area is bordered by Piilani Highway, South Kihei Road, Waipuilani Road, and Lipoa Street. The existing circulation system within the study area is described briefly as follows:

Piilani Highway is a two-lane, State arterial highway which runs north south through the study area. Within the study area, Piilani Highway fronts the Silversword Golf Course and the Maui Research and Technology Park on the mauka side. Other land uses are primarily open space and residential. Within the study area, Piilani Highway is signalized at Lipoa Street.

Within the study area, South Kihei Road is a north-south, County collector road which fronts primarily commercial use. South Kihei Road is a two-lane road through most of Kihei; however, between Azeka Place and the entrance to Longs Drug Store (north of Azeka Shopping Center), South Kihei Road is a four-lane roadway. Traffic signals are located at Lipoa Street, Azeka Shopping Center Driveway and the Longs Drug Store/McDonalds driveways.

Lipoa Street is a two-lane, County collector roadway which runs east-west between Piilani Highway and Uliniu Road. Lipoa Street fronts commercial uses as well as residential use and the Kihei Elementary School. East of Piilani Highway, Lipoa Street becomes Lipoa Parkway serving the Silversword Golf Course and the Maui Research and Technology Park.

Waipuilani Road is a two-lane, east-west, local roadway which serves mostly residential use. Waipuilani Road begins makai of South Kihei Road (serving as beach access) and extends mauka into the residential area with no outlets.

2. ***Water***

A water transmission and distribution system developed by the Department of Water Supply services this area of Kihei. A 36-inch transmission line serving the region follows the County roadway reserve located to the west of the Piilani Village development. The transmission line crosses the Road "C" right-of-way near its intersection with the North-South Collector Road. The transmission line also is located within the proposed North-South Collector Road right-of-way. Distribution lines are also located on nearby Lipoa Street and South Kihei Road.

3. ***Drainage***

Runoff sheet flows in the westerly direction, towards a low point in the Road "C" alignment near the Long's wetland mitigation pond. Stormwater then ponds in low-lying areas until it sheet flows over South Kihei Road, ponds in low-lying areas until it sheet flows over Uluniu Road and eventually flows into the ocean. See Appendix E.

Runoff from an existing 54-inch culvert across Piilani Highway, located just to the north of Road "C", sheet flows to an existing drainageway northwest of the proposed terminus of the North-South Collector Road. The drainageway conveys runoff from the lands mauka of Piilani Highway. Runoff in the drainageway flows to the existing wetland area just mauka of South Kihei Road.

An existing gully runs parallel to and south of the Road "C" alignment, near the intersection of Piilani Highway and Lipoa Street. This gully conveys runoff from lands mauka of Piilani Highway, and terminates about 1,000 feet makai of Piilani Highway. The runoff then flows down Lipoa Street to Kupalaki Street and flows overland to the south into an existing wetland just mauka of South Kihei Road.

There is an existing drainageway through the schools that conveys runoff from lands located to the east of Piilani Highway. The drainageway crosses the proposed North-South Collector Road and flows overland to the west into the existing wetland, just east of South Kihei Road. This drainageway is referred to as the Kihei School Offsite Drainage System.

4. *Wastewater System*

The service area for the County's Kihei wastewater collection system extends from North Kihei to Wailea. The system consists of a number of pump stations, force mains and gravity lines which convey flows to the Kihei Wastewater Reclamation Facility. This treatment and disposal facility, which is located adjacent to the Silversword Golf Course, maintains an existing design capacity of 6.0 million gallons per day (mgd). Improvements to increase the design capacity to 8.0 mgd are currently under construction. Completion is anticipated in late 1997.

Existing sewerlines in the vicinity of the proposed roadway include an 8-inch line extending along Lipoa Street and an 8-inch line along South Kihei Road.

5. ***Electrical and Telephone System***

Electrical and telephone service in the Kihei region is provided by Maui Electric Company, Ltd. and GTE Hawaiian Tel, respectively.

Chapter IV

Potential Impacts and Mitigation Measures

IV. POTENTIAL IMPACTS AND MITIGATION MEASURES

A. IMPACTS TO THE PHYSICAL ENVIRONMENT

1. Surrounding Uses

The proposed Road "C" and North-South Collector Road will traverse lands which are currently vacant or already in use as a dirt road. In this regard, impacts of roadway construction and implementation are not anticipated to adversely affect existing land uses which surround the roadway corridor. In the long-term, the roadway improvements will function as an integral component of the regional transportation network. Moreover, it will serve existing and proposed land uses on immediately surrounding properties.

It is also noted that the westerly segment of Road "C" will follow an alignment between the two (2) existing wetland mitigation ponds. These wetland areas are secured by chainlink fencing and are spaced approximately 76 feet apart. The proposed roadway alignment will fall within a 60 feet right-of-way which will be confined to the area between the two (2) wetland mitigation ponds. Thus, the proposed roadway will not encroach into the secured wetland areas.

2. Flora, Fauna and Wetland Considerations

There are no known habitats or rare, endangered or threatened species of flora located within the project limits. All of the communities contained either alien or indigenous plant species. No endemic plants were found. Native plants which were found are considered indigenous and commonly found in other locations. The removal of the existing flora from the site is not considered an adverse impact.

Similarly, the project is not anticipated to adversely affect fauna typically found in the urbanized Kihei region.

The proposed right-of-way will not encroach into the existing Long's and Azeka's wetland mitigation ponds. However, there has been an inadvertent filling of remnant wetland located to the east of the Long's mitigation pond which is required for the Road "C" right-of-way. Approximately 23 cubic yards of soil, sand and construction debris are currently located within the remnant wetland area. The County has proposed a corrective measure which was approved by the Department of the Army on October 6, 1995 in consultation with the U.S. Fish and Wildlife Service. See Appendix F. While proposing to leave the fill material in place for future use as the roadway base, mitigation has been required in the form of a landscape buffer between the proposed Road "C" and Azeka's as well as the Long's mitigation ponds. Naupaka kahakai (Scaevola sericea) is proposed to be planted with spacing of three (3) feet on center. This is a smooth, spreading succulent shrub which grows from three (3) to ten (10) feet in height. The naupaka will provide additional vegetative buffer between the roadway and the wetland mitigation ponds which in turn is intended to minimize disturbance to the Hawaiian Stilt and other migratory shorebirds that frequent the ponds. The Department of the Army determined that implementation of the corrective measure will substantially eliminate all current and future detrimental impacts resulting from the unauthorized work. The DPWWM intends to conduct the corrective measure immediately after implementation of roadway construction.

It should be emphasized that the area of the remnant wetland fill is not needed for roadway construction. The edge of the paved shoulder improvements are located approximately nine (9) feet away from the wetland fill areas. Areas within the right-of-way, but outside of the paved areas, are intended to be grassed.

3. Archaeological Resources

An archeological inventory survey was undertaken for an approximately 150-foot wide corridor along the previously considered curvilinear alignment of Road "C". The study revealed one (1) archaeological site, a rock shelter, which has been designated State Historic Preservation Division (SHPD) Site No. 50-50-10-3529. This site is considered under the National Register of Historic Places Criterion D, which means that the site has or is likely to yield important information about the history or prehistory of the area.

It is noted that under the current "straight" alignment of Road "C", Site No. 3529 would not be affected. However, data recovery field work has been completed under the auspices of the landowner and the data recovery report has been reviewed by SHPD. A revised report is being done for final SHPD review.

With regard to the North-South Collector Road alignment, the SHPD notes that a known historic site (Historic Site 50-50-10-1710) is located close to the proposed southern terminus of the road. Site 1710 is located approximately 102 feet south of the Lokelani Intermediate School parcel. Site 1710 is an enclosure and associated midden scatter which is for its information value. Since data recovery has not yet occurred, the SHPD recommends that

orange construction fencing be erected around Site 1710 with an appropriate buffer zone prior to initiation of road construction work. See Figure 17. The DPWWM will require the contractor to implement the SHPD's recommendations.

The completion of data recovery for Site 1710 should be addressed at the time that this future roadway segment is implemented.

Should cultural remains be found during construction, work shall cease in the area of the find and the SHPD shall be consulted to determine appropriate mitigation measures. If directed by SHPD, the applicant shall consult with the Maui Burial Council.

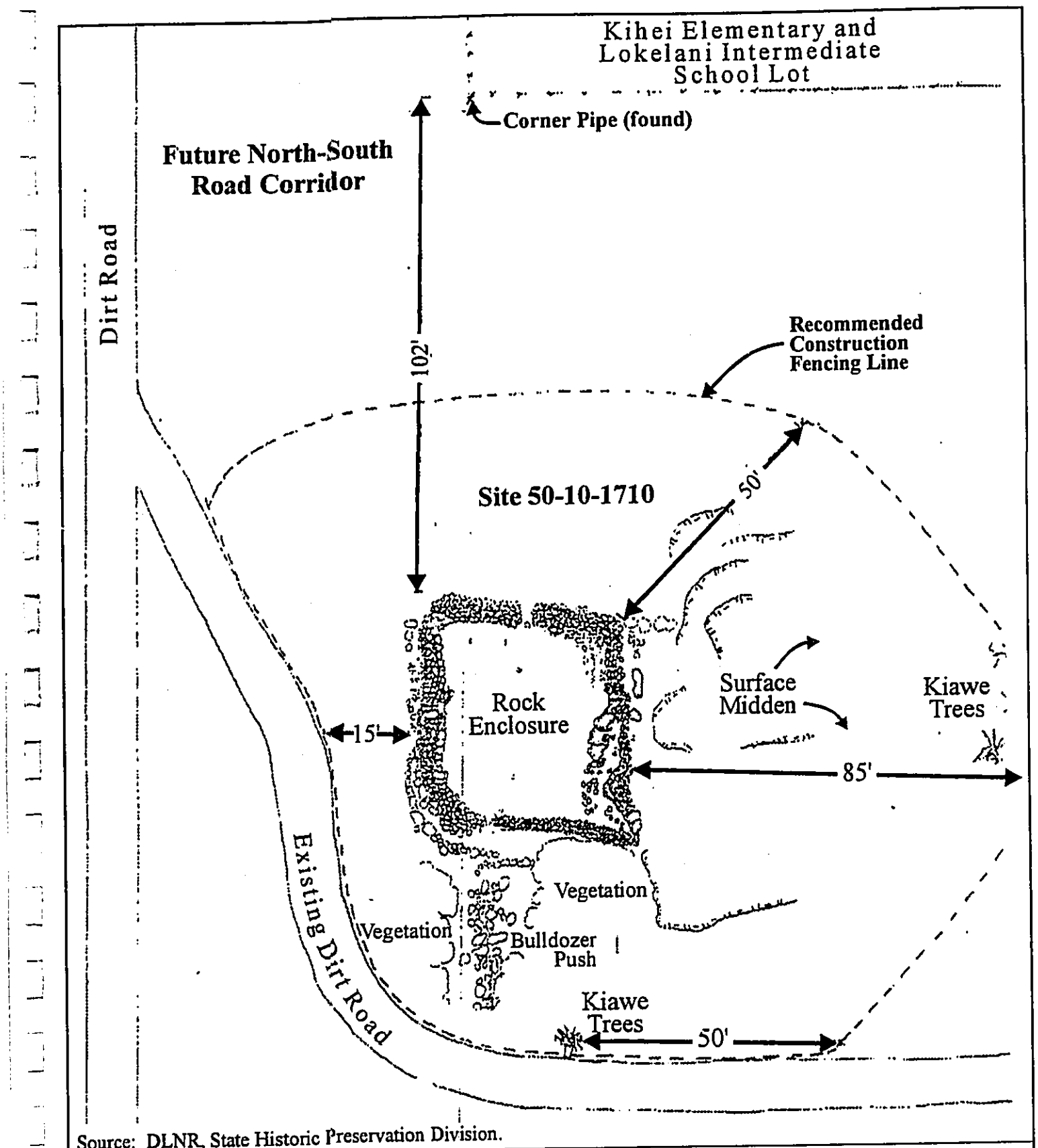
4. ***Air Quality***

Air quality impacts attributed to the project will include dust generated by short-term construction-related activities. Site work such as clearing, grubbing and grading, and utilities and roadway construction for example, will generate air-borne particulates. Dust control measures, such as regular watering and sprinkling, will be implemented to minimize wind-blown emissions.

Once the project is completed, project-related vehicular traffic will generate automotive emissions. However, project-related emissions are not expected to adversely impact local and regional ambient air quality conditions.

5. ***Noise***

Along with the acoustic study conducted in 1995 for the original curvilinear alignment of Road "C", an acoustical evaluation of the straight alignment of Road "C" was formulated in order to update



Source: DLNR, State Historic Preservation Division.

Figure 17 Construction of Road "C" and North-South Collector Road
Location of Archaeological Site
50-10-1710

MUNEKIYO & ARAKAWA, INC.

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

NOT TO SCALE

the assessment relating to noise parameters and impacts. See Appendix C and Appendix C-1.

Short term noise impacts associated with construction activities along the project corridor may occur. These impacts can occur as a result of the short distances (less than 100 feet) between existing receptors and the anticipated construction sites, particularly in the vicinity of the commercial area at the South Kihei Road intersection and near the North-South Collector Road intersection at Lipoa Street.

Construction activities will be restricted to normal daylight working hours, from Monday through Friday, excluding certain holidays. The use of quieted portable engine generators and diesel equipment will be utilized, as appropriate. Heavy truck and equipment staging areas should also be located at areas which are at least 500 feet from noise sensitive properties whenever possible. Truck routes which avoid residential communities should be identified wherever possible. The use of 8- to 12-foot high construction noise barriers may also be used where close-in construction work to noise-sensitive structures are unavoidable.

In terms of long-term noise parameters, the acoustic study for the previously considered curvilinear alignment of Road "C" notes that existing noise sensitive properties along the project corridor include scattered single family residences, classroom and library buildings of Kihei Elementary School, and the Haggai Institute. The study concluded that these noise sensitive properties are not expected to be adversely impacted by Road "C" traffic noise levels following its construction in 1998, or following construction of the entire

North-South Collector Road by 2005. The reason for this conclusion is that traffic volumes and noise levels along existing roadways are not anticipated to increase as a result of the Road "C" project, but the differential volumes and resulting changes in traffic noise levels are anticipated to be 2.8 dB or less, which are not considered to be significant. The study notes that traffic noise mitigation measures should not be required in conjunction with the curvilinear alignment of the Road "C" project.

With the proposed "straight" alignment for Road "C", it is anticipated that traffic noise impacts attributable to the project also should not be adverse. See Table 1 for Comparison of Existing and Projected Noise Levels at Noise Sensitive Properties. Road "C" would aid in the redistribution of east-west traffic linking South Kihei Road and Piilani Highway. This would result in less traffic volumes and lower noise levels at the northeast corner of Kihei Elementary School than would be the case with the curvilinear Road "C" which intersects at the existing Lipoa Street-Piilani Highway intersection.

Table 1

COMPARISON OF EXISTING AND PROJECTED NOISE LEVELS AT NOISE SENSITIVE PROPERTIES		
	Existing (1994) Noise Levels	***Projected Noise Levels with Project***
Classroom and Library Buildings at Kihei Elementary School	61.9 to 64 Leq	63.7 to 66.7 Leq
Cafeteria Building at Kihei Elementary School	66.4 Leq	Less Than 69.2 Leq
Haggai Institute	59 to 62 Leq	64 to 64.8 Leq
Residential Dwellings Near Road "C"/N-S Collector Road Intersection	57.6 to 57.8 Leq	Less Than 62.9 to 63.4 Leq
Residential Dwellings Near Lipoa Street/N-S Collector Road Intersection	64.6 to 65.6 Leq	Similar to 64.6 to 65.6 Leq

Source: Acoustic Study for Kihei Collector Road "C" Project, Y. Ebisu & Associates, June 1995.

Letter from Y. Ebisu & Associates, Inc. to Munekiyo & Arakawa, Inc., April 9, 1997.

In the 1995 acoustic study, it was noted that no noise sensitive property would experience traffic noise levels greater than 67 Leq, except for the Cafeteria Building at Kihei Elementary School. The study noted that this condition would exist in 1998 with or without the curvilinear Road "C" project due to the proximity of the Cafeteria Building to Piilani Highway and Lipoa Street. Under the straight Road "C" alignment, noise levels at the northeast corner of the school are expected to be 1 dB lower than under the curvilinear alignment.

Under the curvilinear Road "C" proposal which involved a closure of the Lipoa Street segment fronting Kihei Elementary School, noise levels at the single family residences fronting Lipoa Street

between South Kihei Road and Kihei Elementary School were projected to experience a 5 to 6 Leq reduction in noise levels if Road "C" were constructed after the North-South Collector Road. Under the "straight" Road "C" proposal, Year 2005 noise levels along Lipoa Street should be similar to Base Year (1994) levels.

The acoustic study assumed that a four-lane North-South Collector Road would be in place by the year 2005. No adverse traffic noise levels were expected for proposed uses fronting the North-South Collector Road, including Kihei Elementary and Lokelani Intermediate Schools. Conclusions of the acoustic study for the subject segment of the North-South Collector Road should remain unchanged.

Because of possible rocky subsurface conditions, excavation within the project site, such as work on the 54-inch drainline and the Piilani-Lipoa borrow site, may be difficult. Controlled blasting may be utilized in order to minimize time of construction. However, should the contractor elect this option, blasting will be limited to after school daylight hours.

Existing noise sensitive properties in the project environs are not expected to be adversely impacted by the construction of Road "C" or the North-South Collector Road segment. Traffic noise mitigation measures should not be required in conjunction with the project.

6. ***Scenic and Open Space Resources***

The proposed roadways are located in Central Kihei, which encompasses residential and commercial uses. In the context of

existing and proposed land uses, the roadways will not conflict with visual or scenic resources. As part of the overall project scope, roadway shoulders will be grassed and maintained by the County of Maui to ensure that the roadways do not detract from the surrounding visual character.

B. IMPACTS TO COMMUNITY SETTING

1. Land Use and Community Character

The proposed Road "C" would be located in the vicinity of Kihei's Lipoa commercial center. This area of Central Kihei is characterized by a number of commercial retail centers, residential uses and the Kihei Elementary and Lokelani Intermediate Schools. In the context of this highly urbanized environment, the proposed action is considered an important element of the Kihei Traffic Master Plan. The roadway's implementation will improve local traffic circulation and relieve congestion in this highly travelled area. In this regard, the proposed action will support and enhance land uses along and surrounding the project corridor.

2. Population

Executive Order 12898 was signed by President Clinton on February 11, 1994 and published in the February 16, 1994 Federal Register, Vol. 59, No. 32. The Executive Order requires that appropriate and necessary steps be taken to identify and avoid "disproportionately high and adverse" effects of Federal projects on minority and low-income populations.

The proposed project is not anticipated to cause adverse population and socio-economic impacts identified in the Executive Order.

3. *Police, Fire, and Medical Services*

The proposed action will not increase demands placed upon police, fire and medical services. However, in improving circulation and relieving traffic congestion, the implementation of the project is anticipated to improve accessibility to local neighborhoods and commercial uses by police, fire and emergency medical services.

4. *Recreation*

The proposed action will not result in any loss of existing recreation space nor increase demand upon existing recreation facilities. However, improvements in traffic circulation attributed to the project could indirectly increase accessibility to various recreational facilities in Central Kihei.

5. *Solid Waste*

A solid waste management plan will be developed in coordination with the Solid Waste Division of the County Department of Public Works and Waste Management for the disposal of clearing and grubbing material from the site during construction.

The completed project is not considered a direct solid waste generator.

C. *IMPACTS TO INFRASTRUCTURE*

1. *Roadways*

A traffic assessment was conducted to evaluate future traffic circulation needs resulting from the project. See Appendix D.

Existing Conditions

An analysis of existing conditions was done in order to provide a basis for the remainder of the study. Level of service is a qualitative measure used to describe the condition of traffic flow, ranging from freeflow conditions at LOS A to congested conditions at LOS F. Level of service definitions for signalized and unsignalized intersections are provided in Table 2 and Table 3 respectively.

Four (4) existing intersections were analyzed. These include:

1. Piilani Highway and Lipoa Street;
2. South Kihei Road and Lipoa Street;
3. South Kihei Road and Waipuilani Road; and
4. South Kihei Road and Road "C".

Table 2

LEVEL OF SERVICE DEFINITIONS FOR UNSIGNALIZED INTERSECTION		
Level of Service	***Delay (Seconds/Vehicle)***	***Description***
A	0.0 - 5.0	Little or no delay
B	5.1 - 10.0	Short traffic delay
C	10.1 - 20.0	Moderate traffic delay
D	20.1 - 30.0	Long traffic delay
E	30.1 - 45.0	Very long traffic delay
F	> 45.0	Failure - extreme congestion

Source: "Highway Capacity Manual", Transportation Research Board, 1994.

Table 3

SUMMARY OF EXISTING YEAR 1996 AND PM PEAK HOUR LEVEL		
Level of Service	***Delay (Seconds/Vehicle)***	***Description***
A	0.0 - 5.0	Little or no delay
B	5.1 - 15.0	Short traffic delay
C	15.1 - 25.0	Moderate traffic delay
D	25.1 - 40.0	Long traffic delay
E	40.1 - 60.0	Very long traffic delay
F	> 60.0	Failure - extreme congestion

Source: "Highway Capacity Manual", Transportation Research Board, 1994.

Table 4 summarizes the existing AM and PM peak hour level of

Table 4

SUMMARY OF EXISTING YEAR 1996 AM AND PM PEAK HOUR LEVEL OF SERVICE

Intersection	***Existing 1996***					
	AM Peak Hour			***PM Peak Hour***		
	Vol./ Cap.	***Delay***	***LOS***	***Vol./ Cap.***	***Delay***	***LOS***
1. Piilani Hwy & Lipoa St	0.62	8.2	B	0.62	8.4	B
2. Kihei Rd & Lipoa St	0.33	5.0	A	0.57	9.5	B
3. Kihei Rd & Waipuilani Rd[a]						
• North Bound Left Turn	--	2.3	A	--	4.5	A
• South Bound Left Turn	--	3.7	A	--	4.9	A
• East Bound Approach	--	7.2	B	--	20.7	D
• West Bound Approach	--	7.4	B	--	32.8	E
4. Kihei Rd & Road C[a]						
• South Bound Left Turn	--	3.5	A	--	4.2	A
• West Bound Right Turn	--	4.4	A	--	5.6	B
• West Bound Left Turn	--	12.7	C	--	27.4	D

[a] Existing stop-controlled intersection. Signalized under future conditions.

Source: Austin, Tsutsumi & Associates, Inc.

service results for the four (4) analyzed intersections. Results of existing conditions show only that the intersection of Waipuilani Road and South Kihei Road is operating at an undesirable LOS of E during the PM peak hour. Poor operating conditions at the intersection are due mainly to the fact that the minor approaches to the intersections are controlled by stop signs, coupled with the relatively high amount of traffic volumes on South Kihei Road, which offers little available gaps and essentially reduces the opportunities for vehicles on the minor street approaches to access the main roadway.

Year 2005 with Road "C" Conditions

A year 2005 with Road "C" alternative was also analyzed. The forecast for the year 2005 traffic conditions is based on the June 1996 Draft Kihei Traffic Master Plan (KTMP) prepared by Kaku Associates, Inc. The KTMP traffic forecast includes the overall development growth for the island, which results in an overall increase in traffic. The traffic analysis also included traffic generation from the Piilani North Development which includes 230 single-family residential units, 145 multi-family residential units, and the Piilani Commercial Center.

Besides Road "C", other planned roadway improvements within the study area include the following:

- ***North-South Collector Road***: The future North-South Collector Road will run parallel to and between Piilani Highway and South Kihei Road. Ultimately, the four-lane North-South Collector Road will run between Uwapo Road and Kanani Road and will serve as an alternative roadway to relieve local traffic demand on South Kihei Road. In addition, the future North-South Collector Road will provide a bicycle route, school bus route and

pedestrian facilities. The traffic assessment limits its analysis to the portion of the two-lane North-South Collector Road that runs between Waipuilani Road to Halekuai Street. The North-South Collector Road's connection with Halekuai Street provides a secondary linkage to South Kihei Road.

- ***Waipuilani Road Extension***: The extension of Waipuilani Road, from its existing eastern terminus to Piilani Highway, is included in this study. The extension will take the current two-lane local roadway to Piilani Highway and form the stem of the "T" intersection.

- ***South Kihei Road:*** South Kihei Road will be widened to five (5) lanes between Lipoa Street and the Long's Drugs/McDonald's driveways. The center lane will function as a continuous left-turn lane serving turning vehicles to various commercial driveways.

- ***Other Roadway Improvements:*** Other roadway improvements include bicycle facilities and pedestrian facilities mainly along South Kihei Road and selected connecting roadways between Piilani Highway and South Kihei Road.

Six (6) future new intersections will be created within the study area as a result of new roadways. These are noted as follows:

1. Waipuilani Road and North-South Collector Road;
2. Waipuilani Road and Piilani Highway;
3. Road "C" and North-South Collector Road;
4. Road "C" and Piilani Commercial Driveway;
5. Road "C" and Piilani Highway; and
6. Lipoa Street and North-South Collector Road.

Year 2005 Analysis and Recommendations

The KTMP's Year 2005 AM and PM peak hour traffic forecasts (with the addition of Piilani North development traffic) are adjusted to reflect the shift of traffic patterns due to the construction of new roadways within the study area. The traffic assignment of Piilani North's generated traffic to specific streets and intersections was

based on the available access into and out of the site and the availability of local routes to access the regional highway system.

Based on the estimated AM and PM peak hour traffic volumes, roadway and intersection configurations are determined. Table 4 summarizes the level of service analysis.

Table 4

SUMMARY OF YEAR 2005 AM AND PM PEAK HOUR LEVEL OF SERVICE

Inter-section	Existing 1996						Year 2005 With Road "C"					
	AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour		
	Vol./ Cap.	Delay	LOS	Vol./ Cap.	Delay	LOS	Vol./ Cap.	Delay	LOS	Vol./ Cap.	Delay	LOS
1. Piilani Hwy & Lipoa Street	0.62	8.2	B	0.62	8.4	B	0.53	7.9	B	0.56	7.3	B
2. S. Kihei Rd & Lipoa St.	0.33	5	B	0.57	9.5	B	0.30	4.8	A	0.60	8.4	B
3. S. Kihei Rd & Waipuilani Rd[a]							0.58	4.6	A	0.97	26.4	D
• North Bound Left Turn	--	2.3	A	--	4.5	A						
• South Bound Left Turn	--	3.7	A	--	4.9	A						
• East Bound Approach	--	7.2	B	--	20.7	D						
• West Bound Approach	--	7.4	B	-	32.8	E						
4. S. Kihei Rd & Road C[a]							0.34	3.4	A	0.55	3.1	A
• South Bound Left Turn	--	3.5	A	--	4.2	A						
• West Bound Right Turn	--	4.4	A	--	5.6	B						
• West Bound Left Turn	--	12.7	C	--	27.4	D						
5. Waipuilani Rd & NS Collector[b]												
• East Bound Left Turn							--	2.3	A	--	2.4	A
• West Bound Left Turn							--	2.3	A	--	2.6	A
• North Bound Approach							--	4.1	A	--	6.0	B
• South Bound Approach							--	1.5	A	--	1.1	A
6. Piilani Hwy & Waipuilani Rd	Future Intersection						--	17.7	C	--	20.0	C
• East Bound Right Turn												
7. Road C & N-S Collector Rd[b]	Future Intersection											
• East Bound Left Turn							--	2.5	A	--	3.2	A
• West Bound Left Turn							--	2.4	A	--	2.9	A
• North Bound Approach							--	4.4	A	--	8.1	B
• South Bound Approach								5.2	B	--	9.4	B
8. Road C & Piilani North Driveways	Future Intersection						0.08	5.7	B	0.15	5.4	B
9. Piilani Hwy & Road C	Future Intersection						0.55	4.0	A	0.69	7.7	B
10. Lipoa St & N-S Collector Rd[b]	Future Intersection											
• East Bound Left Turn							--	2.6	A	--	3.1	A
• West Bound Left Turn							--	3.7	A	--	2.7	A
• North Bound Approach							--	12.6	C	--	8.2	B
• South Bound Approach							--	4.6	A	--	5.2	B

[a] Existing stop-controlled intersection. Signalized under future conditions.
[b] Future stop-controlled intersection.

Source: Austin, Tsutsumi & Associates, Inc.

The following summarizes the recommendations:

1. Based on the projected Year 2005 traffic forecast, regional traffic demand on Piilani Highway will warrant widening from its current two (2) lanes to four (4) lanes. This improvement is consistent with the recommendations in the KTMP which call for the widening of Piilani Highway between Mokulele Highway and Kilohana Drive.

2. It is recommended that Road "C" be a four-lane roadway between Piilani Highway and the future North-South Collector Road. West of the North-South Collector Road, Road "C" can be maintained as a two-lane roadway until demand warrants its widening to its ultimate four (4) lanes.

3. New traffic signal systems will be warranted at the following intersections by the Year 2005:

    1. Road "C" and Piilani Highway;
    2. Road "C" and South Kihei Road; and
    3. Waipuilani Road and South Kihei Road.

4. It is recommended that the future intersection of Waipuilani Road and Piilani Highway be a stop-controlled intersection with turn restrictions to allow only right-turn in and right-turn out movements.

5. The traffic study analyzed the portion of the future North-South Collector Road between Waipuilani Road and Halekuai Street. Intersections along this portion of the North-South Collector Road could be maintained as stop--controlled intersections until the increase in traffic volumes warrants signalization.

With regard to bicycle access, it is noted that bike routes are provided on the North-South Collector Road segment, from Road "C" to Halekuai Street. The roadway section provides for a 6 foot wide paved shoulder on both sides of the vehicle travel lanes. A two (2) lane segment of Road "C" from its existing terminus near South Kihei Road to the North-South Collector Road, would also be available for use as a bike route on an interim basis. For the segment of the North-South Collector Road to the north of Road "C", a 6 foot paved shoulder is available for use as bike route on

the westerly side of the road for bikes traveling in a southerly direction.

In the long term, the North-South Collector Road is envisioned to be a four (4) lane roadway. For the segment of this roadway from 700 feet north of Road "C" to Halekuai Street, there is a sufficiently wide right-of-way to allow for provision of bike access possibly in the form of a bike route or separate bike path. Road "C" is also intended to be a four (4) lane facility in the long term. A four (4) lane segment is currently being proposed between the North-South Collector Road and Piilani Highway.

The provision of bike lanes on Road "C" in the long term, however, poses at least two (2) problematic issues. First, the existing developed segment of Road "C" is built within a 56 foot right-of-way. Four (4) travel lanes and sidewalks have already been constructed. Thus, should bike lanes be desired, additional right-of-way would be required. Cutting and refacing of existing buildings and loss of existing parking will likely be required. Secondly, a portion of the future Road "C" is proposed to be built between the existing Long's and Azeka's wetland mitigation ponds. The distance between the existing fencelines is approximately 76 feet. An eventual four (4) lane facility would occupy 60 feet. This would consist of four (4) 12 foot wide travel lanes, and 6 foot wide sidewalks on each side. In addition, the County of Maui is required to plant naupaka outside of the existing fencelines to provide additional wetland mitigation. Naupaka planting would occupy at least 7.5 feet on each side. A four (4) lane facility and the required naupaka landscape screen occupies 75 feet of right-of-way leaving insufficient space available for bike laneage. Should bike lanes be

desired, the existing wetland mitigation ponds and wildlife habitat would be affected.

According to Bike Plan Hawaii done by R.M. Towill Corporation for the State of Hawaii, Lipoa Street from South Kihei Road to Piilani Highway is a designated bike lane in the Central Kihei area. A portion of this route already has a two (2) way bike lane on the Wailea side of the street. Because the project involves construction of a left-turn lane for mauka bound traffic on Lipoa Street onto the North-South Collector Road and the existing right-of-way width is limited, the existing two-way bike lane will be combined with the sidewalk in the vicinity of the turn lane. The Bike Plan Hawaii Study notes that the portion abutting Kihei Elementary School is designated as a future proposed segment. In the Central Kihei area, the only other future proposed east-west bike lane connector is Welakahao Road, from South Kihei Road to Piilani Highway. A portion of Kulanihakoi Road, extending from its original terminus to Piilani Highway, incorporates a bike lane in each direction.

Piilani Highway provides an existing bike route from Mokulele Highway to its Wailea terminus. South Kihei Road is also designated as a future proposed bike route from North Kihei Road through Wailea. Bike Plan Hawaii proposes that the North-South Collector Road also be designated as a future proposed bike path from Kaonoulu Street to Kilohana Drive. This provides an additional north-south linkage.

A landscaped bike and jogging path has been constructed along the North-South Collector Road alignment from the northerly end of Piilani Village Phase I to Waipuilani Gulch. The construction of

subsequent phases of Piilani Village will also provide the opportunity to extend this paved bike and jogging path further south.

2. ***Water and Wastewater***

The proposed roadway is not anticipated to adversely impact capacity and service requirements for water and wastewater systems.

With regard to the existing 36-inch water transmission line within the County roadway reserve and the 16-inch waterline within the Lipoa Street right-of-way, construction details of the roadway will be coordinated with the Department of Water Supply during the building permit process.

3. ***Drainage***

Stormwater from the Road "C" right-of-way, a portion of the North-South Collector Road north of Lipoa Street, and approximately 21 acres of undeveloped land east of the North-South Collector Road, will be intercepted by a new drainage system constructed within the Road "C" and the North-South Collector Road rights-of-way and conveyed to a temporary detention basin located at the northeasterly end of the North-South Collector Road. The stormwater from approximately 12 acres of undeveloped land will sheet flow directly into the temporary detention basin. Runoff out of the detention basin will flow into an existing drainageway north of the North-South Collector Road. Due to the construction of the detention basin, post-development runoff in the existing drainageway will not exceed the pre-development flow. Runoff in the existing drainageway will flow overland to the wetland just mauka of South Kihei Road per the existing condition. The runoff

flowing into the temporary detention basin will ultimately be discharged into a permanent detention basin located directly north of the temporary detention basin. The permanent detention basin will be constructed at the proposed Piilani Village park site (to be constructed at the time Piilani Village Phase III is fully developed). Stormwater generated makai (west) of the portion of the North-South Collector Road north of Lipoa Street will flow into the low-lying area mauka of the Long's wetland mitigation pond, pursuant to the existing condition. Drainage improvements as described in the County of Maui's Kihei Drainage Master Plan may be expected to be implemented in the future by other entities. These improvements include a box culvert crossing and open channels at South Kihei Road and a drainage outlet at Uluniu Road.

Stormwater from the portion of the North-South Collector Road south of Lipoa Street will drain off the roadway and enter the Kihei School Offsite Drainageway pursuant to the existing condition. An existing culvert will be extended under the North-South Collector Road to convey runoff from Kihei/Lokelani Schools. Runoff will then continue to flow to the existing wetland mauka of South Kihei Road.

Runoff from the existing gully near the Piilani Highway and Lipoa Street intersection will enter a temporary detention basin, to be constructed in Lot A-4 of the Piilani North-II subdivision (by others). Any runoff out of the detention basin will continue to flow onto Lipoa Street. Future improvements by other entities will intercept the runoff at the North-South Collector Road and Lipoa Street intersection with an underground drainage system. The runoff will then be conveyed within the North-South Collector Road right-of-way to the Kihei School Offsite Drainage System. Runoff will then

flow to the wetland just mauka of South Kihei Road and south of Lipoa Street.

Runoff from an existing 54-inch culvert across Piilani Highway located just to the north of Road "C" will be conveyed approximately 400 feet further downstream by a new 54-inch drainline. Runoff will be conveyed to the existing drainageway northwest of the terminus of the North-South Collector Road.

A swale will be constructed along the southerly side of Road "C" (between Piilani Highway and the North-South Collector Road) to preclude localized ponding along Road "C" in low areas created during the roadway construction at locations where the roadway embankment may intersect local ridges.

The existing portion of Road "C" at the intersection of South Kihei Road will continue to drain pursuant to the existing condition.

The Rational Method was used in calculating on-site roadway storm runoff. These calculations are based on a 50-year storm recurrence interval. A runoff rate of approximately 9.0 cubic feet per second (cfs) is calculated for the pre-development condition. A runoff rate of approximately 18.3 cfs is calculated for the post development condition.

The Natural Resources Conservation Service method was used in calculating the pre- and post-development storm runoff through the existing drainageway located at the northerly end of the North-South Collector Road. The calculations are based on a 100-year storm recurrence interval based on a 24 hour storm.

A runoff rate of approximately 908 cfs is calculated for the pre-development condition of the existing drainageway. A runoff rate of approximately 905 cfs is calculated for the post-development condition of the existing drainageway due to attenuation from the temporary detention basin.

The project will require excavation and embankment for the construction of the roadway improvements in order to meet generally accepted highway standards and create an acceptable link with existing roadways. For instance, greater quantities of embankment are needed for the section of Road "C" from the North-South Collector Road to Piilani Highway. Since Piilani Highway was constructed on fill material, it is higher than the adjacent ground surface. An embankment for Road "C" must be created in order to provide a smooth transition. Approximately 32,500 cubic yards of embankment are needed for this segment. The slope from the edge of the paved roadway and shoulder to adjacent properties will be at a ratio of 1:2 which is in accord with standard engineering practices.

All fill material utilized for the project must meet standard specifications for fill and borrow material, as approved by the County of Maui. For instance, materials must meet granular specifications and be free of hazardous substances. A possible source of borrow material is the 3.7 acre site located to the northwest of the Piilani Highway and Lipoa Street intersection, designated for future use as a County park/aquatic center and a multi-family residential development.

Erosion control measures will be incorporated during the construction period to minimize soil loss and erosion hazards. The following measures will be taken:

1. Minimize the time of construction;

2. Retain existing ground cover until the latest date to complete construction;

3. Early construction of drainage control features;

4. Use temporary area sprinklers in non-active construction areas when ground cover is removed;

5. Station water truck on-site during construction period to provide for immediate sprinkling, as needed, in active construction zones (weekends and holidays included);

6. Use temporary berms and cut-off ditches, where needed, for control of erosion;

7. Graded areas shall be thoroughly watered after construction activity has ceased for the day and on weekends; and

8. All cut and fill slopes shall be sodded or planted immediately after grading work has been completed.

The proposed grading and drainage improvements will be designed to produce no adverse effects by storm runoff to adjacent properties. All drainage improvements will conform to County standards. See Appendix E.

Chapter V

Relationships to Governmental Plans, Policies and Controls

V. RELATIONSHIPS TO GOVERNMENTAL PLANS, POLICIES, AND CONTROLS

A. STATE LAND USE DISTRICTS

Chapter 205, Hawaii Revised Statutes, relating to the Land Use Commission, establishes the four major land use districts in which all lands in the State are placed. These districts are designated "Urban", "Rural", "Agricultural", and "Conservation". The subject parcel is within the "Urban" district. The proposed action involves the construction of a roadway which is compatible with the "Urban" designation.

B. MAUI COUNTY GENERAL PLAN

The Maui County General Plan (1990 Update) sets forth broad objectives and policies to help guide the long-range development of the County. As stated in the Maui County Charter, "The purpose of the General Plan is to recognize and state the major problems and opportunities concerning the needs and the development of the County and the social, economic and environmental effects of such development and set forth the desired sequence, patterns and characteristics of future development".

The proposed action is in keeping with the following General Plan objectives and policies:

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

Policy:

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

C. *KIHEI-MAKENA COMMUNITY PLAN*

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

The proposed Road "C" right-of-way and the North-South Collector Road right-of-way traverse lands designated by the Kihei-Makena Community Plan land use map as Business/Commercial, Single Family Residential, Public/Quasi-Public and Project District 5. See Figure 18. Project District 5 includes a mix of single family and multi-family residential, neighborhood commercial, and park and open space uses.

On June 7, 1991, a Bill for an Ordinance to Amend Ordinance No. 1490 (1985) pertaining to the Kihei-Makena Community Plan was approved by the Maui County Council. This amendment states:

> Plan, design, and construct a road (temporarily designated Road "C") running east to west, connecting South Kihei Road and Piilani Highway. Said Road shall meet South Kihei Road in the vicinity of the southern boundary of the parcel designated as TMK: 3-9-2:109, and shall be constructed in coordination with the development of the projects abutting the road.

The proposed project is not contrary to the existing Kihei-Makena Community Plan provisions.

The County of Maui is currently in the process of comprehensively updating each community plan. For the Kihei-Makena Community Plan,

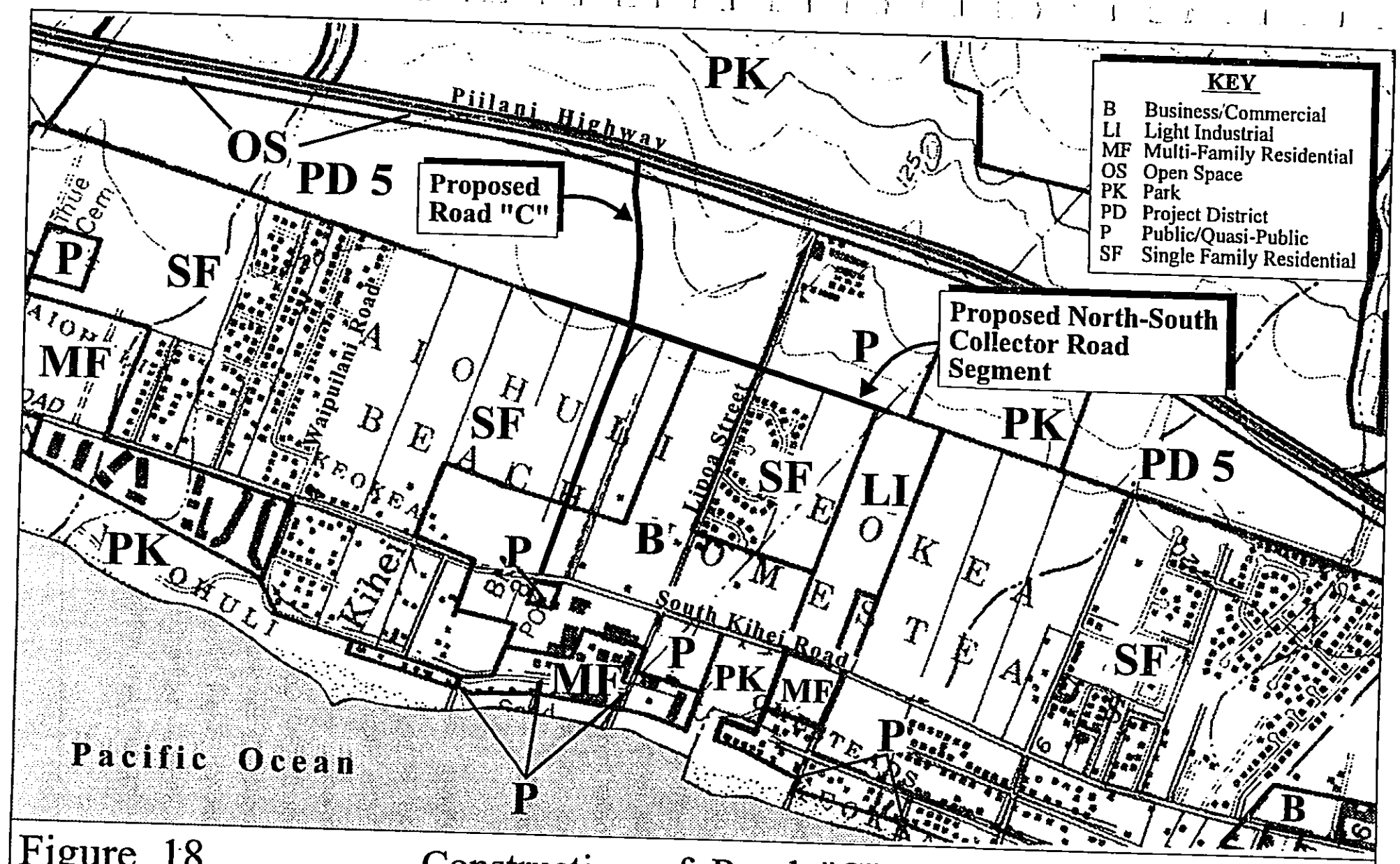


Figure 18

Construction of Road "C" and
North-South Collector Road
Kihei-Makena Community Plan Land Use Designations

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

0 500 1000 2000 Feet

MUNEKIYO & ARAKAWA, INC.

the process involves review by the Kihei-Makena Citizen Advisory Committee (CAC), the Department of Planning, the Maui Planning Commission and the Maui County Council.

During the process which was initiated in May 1992, the CAC, Planning Department and the Maui Planning Commission have recommended that the curvilinear alignment of Road "C" be implemented. The Maui Planning Commission transmitted its recommendations to the Maui County Council in January 1994. County Council action on the proposed changes to the Community Plan is pending.

However, upon further review, it was found that a "straight" alignment for Road "C" provides an alternative which is technically and operationally superior to the curvilinear alignment. The straight alignment provides additional laneage to accommodate east-west traffic flow in the Central Kihei area as well as greater flexibility for future expansion. Moreover, the geometrics are preferable from an engineering and safety standpoint. Thus, the "straight" Road "C" alignment is being pursued by the DPWWM. In order to clarify any ambiguity, DPWWM has submitted a request to the Maui County Council which recommends adoption of the "straight" alignment for Road "C".

D. ZONING

Road "C" begins at South Kihei Road, extending in an easterly direction to Piilani Highway. The section of roadway which has been improved in connection with the Long's Drugs Store and Azeka Place II projects falls within the B-2, Community Business zoning district. The roadway section bounded by the two (2) shopping centers and the westerly limits of the proposed Piilani Village development is zoned R-3, Residential. The mauka-most segment of roadway, traversing the proposed Piilani Village development falls within the Project District 5 zoning category. The

segment of the North-South Collector Road which is included within the project is also located within the Project District 5 zoning category. A small portion of the project also affects the Kihei School and Lokelani Intermediate School parcel which is zoned Public/Quasi-Public. The proposed roadway use is in consonance with the underlying land zoning designations.

E. KIHEI TRAFFIC MASTER PLAN

The Kihei Traffic Master Plan was prepared for the County of Maui, Department of Public Works and Waste Management by Austin, Tsutsumi & Associates, Inc. in October 1989. Its purpose was to meet the objectives set forth in the Kihei-Makena Community Plan in terms of providing a long-range roadway master plan for Kihei. The study focused on major arterial roadways as well as the collector road system in the Kihei area.

Road "C" is one (1) of the four (4) major East-West connector roads proposed by the Kihei Traffic Master Plan that will improve the overall traffic network in the Kihei area. The North-South Collector Road is also proposed by the Kihei Traffic Master Plan to improve traffic circulation within the region.

F. COUNTY OF MAUI SPECIAL MANAGEMENT AREA

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

1. ***Recreational Resources***

Objective: Provide coastal recreational resources 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 recreation activities that cannot be provided in other areas;

(ii) Requiring replacement of coastal resources having 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 use 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, County Planning Commission; and crediting such dedication against the requirements of Section 46-6 of the Hawaii Revised Statutes.

Response: The proposed project is not anticipated to affect existing coastal or inland recreational resources. However, accessibility to these resources may be indirectly improved as a result of the project.

2. ***Historical/Cultural Resources***

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

Policies:

a. Identify and analyze archaeological resources;

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

c. Support State goals for protection, restoration, interpretation and display of historic resources.

Response: An archaeological inventory survey found no historic sites within the Road "C" corridor. Other surveys also did not uncover any archaeological materials within the project site. However, a low rock shelter (Site 3529) has been found adjacent to the corridor. The data recovery process is nearing completion. The SHPD inspected the corridor for the segment of the North-South Collector Road and noted that data recovery on a nearby

enclosure (Site 1710) has not been completed. Thus, a buffer zone and fencing is being erected around the site during the construction period to ensure its protection.

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 land forms 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 which are not coastal dependent to locate in inland areas.

Response: The proposed roadway will not impact coastal scenic and open space resources. Furthermore, the project will not 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. Improve the technical basis for natural resource management;

b. Preserve valuable coastal ecosystems, including reefs of biological or economic importance;

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

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

Response: Improvements to the subject property are not expected to adversely impact coastal ecosystems. Erosion control measures will be implemented during construction to ensure that coastal ecosystems are not impacted.

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 would have a beneficial short-term impact on the local economy during construction. Road "C" is considered an integral component of the Kihei transportation network. Implementation will serve to improve the movement of goods and services to and from the Central Kihei area. The implementation of the roadways will, in the long-term, facilitate the planned development of the area. In this context, the proposed project is considered significant in maintaining and enhancing the region's long-term economic stability.

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, subsidence, and point and nonpoint source pollution hazards;

c. Ensure that developments comply with requirements of the Federal Flood Insurance Program; and

d. Prevent coastal flooding from inland projects; and

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

Response: Erosion control measures will be incorporated during the construction period to minimize soil loss and erosion hazards. All drainage improvements will conform to County standards. No adverse drainage impacts to downstream properties should result from the proposed project.

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 and short and long-term impacts of proposed coastal developments early in their life-cycle and in terms understandable to the general public to facilitate public participation in the planning and review process.

Response: In compliance with the Special Management Area Rules and Regulations of the County of Maui, required documentation will be filed with the County Planning Department and will undergo public hearing and decision by the Maui Planning Commission. In addition, early consultation is provided through the process of preparing the Environmental Assessment. A Draft Environmental Assessment is prepared for public review in compliance with Chapter 343, Hawaii Revised Statutes, and

Chapter 200 of Title 11, Administrative Rules, Environmental Impact Statement Rules.

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

8. ***Public Participation***

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

Policies:

a. Maintain a public advisory body to identify coastal management problems and to provide policy advice and assistance to the coastal zone management program;

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

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

Response: The proposed project is designed to accommodate current and projected traffic demands in the Central Kihei area. A public hearing is required as part of the County's SMA process. The proposed project is not contrary to the objective of public awareness, education and participation.

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 and to minimize loss of improvements due to erosion;

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

c. Minimize the construction of public erosion-protection structures seaward of the shoreline.

Response: At its western terminus, the proposed Road "C" is located approximately 975 lineal feet inland from the nearest shoreline. Consequently, the proposed project is not anticipated to adversely impact any beaches in the vicinity.

G. *U.S. DEPARTMENT OF THE ARMY CORRECTIVE MEASURE*

The U.S. Department of the Army has approved a corrective measure in order to address the inadvertent filling of remnant wetland located to the east of the Long's mitigation pond. Refer to Figure 14. Mitigation for the wetland fill was required in the form of planting of naupaka kahakai between Road "C" and the Long's as well as the Azeka's wetland mitigation ponds. Thus, a Department of the Army permit is not necessary. Other regulatory permits such as the Section 401 Water Quality Certification, Coastal Zone Management Consistency Determination, and Stream Channel Alteration Permit are not applicable.

Chapter VI

Summary of Adverse Environmental Effects Which Cannot be Avoided

VI. SUMMARY OF ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

Chapter 200 of Title II, Hawaii Administrative Rules, relating to "Environmental Impact Statement Rules", and Chapter 202 relating to "Special Management Area Rules for the Maui Planning Commission" require a discussion of adverse environmental effects which cannot be avoided. Since this is a combined NEPA/State Environmental Assessment as well as a County SMA review document, the discussion is included within this document.

The proposed development of Road "C" and the North-South Collector Road will result in unavoidable construction related impacts as described in Chapter III, Potential Impacts and Mitigation Measures.

Potential effects include noise-generated impacts occurring from site preparation and construction activities. In addition, there may be temporary air quality impacts associated with dust generated from construction activities, and exhaust emissions discharged by construction equipment.

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

Chapter VII

Irreversible and Irretrievable Commitments of Resources

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The proposed project will result in the loss of approximately 11 acres of land for the development of Road "C" and the North-South Collector Road Segment. While the loss of this land is considered irretrievable, the projected need for roadway improvements in the Central Kihei area is considered essential.

The proposed construction of Road "C" will involve the loss of approximately 414 square feet of remnant wetland located within the right-of-way due to inadvertent filling by the landowner. However, mitigation in the form of landscape planting between Road "C" and the existing Long's and Azeka's mitigation pond will substantially eliminate all current and future detrimental impacts resulting from the fill.

No other irreversible and irretrievable commitments of resources have been identified in connection with the proposed action.

Chapter VIII

Findings and Conclusions

VIII. FINDINGS AND CONCLUSIONS

The proposed project involves the implementation of Road "C", a segment of the North-South Collector Road, from a point approximately 700 feet north of Road "C" extending south to Halekuai Street, and associated drainage and waterline improvements, in Kihei, Maui, Hawaii.

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

1. *No Irrevocable Commitment to Loss or Destruction of any Natural or Cultural Resource Would Occur as a result of the Proposed Project*

There are no known habitats or rare, endangered or threatened species of flora and fauna within the project limits. However, the Road "C" right-of-way is proposed to be located between two (2) existing wetland mitigation ponds located east of the Long's Drugs Store and the Azeka Place II. These wetlands serve as host areas for the Hawaiian Stilt, Hawaiian Coot and other migratory shorebirds. Although the proposed roadway right-of-way will not encroach into the enhanced wetlands, mitigation in the form of increased planting between Road "C" and the mitigation ponds will be implemented to ensure that the proposed project will minimize disturbance to the migratory shorebirds.

An archaeological site has been identified in close proximity to the proposed roadway corridor. This site has been identified as a rock shelter (Site No. 50-50-10-3529) and was evaluated as "significant". Data recovery field work has already been completed and the final report is in the process of being prepared.

Another archaeological site (50-50-10-1710), is located close to the southern boundary of the North-South Collector Road (approximately 102 feet south of the Lokelani Intermediate School parcel). Although recommended for data recovery which has not yet occurred, an appropriate buffer zone with fencing will be erected prior to construction work to ensure that the site will not be damaged.

2. ***The Proposed Action Would Not Curtail the Range of Beneficial Uses of the Environment***

The project would not have a effect on the beneficial uses of the environment. Most of the project site is already in use as a dirt road with the remainder being vacant.

3. ***The Proposed Action Does Not Conflict With the State's Long-Term Environmental Policies or Goals or Guidelines as Expressed in Chapter 344, Hawaii Revised Statutes***

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

Environmental Policy:

Enhance the quality of life by:

* * *

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

Guidelines:

* * *

Transportation

* * *

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

4. ***The Economic or Social Welfare of the Community or State Would Not Be Substantially Affected***

The project would directly benefit the local economy during the construction phase. In the long term, however, the project should have an indirect beneficial effect since the enhanced circulation system should benefit local businesses in the area.

5. ***The Proposed Action Does Not Affect Public Health***

No impacts to the public's health and welfare are anticipated.

6. ***No Substantial Secondary Impacts, Such as Population Changes or Effects on Public Facilities, are Anticipated***

No major population changes are anticipated as a result of the proposed project. The project is not anticipated to have adverse impacts upon medical, police and fire protection services as well as other public service systems.

For the year 2005, all intersections within the study area are anticipated to operate at LOS D or better, with the implementation of recommended regional and local roadway, turn lane, and signalization improvements. The proposed project should have a negligible impact upon water and wastewater systems. All drainage improvements will conform to County standards. No major effects on public facilities are anticipated.

7. ***No Substantial Degradation of Environmental Quality is Anticipated***

No substantial degradation of environmental quality is anticipated as a result of the project. The project responds to a need for improved east-west connector roads as well as improved internal circulation within Central Kihei.

8. ***The Proposed Action Does Not Involve a Commitment to Larger Actions, Nor Would Cumulative Impacts Result in Considerable Effects on the Environment***

The proposed project takes into consideration the entire right-of-way needed for Road "C" and the North-South Collector Road, from approximately 700 feet north of Road "C to Halekuai Street. Details on additional commitments and time frame for road widening or extensions are uncertain at this point in time. Should additions be proposed, these will be evaluated under the appropriate permit processes. Should Federal, State, or County funding be involved, environmental review would be required. Any additions makai of Piilani Highway would also be subject to County SMA review.

9. ***No Rare, Threatened or Endangered Species or Their Habitats Would Be Adversely Affected by the Proposed Action***

There are no rare, threatened or endangered species of flora, fauna, or avifauna or their habitats on the subject property. Additional landscape buffers will be planted between Road "C" and the existing wetland

mitigation ponds as mitigation for inadvertent minor fill placed in a remnant wetland. It is noted that the proposed project will not alter the existing ponds.

10. ***Air Quality, Water Quality or Ambient Noise Levels Would Not Be Detrimentally affected by the Proposed Project***

Construction activities will result in short term air quality and noise impacts. Dust control measures, such as regular watering and sprinkling, will be implemented to minimize wind blown emissions. Noise impacts will occur primarily from construction equipment. It is anticipated that construction will be limited to daylight working hours.

In the long term, the project is not anticipated to have a impact on air quality or noise parameters.

11. ***The Proposed Project Would Not Affect Environmentally Sensitive Areas, Such as Flood Plains, Tsunami Zones, Erosion-prone Areas, Geologically Hazardous Lands, Estuaries, Fresh Waters or Coastal Waters***

Most of the project area is located in Zone C, areas of minimal flooding. Makai portions are designated Zone AH, areas of 100-year shallow flooding with base flood elevations of six (6) feet. The project does not involve the construction of any habitable areas. The project does not involve lands subject to tsunami inundation, erosion-prone areas, geologic hazards, estuaries, fresh waters, or coastal waters. Drainage patterns in the area surrounding the project will not be altered.

12. ***The Proposed Project Would Not Substantially Affect Scenic Vistas and Viewplanes Identified in County or State Plans or Studies***

Scenic vistas and viewplanes from the subject property are not identified in any County or State plans or studies.

13. ***The Project Would Not Require Substantial Energy Consumption***

The project would ease traffic congestion within the Central Kihei area and minimize wasted time and energy.

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

Chapter IX

Agencies Contacted in the Preparation of the Environmental Assessment

IX. AGENCIES CONTACTED IN THE PREPARATION OF THE ENVIRONMENTAL ASSESSMENT

The following agencies and organizations were contacted during the preparation of the Environmental Assessment:

1. U. S. Army Corps of Engineers
   Pacific Ocean Division
   Building 230
   Fort Shafter, Hawaii 96858

2. U. S. Fish and Wildlife Service
   Office of Environmental Services
   300 Ala Moana Blvd, Room 6307
   Honolulu, Hawaii 96813

3. State of Hawaii
   Department of Transportation
   Highways Division
   650 Palapala Drive
   Kahului, Hawaii 96793

4. Department of Land and Natural Resources
   State Historic Preservation District
   1151 Punchbowl Street
   Honolulu, Hawaii 96813

5. State of Hawaii
   Department of Health
   54 High Street
   Wailuku, Hawaii 96793

6. Department of Planning
   County of Maui
   250 South High Street
   Wailuku, Hawaii 96793

7. Department of Education
   State of Hawaii
   Maui District Office
   54 High Street, 4th Floor
   Wailuku, Hawaii 96793

8. Baldwin-Malama
   915 Fort Street, Suite 702
   Honolulu, Hawaii 96813

9. Kihei Community Association
   P.O. Box 662
   Kihei, Hawaii 96753

Letters requesting early consultation comments were sent on November 18, 1996 to nine (9) agencies/organizations. Written replies were received from four (4) agencies. These included the State Department of Education (DOE), County of Maui Planning Department, the State Department of Health (DOH), and Kihei Community Association (KCA). Copies of the letters are attached on the following pages.

The applicant met with the DOE regarding construction impacts and ingress/egress concerns. Details regarding construction methods and driveway and traffic access were discussed and resolved.

Comments raised by the Planning Department relating to bikeways, wetlands, and the Special Management Area (SMA) Use permit have been addressed within the text of the Environmental Assessment. Briefly, bike lanes will be provided where practicable. Wetlands will be avoided or acceptable mitigation measures will be implemented. The SMA Use permit application requirement is acknowledged.

Regarding DOH comments, the applicant will comply with applicable provisions relating to community noise control.

The applicant met with the Planning and Development Committee of the Kihei Community Association (KCA) on January 10, 1997. The project was presented at a general membership meeting of the KCA on January 21, 1997. A second meeting was held with the Planning and Development Committee on May 12, 1997.

There were several concerns raised at the KCA meetings.

Questions were asked as to why the curvilinear alignment for Road "C" has been revised to a straight alignment. The applicant noted that the straight alignment represented a technically superior alignment.

There were concerns raised regarding the extent of fill utilized for the eastern portions of Road "C". The applicant noted that the fill is being proposed in order to provide a smooth transition to Piilani Highway which was constructed at a higher elevation.

Several people felt that additional bikeways should be provided by the project. The applicant noted that Bike Plan Hawaii done for the State of Hawaii designates Lipoa Street as the bike lane in this vicinity.

BENJAMIN J. CAYETANO
GOVERNOR

HERMAN M. AIZAWA, Ph.D.
SUPERINTENDENT

STATE OF HAWAII
OFFICE OF DISTRICT SUPERINTENDENT
DEPARTMENT OF EDUCATION
54 HIGH STREET, 4TH FLOOR, RM. 401
WAILUKU, MAUI, HAWAII 96793

November 20, 1996

TO: Mr. Milton Arakawa
Project Manager, Munekiyo & Arakawa, Inc.

FROM: Ralph M. Murakami
District Superintendent

SUBJECT: ROAD "C"

Your request for comments on the Road "C" project has been transmitted to Lester Chuck, Director of Facilities and Support Services of the Department's Office of Business Services.

A response to the proposed Road "C" should be forthcoming from his office.

RMM:aas

Benjamin J. Cayetano
GOVERNOR

HERMAN M AIZAWA, PH D
SUPERINTENDENT
[redacted]

STATE OF HAWAII
DEPARTMENT OF EDUCATION
P. O. BOX 2360
HONOLULU, HAWAII 96804

OFFICE OF THE SUPERINTENDENT

December 3, 1996

Mr. Milton Arakawa, Project Manager
Munekiyo & Arakawa, INC.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Arakawa:

SUBJECT: Pre-Draft Environmental Assessment
Road C in Kihei, Maui, Hawaii

The Department of Education (DOE) has reviewed the subject project summary. We have the following concerns regarding the proposed construction of Road "C" as it relates to the schools in the area:

1. The DOE will request that the developer take mitigating measures to minimize the noise and dust impacts on the schools during the construction period. If noise and dust levels are beyond Department of Health standards, the DOE will require that the developer provide air-conditioning at no cost to the DOE for the classrooms being impacted by the noise and/or dust.

2. The DOE will request that the developer inform and consult with school officials on the construction schedule and any traffic impact this project will have on the schools.

3. The DOE will request an opportunity to review the subject plans to assure proper connection/exit/entrance concerns to the existing schools.

Should there be any questions, please call the Facilities Branch at 733-4862.

Sincerely,

Herman M. Aizawa, Ph.D.
Superintendent

HMA:hy

cc: A. Suga, OBS
R. Murakami, MDO

LINDA CROCKETT LINGLE
Mayor

DAVID W. BLANE
Director

GWEN OHASHI HIRAGA
Deputy Director

COUNTY OF MAUI
PLANNING DEPARTMENT
250 S. HIGH STREET
WAILUKU, MAUI, HAWAII 96793

December 4, 1996

Mr. Milton Arakawa
Munekiyo & Arakawa, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

Dear Mr. Arakawa:

RE: Draft Environmental Assessment for Road "C"

Responding to your letter of November 18, 1996, the Planning Department appreciates the opportunity to comment on the proposed Road "C" draft Environmental Assessment. The Planning Department offers the following comments:

1. Bikeways are recommended to be included.

2. Attention should be focused on the wetland issues, as the Azeka Wetland is under continual pressure from the associated urbanization.

3. A Special Management Area Use Permit will be required.

Should you have additional questions, please contact Don Schneider of this office at 243-7735.

Very truly yours,

Gwen Ohashi Hiraga
for DAVID W. BLANE
Planning Director

DWB:DAS
cc: Clayton Yoshida, Planning Program Manager
Don Schneider, Planner
(F:roadc.ea)

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

LAWRENCE MIIKE
DIRECTOR OF HEALTH

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

In reply, please refer to:
File.

December 5, 1996

Mr. Milton Arakawa, Project Manager
Munekiyo & Arakawa, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

SUBJECT: Proposed Construction of Road "C", North-South Collector Road, Kihei, Maui

We offer the following comments to the subject proposal:

1. Activities associated with the construction phase of the project must comply with the provisions of Chapter 11-46, Hawaii Administrative Rules, "Community Noise Control."

   a. The contractor must obtain a noise permit if the noise levels from the construction activities are expected to exceed the allowable levels of the regulations.

   b. Construction equipment and on-site vehicles requiring an exhaust of gas or air must be equipped with mufflers.

   c. The contractor must comply with the conditional use of the permit as specified in the regulations and conditions issued with the permit.

Should there be any questions, please contact Mr. Daryn Yamada, Supervisor, Noise Section at 586-4700.

Very truly yours,

Jerry Y. Haruno
Environmental Health Program Manager
Noise, Radiation & Indoor Air Quality Branch

Post Office Box 662

KIHEI COMMUNITY ASSOCIATION
KCA

Kihei, Maui 96753

DEC 16 1996

December 16, 1996
FAX: 244-8729

Mr. Milton Arakawa, Project Manager
Munekiyo & Arakawa, Inc.
305 High Street, Suite #104
Wailuku, Hawaii 96793

Dear Milton:

Thank you for your letter of November 18, 1996 inviting the Kihei Community Association to participate in the *"Environmental Assessment process for Road C"*. As the Board of Directors did not meet until December 5, 1996, a response could not be prepared by your deadline of December 6, 1996.

The Board, as well as many members of our community, are extremely concerned about the maintenance of Piilani Highway as a major carrier of the bulk of our N/S traffic. Each time a light/controlled intersection is added, it reduces the utility of the facility that much more. To add an intersection so close to the existing Lipoa light controlled intersection does not appear to be prudent.

The Board has been advised that the State and Federal officials favor the "Road C" alignment which would cause this additional intersection. It is the intention to invite the County of Maui, State of Hawaii DOT and Federal Highway officials to a our ***regularly scheduled public meeting to be held on January 21, 1997 at 7:30 p.m. at the Haggai Institute Ballroom, 175 E. Lipoa Street,*** at which time they could explain their reasons for the proposed alignment.

The KCA Board reserves the right to make further comments as the process continues. Should you have any questions, please do not hesitate to contact ***KCA Director Brian Miskae, the KCA President-elect for 1997 at the KCA office, 879-5390.***

With Aloha,

Carla M. Flood, President
KIHEI COMMUNITY ASSOCIATION

cc: Mayor Linda Crockett Lingle **FAX: 243-7870**

Chapter X

Comments Received During Public Comment Period and Applicable Responses

PUBLIC HEARING SUMMARY

Pursuant to the National Environmental Policy Act of 1969, a public hearing on the Road "C" and North-South Collector Road was held on July 23, 1997 at 7:00 pm at the Kihei Elementary School Cafeteria. Notice of the public hearing was published in the July 8, 1997 edition of the Maui News.

Nine (9) people testified at the public hearing.

Buck Joiner raised a number of questions and concerns:

1. Adequacy of public notice;
2. Why is existing Level of Service at South Kihei Road and Lipoa Street intersection different from 1994 Kihei Traffic Master Plan;
3. Possible extension of North-South Collector Road to Waipuilani Road;
4. Bike paths should be part of the project;
5. Detention basin should not be located next to soccer field;
6. Conduit and sensor boxes at the Lipoa and North-South Collector Road intersection were not discussed; and
7. There was no discussion of environmental impact of use of fill.

A written response to Mr. Joiner is attached.

Jeff Pearson spoke in favor of the project since it will alleviate traffic congestion at Lipoa Street. He also noted that the majority of the money for the project comes from Federal funding.

Kitti Ford spoke in favor of the project since Road "C" will encourage moving away from the strip mall concept and start something that can be considered a true downtown. This will concentrate shops in one area. It will reduce traffic on Lipoa Street and South Kihei Road. The project would also make it easier to use Piilani Highway and will improve access to the Kihei Elementary and Lokelani Intermediate Schools.

Bonnie Monares testified in support of the project since it will ease traffic congestion and help businesses in the area.

Becky Collins testified in favor of the project because the project can only add to the economic vitality of the town.

Bob Diffley noted that he was in favor of the project. He felt that the EA is very thorough and complete, urging acceptance of the document.

Dennis Reid thanked the County for planning its roads and moving ahead and building them. He felt that this project was being done in a good fiscal manner in anticipation of

development that is going to occur naturally.

Mickey Hewitt said he was in favor of the project and feels this is one of the best things that is going to happen in the Kihei area.

AUG 13 1997

LINDA CROCKETT LINGLE
Mayor

CHARLES JENCKS
Director

DAVID C. GOODE
Deputy Director

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

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration

EASSIE MILLER, P.E.
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.
Engineering Division

Solid Waste Division

BRIAN HASHIRO, P.E.
Highways Division

August 13, 1997

Mr. Buck Joiner
3443 Malina Place
Kihei, Hawaii 96753

SUBJECT: CONSTRUCTION OF ROAD "C" AND NORTH-SOUTH COLLECTOR ROAD
FEDERAL AID PROJECT NO. STP-0900(42)

Dear Mr. Joiner:

Thank you for your testimony at the July 23, 1997 public hearing on the subject project. A number of concerns were raised and we would like an opportunity to provide a response.

Regarding the issue of public notice, the notice of availability of the environmental assessment and public hearing was published in the Maui News on July 8, 1997. A copy of the Draft Environmental Assessment and a notification of the public hearing date was also sent to the Kihei Community Association on July 2, 1997.

With regard to the Level of Service (LOS) at the South Kihei Road/Lipoa Street intersection, it is noted that data were collected on the evening of September 9, 1996 and the morning of September 10, 1996. Utilizing the existing traffic signal timing plan, the LOS at the intersection was computed as "A" in the a.m. and "B" in the p.m. peak hours of commuter traffic.

Field observations on the date of the traffic counts indicated little queuing on South Kihei Road in the southbound direction during the p.m. peak hour of commuter traffic. During the a.m. peak hour of commuter traffic, the intersection was observed to operate with very little or no delay.

However, it is acknowledged that on other occasions, traffic in the southbound direction on South Kihei Road was queued from Lipoa Street to the traffic signal at the Azeka's driveway. In the northbound direction, South Kihei Road was backed up from the traffic signal at the Azeka driveway through Lipoa Street to south of Kapu Place. Therefore, although the LOS indications may be satisfactory based upon the traffic volumes, the actual operation at the intersections can be influenced by upstream or downstream traffic conditions (e.g., the commercial driveways between Lipoa Street and Road "C").

It should be noted that the Kihei Traffic Master Plan did indicate a LOS of B/D for this intersection as well.

In any event, the South Kihei Road/Lipoa Street intersection is scheduled to be improved during the next fiscal year by the County of Maui. Additional lanes will be added on South Kihei Road and the traffic signal system will be interconnected with the traffic signals at the Azeka driveway and the new traffic signal at Road "C".

A question was also raised as to whether the North-South Collector Road should be extended further north to Waipuilani Road. The North-South Collector Road extends approximately 700 lineal feet north of its intersection with Road "C". It is noted that this segment is a Federal non-participating cost which is being paid for by the abutting developer. Thus, the 700 lineal foot segment of the North-South Collector Road abuts property proposed to be developed as a shopping center.

As the abutting property to the north up to Waipuilani Road is developed, it is the intent of our Department to recommend that future segments of the North-South Collector Road be constructed at the abutting developer's own cost.

Regarding the issue of bikeways, it is noted that paved shoulders are being provided which could be utilized as a bike route. As abutting properties are developed, our intent is to require sidewalks which are eight (8) feet in width. This would jointly serve bicyclists and pedestrians. For instance, as properties along Road "C", from the North-South Collector Road to the wetland mitigation ponds are developed, we would anticipate that the wider sidewalks would be required of the abutting development. In the case of the proposed commercial development within Project District 5, construction of the eight (8) foot wide sidewalks along their frontages are being built at the commercial development's own cost.

With regard to bike routes within the existing developed portion of Road "C", from the wetland mitigation ponds to South Kihei Road, we do not believe that reducing lane width to provide additional room for bikeways would be a preferable option. A reduction in lane width would raise additional safety concerns for motorists, bicyclists and pedestrians. The other possibility of widening the right-of-way involves cutting and refacing existing buildings and loss of existing parking.

An approximately four (4) acre detention basin is being proposed to the north of the Pi'ilani Commercial Center site abutting the North-South Collector Road. The detention basin is proposed to be grassed and utilized as a playfield. Thus, multiple uses of the site are planned resulting in more efficient resource utilization.

Conduit and sensor boxes at the Lipoa and North-South Collector Road intersection are not being installed with this project. Development is likely to occur at the Kihei Community Center site located to the northeast of the Lipoa/North-South Collector intersection in the near future and there are proposed drainage improvements which are likely to occur at this intersection. Thus, the conduit and sensor boxes at this location are not being included.

With regard to the issue of fill, much of the fill material is anticipated to come from the 3.7 acre borrow site located to the northwest of the Pi'ilani Highway and Lipoa Street intersection. Thus, the borrow site in close proximity to the project site should minimize the number of truckloads of fill traversing on public rights-of-way.

All fill material must meet County specifications. The slope from the edge of the paved roadway and shoulder to adjacent properties should be at a ratio of 1:2 which is in accord with standard engineering practices. Moreover, erosion control measures will be incorporated during the construction period to minimize soil loss and erosion hazards. These measures should result in no adverse impact upon surrounding and downstream properties.

If you have any questions on the above comments, please call Lloyd Lee, Engineering Division Chief, at 243-7745. Thank you for your interest in the project.

Very truly yours,

Charles Jencks
Director of Public Works & Waste Management

JK:mku(ED97-1067)
s:\eng\all\0900-42.bj

cc: Milton Arakawa, Munekiyo & Arakawa, Inc.

BENJAMIN J. CAYETANO
GOVERNOR

ESTHER UEDA
EXECUTIVE OFFICER

'97 JUL 25 P2:12

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
P.O. Box 2359
Honolulu, HI 96804-2359
Telephone: 808-587-3822
Fax: 808-587-3827

July 24, 1997

Mr. David W. Blane
Director of Planning
Planning Department
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Blane:

Subject: Special Management Area Use Permit Application (SM1 970013) for the Construction of Road "C" and North-South Collector Road, Kihei, Maui, TMKs 3-9-02: por. 30, por. 76; 2-2-02: por. 42, por. 43; por. 66, and por. 67

We have reviewed the application for the subject project that was forwarded by your transmittal dated July 18, 1997, and confirm that proposed Road "C" and the proposed North-South Collector Road, as represented on Figure 1 of the application, are located within the State Land Use Urban District.

For your information, segments of the proposed roads are located on lands urbanized under LUC Docket No. A82-536/Haleakala Ranch Company, which involved the reclassification of approximately 189.7 acres of land from the Agricultural District to the Urban District for residential, commercial, recreational, and open space uses.

We have no further comments to offer at this time. We appreciate the opportunity to comment on the subject application.

Should you have any questions, please feel free to call me or Bert Saruwatari of our office at 587-3822.

Sincerely,

ESTHER UEDA
Executive Officer

EU:th

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

AUG 06 1997

'97 AUG -5 P1:10

RECEIVED

August 1, 1997

Mr. David W. Blane
Planning Director
Maui Planning Department
250 S. High Street
Wailuku, HI 96793

Subject: Road "C" and North - South Collector Road
TMK 3-9-002:por of 30, por of 76; 2-2-02:por of 42, por of 43 and por of 66
I.D. No.: SM1 970013

Dear Mr. Blane:

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. Since coordination of the relocation and placement of the existing electrical lines and the placement of new electrical facilities is required, we encourage the developer's consultant to meet with us as soon as practical to verify the project's electrical requirements 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 Shinjo

for Edward L. Reinhardt
Manager, Engineering

ELR/lh

AUG 13 1997

LINDA CROCKETT LINGLE
Mayor

CHARLES JENCKS
Director

DAVID C. GOODE
Deputy Director

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

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration

EASSIE MILLER, P.E.
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.
Engineering Division

Solid Waste Division

BRIAN HASHIRO, P.E.
Highways Division

August 12, 1997

Mr. Edward L. Reinhardt
Manager, Engineering
MAUI ELECTRIC COMPANY, LTD.
210 West Kamehameha Avenue
P.O. Box 398
Kahului, Hawaii 96733-6898

SUBJECT: KIHEI ROAD "C" AND NORTH-SOUTH COLLECTOR ROAD
FEDERAL AID PROJECT NO. STP-0900(42)

Dear Mr. ~~Reinhardt~~ Ed:

We have received a copy of your August 1, 1997 letter to David Blane, Planning Director, pertaining to the subject project.

We intend to coordinate with Maui Electric Company on the relocation and placement of existing and new electrical facilities and lines relating to the subject project.

Thank you for apprising us of your concern.

Very truly yours,

Charles Jencks
Director of Public Works & Waste Management

JK:mku(ED97-1068)
s:\eng\all\0900-42.er

cc: Milton Arakawa, Munekiyo & Arakawa, Inc.

STEWART E. FERN
44-003 Aumoana Place
Kaneohe, Hawaii 96744

'97 AUG -6 A10:35

COUNTY OF MAUI
PUBLIC WORKS

'97 AUG -8 A8:38

ENGINEERING DIVISION
DEPT. OF PUBLIC WORKS

August 2, 1997

(17) 2621

RECEIVED
COUNTY OF MAUI

BRUSH

DEPT. OF PUBLIC WORKS	INFO	ACTION	SEE ME	COMMENTS	COPY	FILE
DIRECTOR						
DEP. DIR						
PERS.						
STAFF CE						
LUCA						
WW I ECL.						
SOLID W.						
ENGR.						
HWYS						
SLOTY						

Re:
Re:
By:

Mr. C. Jencks
Public Works Director
County of Maui
200 South High Street
Wailuku, Hawaii 96793

Mr. Jencks:

My intention was to attend the public meeting in Kihei the 23rd of July. Unfortunately, I was unable to arrange my schedule to permit my vocal support of Road C (Piikea Parkway).

This letter is to provide that support. As a landowner of property in Kihei for nearly 50 years I feel this road is vital to relieve traffic on South Kihei Road and lessen commercial traffic in the school areas on Lipoa. With the new community center directly across from the elementary school it seems doubly important to reduce traffic in this location.

Sincerely,

Stewart E. Fern

Stewart E. Fern

AUG 12 1997

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813-5249
PHONE (808) 594-1888
FAX (808) 594-1865

August 05, 1997

Mr. Milton Arakawa
Muneyiko & Arakawa, Inc.
305 High Street, Suite 104
Wailuku, HI 96793

Subject: Draft Environmental Assessment for Construction of Road "C" and North-South Collector Road, Kihei, Island of Maui.

Dear Mr. Arakawa:

Thank you for the opportunity to review the Draft Environmental Assessment (DEA) for Construction of Road "C" and North-South Collector Road, Kihei, Island of Maui. The Department of Public Works and Waste Management proposes the construction of these roads to mitigate local traffic circulation constraints along South Kihei Road and Piilani Highway.

The Office of Hawaiian Affairs (OHA) has no concerns at this time with the proposed road constructions. These developments apparently bear no significant long-term adverse impacts on adjacent wetlands nor upon existing flora or fauna habitats. Furthermore, no known archaeological remains exist in the area. But OHA expects the preparers to include specific language in the DEA to indicate that if cultural remains are found, archaeological consultation must be immediately sought with the Maui Burial Council.

The Office of Hawaiian Affairs would like to request the preparers' cooperation by providing the agency with a written response to the above concerns. Please contact Lynn Lee, Acting Officer of the Land and Natural Resources Division, or Luis A. Manrique, should you have any questions on this matter.

Sincerely yours,

Randall Ogata
Administrator

Lynn Lee
Acting Officer,
Land and Natural
Resources Division

LM:lm
cc Trustee Clayton Hee, Board Chair
Trustee Abraham Aiona, Board Vice-Chair
Trustee Rowena Akana, Land & Sovereignty Chair
Trustee Haunani Apoliona
Trustee Billie Beamer
Trustee Frenchy DeSoto
Trustee Moses Keale
Trustee Colette Machado
Trustee Hannah Springer
CAC, Island of Maui

AUG · 1 3 1997

LINDA CROCKETT LINGLE
Mayor

CHARLES JENCKS
Director

DAVID C. GOODE
Deputy Director

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

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration

EASSIE MILLER, P.E.
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.
Engineering Division

Solid Waste Division

BRIAN HASHIRO, P.E.
Highways Division

August 13, 1997

Mr. Randall Ogata
Administrator
OFFICE OF HAWAIIAN AFFAIRS
711 Kapiolani Boulevard, Suite 500
Honolulu, Hawaii 96813

SUBJECT: CONSTRUCTION OF ROAD "C" AND NORTH-SOUTH COLLECTOR ROAD
FEDERAL AID PROJECT NO. STP-0900(42)

Dear Mr. Ogata:

We have received a copy of your August 5, 1997 letter to Milton Arakawa pertaining to the subject project.

Pursuant to your comment, we have included language in the Environmental Assessment noting that should cultural remains be found, work in the area of the find shall cease and the State Historic Preservation Division (SHPD) shall be notified to determine appropriate mitigation. If required by SHPD, we will notify the Maui Burial Council accordingly.

If you have any questions, please call Lloyd Lee, Engineering Division Chief, at (808) 243-7745. Thank you for your interest in the project.

Very truly yours,

Charles Jencks
Director of Public Works & Waste Management

JK:mku(ED97-1073)
s:\engla!\0900-42.oha

cc: Milton Arakawa, Munekiyo & Arakawa, Inc.

2648

Longs Drug Stores

General Offices: 141 North Civic Drive, P.O. Box 5222, Walnut Creek, California 94596, (510) 937-1170

August 7, 1997

Mr. Lloyd Lee
Department of Public Works
County of Maui
200 S. High Street
Wailuku, Hawaii 96793

RE: **Support of Road C (Pilkea Parkway) in Kihei**

Dear Mr. Lee:

We understand the Environmental Assessment public hearing was last week. We apologize for not having someone there to represent Longs.

Hopefully, this letter will indicate our complete support for this project. Obviously, it will be beneficial to Longs but we feel it will also benefit the people traveling in the Kihei area by providing a much smoother flow of traffic and relieve Lipoa of a great portion of its business traffic.

If there is any additional information you need, or if you have any questions, please contact me at the above address or by facsimile at 510/210-6887.

Yours very truly,

LONGS DRUG STORES CALIFORNIA, INC.

M. K. Raphel

Michael K. Raphel
Vice President - Real Estate

MKR/bak
cc: Mr. George Killam
Mr. Gerald Saito #809

References

References

Austin, Tsutsumi & Associates, Kihei Traffic Master Plan, October, 1989.

Community Resources, Inc., Maui County Community Plan Update Program Socio-Economic Forecast Report, January, 1994.

Kihei-Makena Citizen Advisory Committee, Recommended Revisions to the Kihei-Makena Community Plan, December 15, 1992.

Kihei-Makena Community Plan Of The County of Maui, July 1985.

Maui Economic Development Board, Inc., Maui County Data Book, December 1994.

Michael T. Munekiyo Consulting, Inc., Special Management Area Permit Application - Road "F"/Kamaole Heights, October, 1993.

Michael T. Munekiyo Consulting, Inc., Special Management Area Permit Application - Royal Kiawe Plaza, December, 1993.

Paul H. Rosendahl Inc., Archaeological Inventory Survey, Piilani Residential Community-Phase I, July 1989.

R.M. Towill Corporation, Bike Plan Hawaii A State of Hawaii Master Plan for Bikeways, Prepared for Highways Division, Department of Transportation, State of Hawaii, April 1994.

R.M. Towill Corp., Public Facilities Assessment Report, prepared for County of Maui, Planning Department, August, 1992.

State Of Hawaii, Department of Business, Economic Development, and Tourism, Data Book, March, 1993.

Telephone conversation with Department of Education employee, Aileen Shirota, September 1996.

Telephone conversation with Department of Fire Control employee, Lee Miyabara, September 1996.

Telephone conversation with Maui Police Department employee, Officer Geri Neff, September 1996.

U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State Of Hawaii, 1972.

University of Hawaii, Department of Geography, Atlas of Hawaii, Second Edition, 1983.

University of Hawaii, Land Study Bureau, Detailed Land Classification-Island of Maui, May, 1967.

Appendices

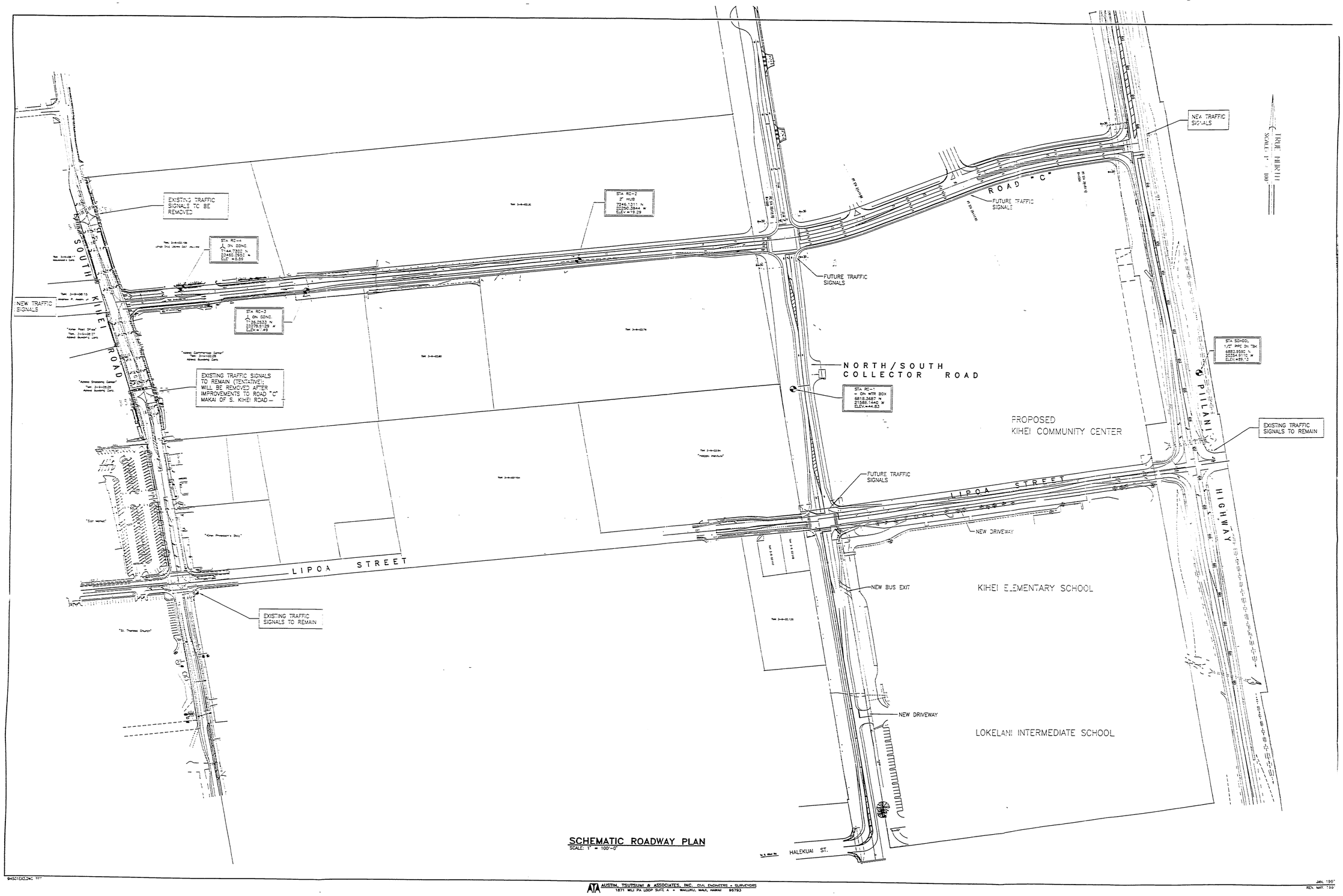
Appendix A

Road "C" and North-South Collector Road Laneage Plan

OVERSIZED DRAWING/MAP

PLEASE SEE 35MM ROLL

0020



SCHEMATIC ROADWAY PLAN

SCALE: 1" = 100'-0"

AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS + SURVEYORS
1871 WILI PA LOOP SUITE A + WAILUKU, MAUI, HAWAII 96793

94501EXD.DWG 927

JAN. 1995
REV. MAY. 1995

Appendix B

Archaeological Inventory Survey and Botanical Survey

INVENTORY SURVEY REPORT
FOR ROAD "C" CORRIDOR,
WAIOHULI *AHUPUA'A*, MAKAWAO
AND WAILUKU DISTRICTS,
MAUI ISLAND
(TMK 2-2-02: por. 66, 67; 3-9-02: 109)

Prepared for:

Munekiyo and Arakawa, Inc.
Wailuku, Hawaii

Prepared by:

Xamanek Researches
P.O. Box 131
Pukalani, Hawaii 96788

Erik M. Fredericksen
Demaris L. Fredericksen

BOTANICAL SURVEY
by
David Paul, B.A.

Revised April, 1995

ERRATA

Page 2, Paragraph 2: *i'lima* should be spelled *'ilima*.

Page 3, Paragraph 1: Reference to Donham, 1990, should read Donham, 1990a.

ABSTRACT

In May of 1994, an archaeological inventory level survey was conducted by Xamanek Researches along the corridor of the proposed collector road known as "Road C". The subject parcel consists of c. 150 foot wide road corridor which would connect South Kihei Road with Pi'ilani Highway, and is located in Waiohuli *ahupua'a*, Wailuku and Makawao Districts, Kihei, Maui, Hawaii. One archaeological site, a low overhang rock shelter was located during the pedestrian portion of the survey. Evaluation of Site 3529 formed the second phase of the inventory survey.

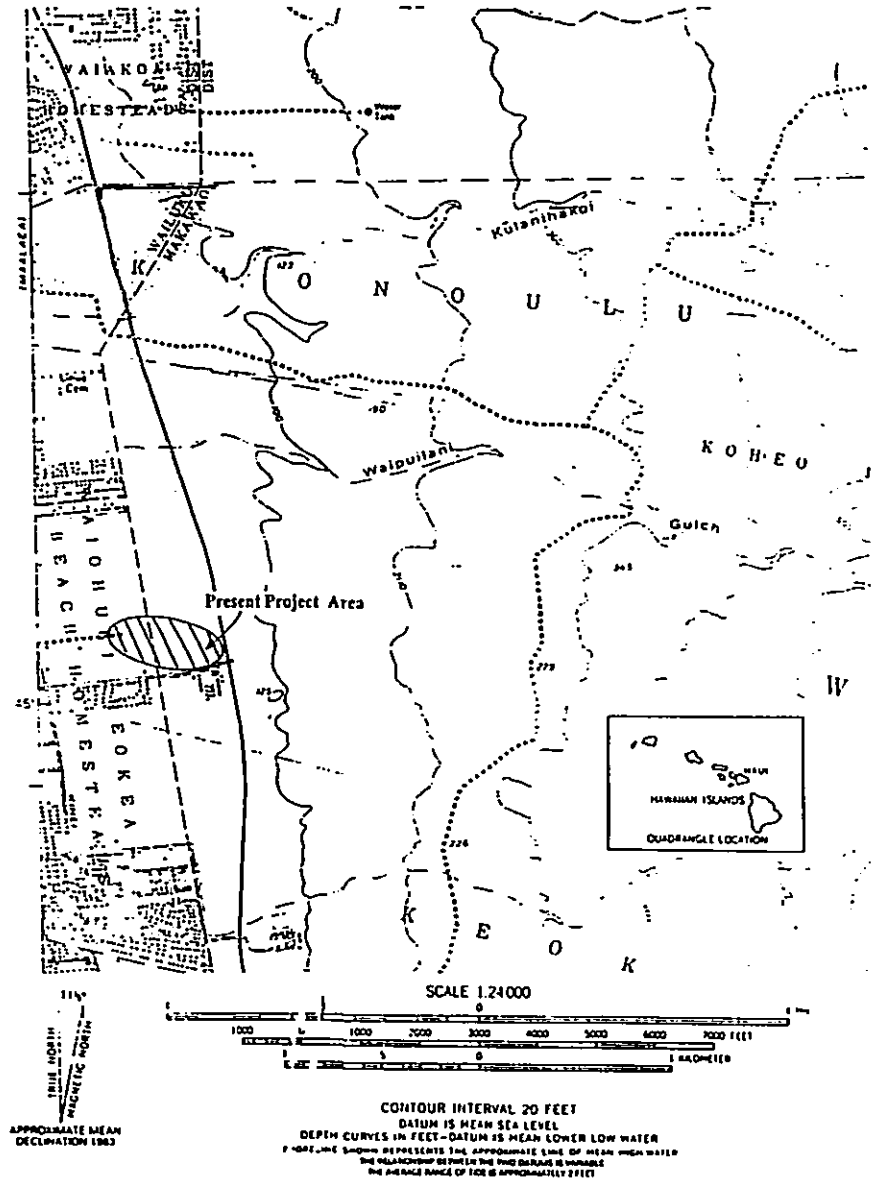
Intensive surface inspection of the site indicated that it had not been disturbed during historic times. Overall site condition ranged from good near the rock shelter to fair on the areas downslope.

Subsurface investigation revealed a c. 20 to 25 cm. thick *in situ* cultural deposit about 20 to 25 square meters in area directly west or *makai* of the rock shelter. In addition, somewhat eroded, thin cultural deposits extended up to 16 m. west, north and south from the rock overhang. In all, 17 shovel tests (ST) and 1 test unit (0.5 m. by 0.5 m. by 0.6 mbs) were excavated at Site 3529. Test Unit #1 yielded quantities of midden, and several indigenous artifacts, including a small coral abrader, a small coral file, a possible bone fish hook blank, a fish bone pick, a pencil urchin file, 2 utilized basalt flakes, and 23 waste flakes of volcanic glass. The majority of the above portable remains were recovered from c. 25 to 50 cmbs. Charcoal flecking was noted in TU #1, but it was not possible to obtain a sufficient sample to submit for analysis. Nine of the 17 shovel tests contained cultural materials. In addition to food midden, 3 waste flakes of volcanic glass and the shank of a 2-piece bone fish hook were found.

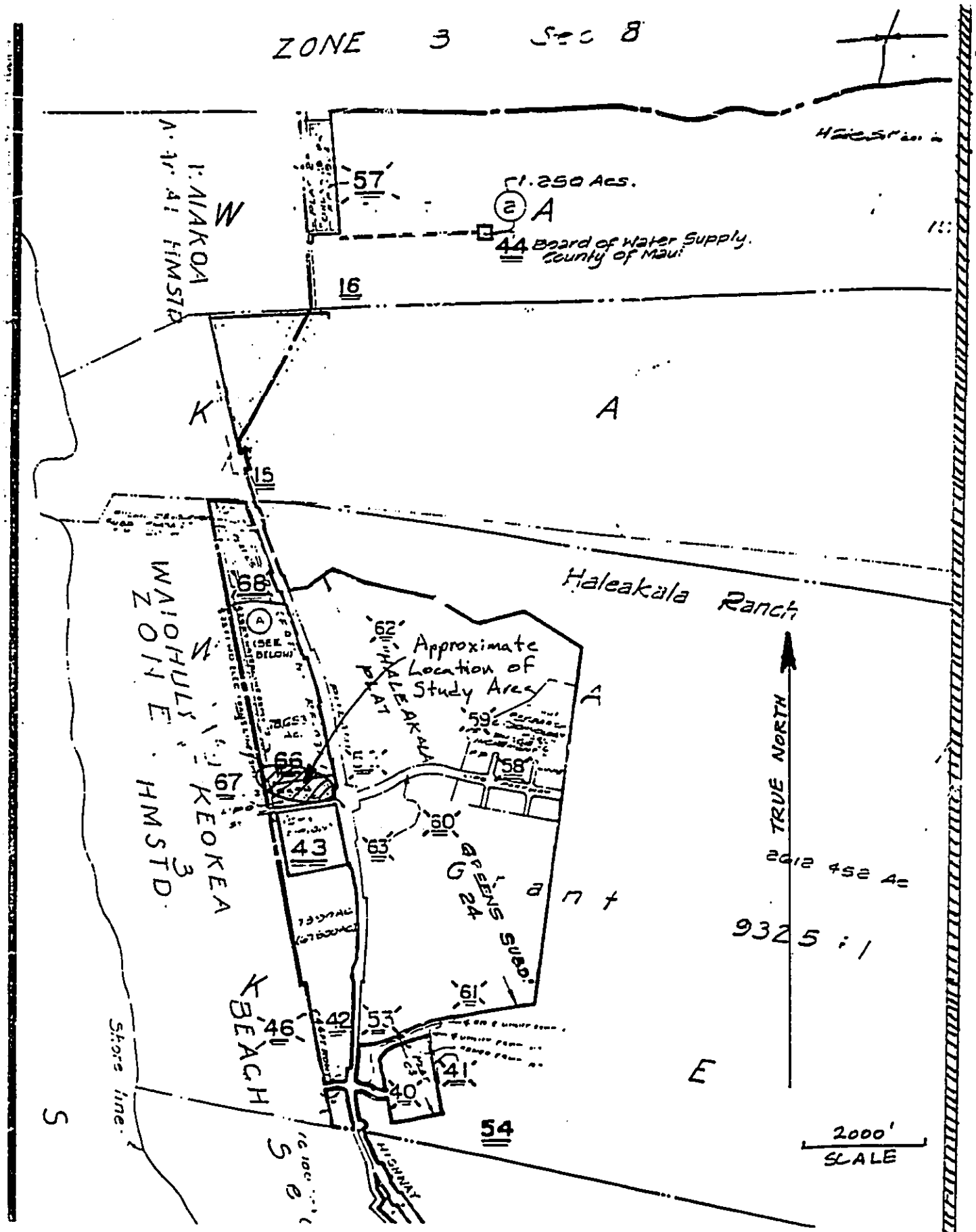
Inventory level survey work identifies Site 3529 as an apparently undisturbed precontact temporary habitation site. This well-preserved site lies in the "intermediate or barren zone" of Kihei, an area which has not been intensively examined. Site 3529 is deemed significant under Criterion "D" of Federal and State historic preservation guidelines. Because of its research potential, it is still considered significant for its information content and requires further mitigative work. The site will be impacted by road construction activities. Consequently, data recovery work is recommended for this archaeological resource.

TABLE OF CONTENTS

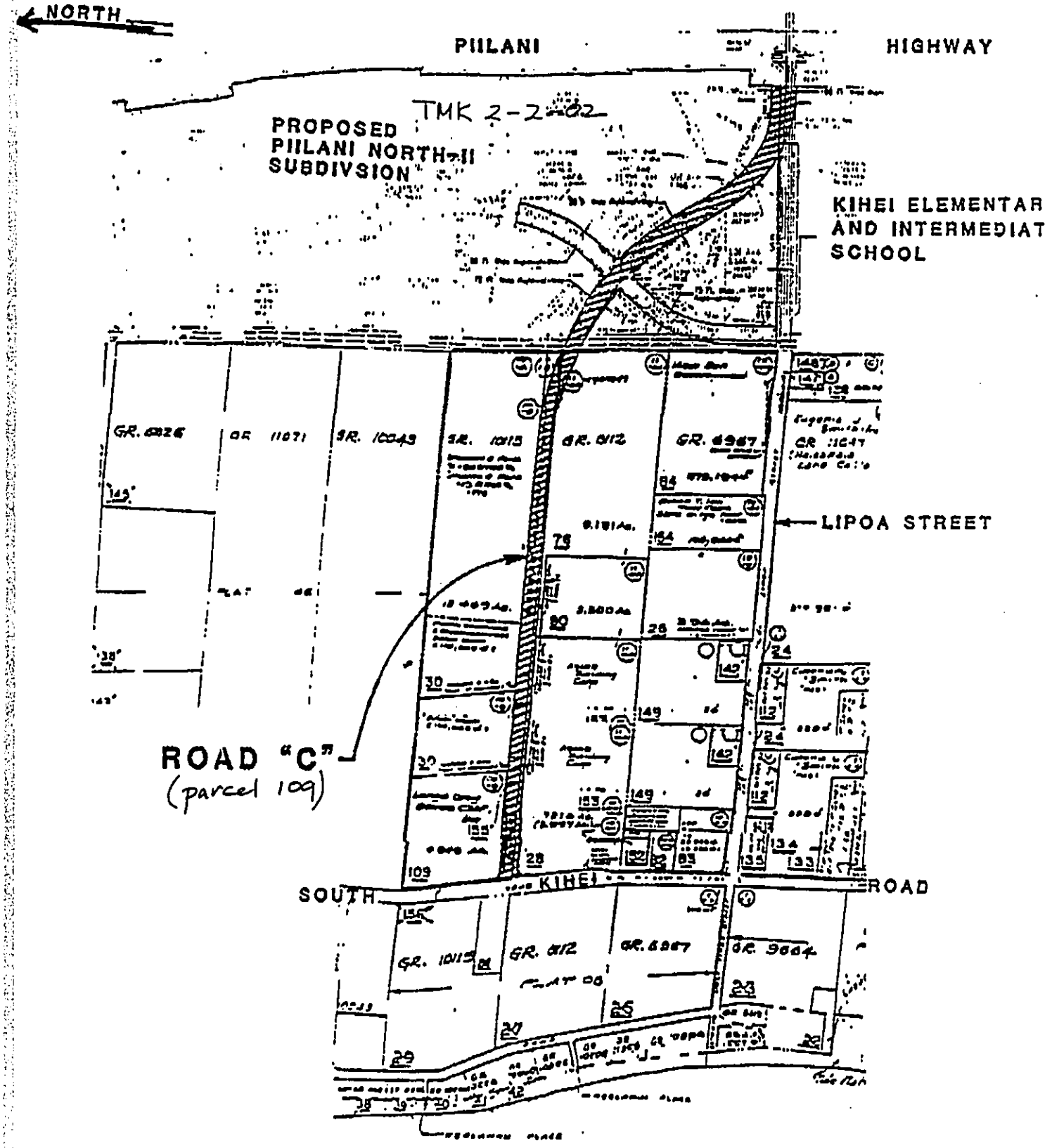
List of Maps, Figures and Photographs



MAP 1 - Topographic Map, U.S.G.S., Puu O Kali Quadrangle, Scale 1:2400, 1983.

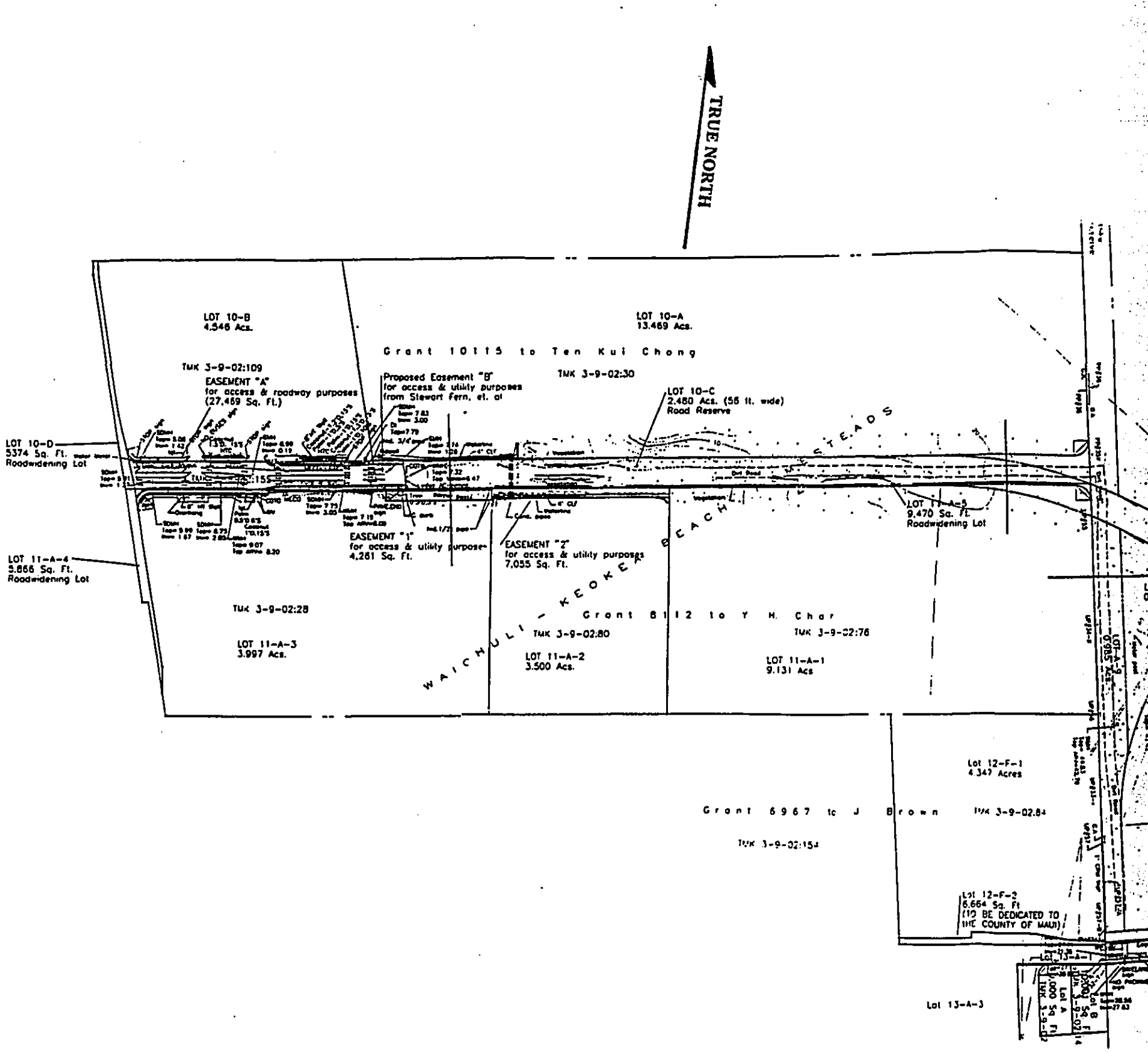


MAP 2 - Tax Map, Zone 2, Section 2, Plat 02, State of Hawaii Tax Map Service.

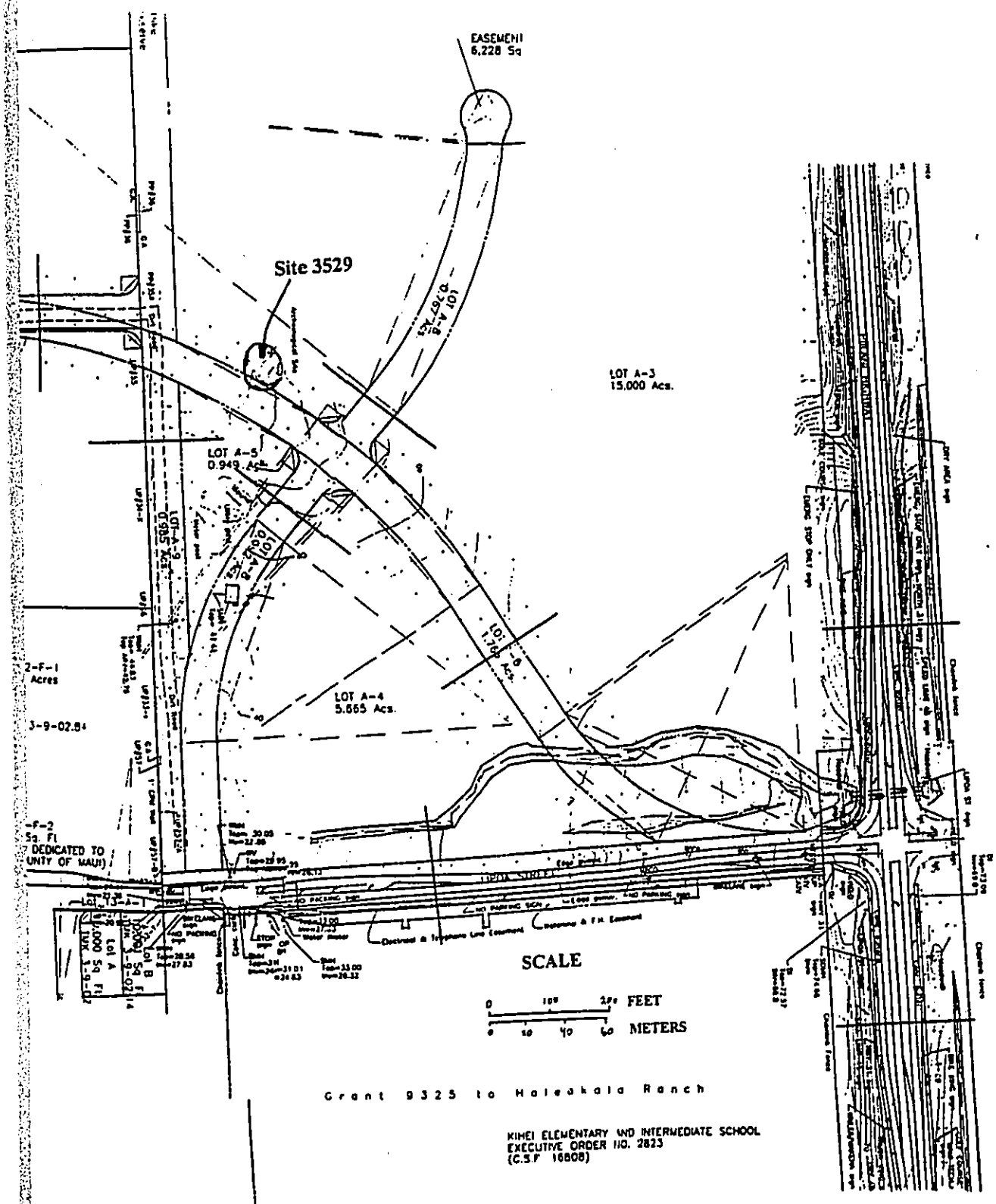


Map 2a - Portion of Tax Map, Zone 3, Section 9, Plat 2, showing parcel 109.

VICINITY MAP- ROAD "C"	AUSTIN, TSUTSUMI, & ASSOC., INC. ENGINEERS. SURVEYORS TMK: 3-9-2 SCALE : 1":600' 4/26/94	EXHIBIT 1



Map 3 - Topographic map of Road "C" study area, including location of Site 3529. (Map by Austin, Tsutsumi and Associates, Inc.)


EASEMENT
6,228 Sq
Site 3529
LOT A-3
15.000 Acs.
LOT A-5
0.949 Acs.
LOT A-6
1.162 Acs.
LOT A-4
5.665 Acs.
2-F-1
Acres
3-9-02:84
-F-2
Sq. Ft
DEDICATED TO
UNTY OF MAUI)
SCALE
0 100 200 FEET
0 50 100 METERS
Grant 9325 to Haleakala Ranch
KIHEI ELEMENTARY AND INTERMEDIATE SCHOOL
EXECUTIVE ORDER NO. 2823
(C.S.F. 16808)

INTRODUCTION

In October of 1993, Xamanek Researches was approached by MTM Consulting, Inc., on behalf of the County of Maui Public Works Division, regarding the undertaking of an archaeological inventory survey along the corridor of the proposed collector road, identified as Road "C". This proposed road would run from Azeka Place II and Longs Drug Store and meet Pi'ilani Highway at the intersection of Lipoa Street near the entrance to Kihei Elementary School and Lokelani Intermediate School. Since the proposed roadway would pass through an existing Federal Wetlands Sanctuary for a portion of its extent, a botanical survey was also requested. We prepared a proposal and it was accepted. The area of the roadway had been surveyed on at least 2 previous occasions by different archaeological firms, so it was not anticipated that significant archaeological finds would be located.

The eastern portion of the Road "C" corridor transects part of the Baldwin*Malama Partnership Pi'ilani Village 187-acre residential and commercial subdivision, and would direct the bulk of the traffic between South Kihei Road and Pi'ilani Highway that is now born by Lipoa Street. Lipoa would dead-end at Kihei Elementary School and Lokelani Intermediate School, taking school traffic out of the mix. The western part adjacent to the Baldwin*Malama property is designated as Lot 10-C "Road Reserve", and is 56 feet wide and consists of 2.480 acres and cuts through Waiohuli-Keokea Beach Homesteads. The final portion which intersects with South Kihei Road is made up of Easement "B" from Stewart Fern, et. al, for access and utility purposes, which bisects the wetlands sanctuaries, and Easement "A", also for access and roadway purposes, which crosses the shopping complex.

On May 21, 1994, our surface archaeological inventory work and botanical fieldwork started. The entire project area, which consisted of a corridor 150 feet in width and approximately three-quarters of a mile in length, was covered by observers.

SURVEY AREA

Natural History

The survey area is located in Kihei, in the *ahupua'a* of Waiohuli, Makawao and Wailuku District, on the island of Maui. It is comprised of a c. 150 foot wide corridor that begins at the Longs Drug and Azeka's Place II developments and ends at the intersection of Pi'ilani Highway and Lipoa Street (Map 3). The total land area is c. 4.5 acres. Elevations range from a low of c. 3 ft. AMSL near the western or *makai* boundary

to c. 66 ft. AMSL near the eastern or mauka boundary near the Pi'ilani Highway and Lipoa Street intersection.

This portion of the Kihei coastal plain is composed of eroded lava from the Kula Series, alluvium from Haleakala volcano, and aeolian deposits primarily associated with the prevailing trade winds. The study parcel is located in an area of generally thin, eroded soil deposits and exposed bedrock outcrops.

Annual rainfall in this area of Kihei is less than 20 inches. The vegetation tends to be dominated by xerophytic species such as buffelgrass (Cenchrus ciliaris), *kiawe* (Prosopis pallida) trees, and scattered *'ilima* (Sida fallax). However, a wetland plant community is present near the western or *makai* boundary of the study area, and there are disturbance plant communities on other portions of the project area (see Appendix B).

BACKGROUND RESEARCH

Previous archaeological work

The subject parcel (TMK 3-9-02: 109 and 2-2-02: por. 66, 67) is located within the large *ahupua'a* of Waiohuli. This land division has been studied by several archaeologists within the last 20 years, in conjunction with tourist resort and commercial development. After consultation with the State Historic Preservation Division, we found that the area that the proposed Road "C" corridor crosses had been part of 2 other, earlier archaeological inventory surveys. One was by Environmental Impact Study Corp. in 1982, and the other was by PHRI in July of 1989, for Baldwin Pacific's Pi'ilani Residential Community, Phase I (TMK 2-2-02: por 42).[1]

The EISC study located one site which was described as "a possible alignment of very loosely stacked basalt extending downslope from an outcrop knoll" (1982, pg. B-4), and did not recommend further work because of low research potential. The PHRI survey, conducted by Theresa Donham (July, 1989), encompassed 114 acres situated along the west side of Pi'ilani Highway, between Kihei Elementary School and Lokelani Intermediate School and the northern border of Waiohuli *ahupua'a*. During that survey 5 new sites were discovered, and 2 others relocated--Site 2476 identified by EISC, and Site 1705 initially recorded by Cordy during his reconnaissance survey for the Corps of Engineers (1977).

Donham's work on all 7 identified sites determined that 2 were bulldozer push piles, and were not assigned SIHP numbers. The other 5 sites were mapped and tested in order to determine their significance. Site 1705 was described as a biface wall, possibly a corral. Sites 2473 and 2475 are thought to be historic dependency structures associated

[1]This large parcel has subsequently been divided and now is identified as Parcels 66, 67 and 68.

with ranching activities. Site 2475 consists of 2 stone cairn features, one of which was recommended for data recovery, as it was thought it might contain human remains. The fifth site, Site 2476 is a complex of 5 rock alignments, which may have had an agricultural function (Donham, 1989, pp. 8-14).

Archaeological data recovery was undertaken in 1990 on Site 2475, to determine if it was a burial complex. Subsurface test excavations did not produce human remains, or evidence of cultural deposits, midden or charcoal. However, further data recovery "indicated that it was a terrace complex covering a major portion of the natural terrace crest and its slopes" (Donham, 1990, p. 10). The site was interpreted as an agricultural complex and appeared "to represent relatively intensive modification of natural slopes for purposes of planting" (Ibid.). The rock alignments that make up Site 2476, which lies nearby, may also be additional terracing. The location of the site, one-half mile *mauka* of the coastal zone, as defined by Cordy (1977), leads Donham to suggest a "coastal perimeter zone", an area which was exploitated more heavily than the "intermediate zone" in general. She suggests the possibility of seasonal usage during periods of increased rainfall, or simply the response to land availability pressures in the coastal zone (Donham, 1990, p. 10).

Two of the first studies in the lowland portion of the *ahupua'a*, were conducted in association with the construction of Pi'ilani Highway (Cox, 1976; Cordy, 1977). The studies by Cox (1976) along the coastal area included information about two *heiau*, Kalaihi Heiau (in the neighboring *ahupua'a* of Kaonoulu), and Kealaipoa Heiau in Waiohuli *ahupua'a*. He also mentions 3 fishponds noted from historic sources, one of which may have been rebuilt by Kamehameha I. Cordy found wall remnants at the mouth of Waipuilani Gulch (Site 1704), which may be the remains of one of these ponds (1977). He also located Site 1705, mentioned earlier, which was in the Pi'ilani Residential Subdivision, of which the present study area is a part.

In 1986, Kennedy conducted a surface reconnaissance survey for the Silversword Golf Course, and reported in a brief letter that no archaeological features were found in the approximate 125-acre survey area. This golf course lies directly to the east of the present project area, and will share the intersection on Pi'ilani Highway with the proposed Road "C".

On the grounds of Lokelani Intermediate School, about 500 meters southeast of the project area, Xamanek Researches excavated a rock shelter, Site 3193, in July of 1993 (Fredericksen, et. al., September, 1993). The shelter was 5.5 meters in length, extended a maximum of 1.6 meters inward, and had a maximum interior height was 0.85 m. The ceiling was dome shaped and dropped to the ground level at either side. A large *kiawe* tree, which had recently burned, had formerly grown at the drip line. The site appears to have been used intermittently, and contained midden, artifacts, and over 100 pieces of volcanic glass. Much of the volcanic glass was waste material, the by-product of knapping activity. Midden was made up primarily of *pipipi* (Nerita picea), cowrie

(Cypraea sp.), and cone shell (Conus sp.). Artifacts consisted of bone picks, coral abraders and a piece of worked bone. Three hearths were excavated, and charcoal from one produced a radiocarbon date of AD 1560-1800 (270 ± 120 RCYBP).

Other archaeological work west or *makai* of the study area in Waiohuli *ahupua'a* was conducted by Xamanek Researches for the Azeka II Shopping Center and Longs Drug Center (Fredericksen, et. al., 1990a and 1990b). No significant archaeological finds were made. However, identification of the wetland areas was established at this time, and subsequently the Federal and State Wetlands Sanctuary was developed. A parcel at the intersection of Lower Kihei Road and Lipoa was also surveyed (Fredericksen, et. al., February 1994), and no significant archaeological finds were made. The above study areas would have likely been within a wetlands area directly east or *mauka* of the coastal zone sand dunes in precontact times.

In the upland region of the *ahupua'a*, PHRI did an inventory survey of Keokea and Waiohuli Subdivision for the Department of Hawaiian Homes Lands (Brown and Haun, 1989). The University of Hawaii-Manoa held an archaeological field school there in the summer of 1994, under the direction of Michael Kolb. Both of these studies identified numerous precontact sites, indicating fairly extensive habitation and agricultural activity in the uplands region.

Historical Background Research

The *ahupua'a* of Waiohuli lies within Makawao District which was considered to be government lands after the Great Mahele. It was officially approved as being Crown Land in 1890 by King Kalakaua (Wong-Smith, 1990, B-3). While a good deal of agricultural activity took place in the mid- and latter 1800's in the upland Kula region, little activity is noted for the lower portions of the *ahupua'a*. No Land Commission Awards (LCA) of native *kuleana* (house and/or garden plots) are found within the project area, nor were any claimed (Donham, 1989, p. 6). The eastern portion of the project area is part of Apana I of Grant 9325 to Haleakala Ranch Company. During the early part of this century, the area had been used primarily for cattle grazing. The importation of grasses (i.e., buffelgrass) for livestock feed has altered the natural flora and ranching activities have no doubt impacted archaeological features that might have existed in the area. The western part of the corridor crosses through Waiohuli-Keokea Beach Homesteads, which were opened for sale in the 1930's.

During World War II, much military activity affected the Kihei area, including operations of the Naval Combat Demolition Training and Experimental Base, the Kamaole Amphibious Training Base, and the Puunene Naval Air Station. The present study area was also likely to have been impacted. Archaeological evidence of such militaty activity was found by the authors during an inventory survey in Kaonoulu *ahupua'a* approximately 1 mile to the north (Fredericksen, et. al., July 1994).

Since the beginning of the 1970s intensive commercial, resort and residential development has altered the landscape of Kihei. This pattern of development is scheduled to continue into the future.

Overview of settlement patterns

The study area lies within what is known as the "barren zone, or intermediate zone" as postulated by Cordy (1977). This is the area between the inhabited coastal and inland zones. Because of generally inhospitable conditions, little human activity is expected, with the exception of intermittent and/or transitory habitation. Donham's identification of agricultural terraces *mauka* of the study area, suggests that the perimeter of the coastal zone may have been more heavily utilized for food production activity than had been previously thought. However, she also noted that agricultural activity could have been intermittent during seasonal increases in rainfall, or periods of overall increased moisture. She proposed another zone, the "coastal perimeter zone" to designate this area.

At present there are relatively few clearly precontact archaeological sites identified in the "intermediate zone". A few radiocarbon dates have been obtained, the majority of which seem to fall within the late precontact to early post-contact period (refer to Table 4), suggesting that little human activity occurred in this region prior to that time. Again, given the somewhat harsh climatic conditions of the area, this is not surprising. As overall population of the island increased, it likely became necessary to begin exploitation of less desirable areas in the late precontact to early post-contact period.

Cordy also postulates (1977, p. 12) that the few sites that would be found in the "intermediate zone" would be temporary in nature, and would be "associated with transportation routes (e.g. trails)". The present study area may represent one of these transportation routes.

ARCHAEOLOGICAL SURVEY METHODS

The field director for the area inventory survey was Erik M. Fredericksen (M.A.), and project directors and coordinators were Walter M. Fredericksen (Professor emeritus) and Demaris L. Fredericksen (Ph.D., abd). Three to 5 persons participated in the inventory level archeological field work phases.

The archaeological inventory survey consisted of two phases. Initially, a pedestrian survey covering 100% of the Road "C" corridor was undertaken (Photos 1-3). The approximately 4.5 acre parcel was visually inspected by crew members spaced c. 5 m. apart. Visibility on the portion of the study area immediately to the east of the

enhanced water fowl habitat was generally poor, due to dense *kiawe* trees and undergrowth. The remainder of the survey area was primarily vegetated with moderate to dense buffelgrass cover and visibility was fair. During the course of the walk-over survey, Site 3529, a low rock shelter, was located in an area of dense buffelgrass cover (see Map 3). No other archaeological sites were identified during the pedestrian survey.

The second phase of the inventory level survey consisted of an evaluation of Site 3529. Initially, the area around the rock shelter was cleared of vegetation. A 0.5 m. by 0.5 m. by 0.6 m. deep test unit (TU #1) and 17 shovel tests (STs #1 to #17) were excavated at Site 3529, in an effort to determine site extent and function (Figure 1). Shovel Tests #15, #16 and #17 were placed at the site after initial fieldwork for the inventory level survey had been completed. These additional 3 tests were excavated to further investigate the shallow soil deposits near ST #5 and an area of exposed surface shell found eroding next to the dirt access road (see Figure 1). The shovel tests were c. 0.3 m. by 0.5 m. by 0.1 to 0.3 m. deep. It was not possible to utilize auger testing at the site because of very stony soil conditions. All units were excavated in 10 cm. levels. All soil from TU #1 was sifted with 1/8" hardware mesh screen, and all soil from the shovel tests was screened through 1/4" hardware mesh cloth. One hundred percent of material culture remains found in the screening process were saved from each 10 cm. level for later laboratory analysis.

A site map was prepared using a hand bearing electronic compass and metric survey tapes. Descriptive notes were kept in the field, and photographs were taken with T-Max 400, black and white film. All notes, photographs, cultural materials, and midden are curated by Xamanek Researches, Pukalani, Maui, Hawaii.

ARCHAEOLOGICAL FIELD RESULTS

The pedestrian survey located one archaeological site with two components. Site 3529 consists of a rock shelter and an associated subsurface *in situ* cultural deposit (Figure 1). Upon discovery, the rock shelter was identified by a low overhang with an exposed opening c. 3 m. wide by 0.4 m. at its highest point (Photo 4, Figure 2). The entrance to this small lava tube and the area in front of it appear to have been filled in over time by aeolian soil deposits. Intensive observation of the general area in front of the rock shelter did not reveal any surface evidence of historic disturbance. Limited subsurface testing at Site 3529 indicated that a relatively thick *in situ* cultural deposit was present in the area directly to the west, or *makai* of the rock overhang. This *in situ* cultural deposit appeared to be c. 20 to 25 square meters in area. In addition, the subsurface deposit fans out from the rock shelter further to the west, north and south, with thin, eroded soil deposits generally less than 15 cm. thick overall. Cultural materials recovered during limited excavation indicate that the rock shelter was likely used as a temporary habitation site. Overall areal dimensions of the Site 3529 subsurface cultural

layer are c. 14 m. N-S by c. 16 m. E-W. A discussion of the above findings follows. Refer to Table 1 for a summary of midden recovered from TU #1, Table 2 for a summary of artifacts recovered at Site 3529, Table 3 for a summary of shovel test results, and Appendix A for detailed descriptions of stratigraphic profiles.

Site 50-50-10-3529

This site is located on a gently sloping open grassland at c. 30 to 34 ft. AMSL (Photos 2 & 4). Surface evidence such as charred *klawe* stumps and charcoal staining indicate that one or more brush fires have occurred in the general area in the relatively recent past. Xerophytic vegetation is dominated by buffelgrass. In general, soils are somewhat eroded and thin. However, a marked exception occurs in the immediate area west or *makai* of the rock shelter (Figure 1). It appears that the mouth of the small lava tube has served as a catchment for wind-born sediment over time. Initial testing indicates that aeolian soil deposits may exceed 60 cm. in depth on this portion of Site 3529. In addition, the small lava tube also appears to have been nearly filled in by wind-sorted soil over time. Intensive surface inspection of the site indicates that it has not been disturbed in historic times, although evidence of past bulldozing activity is present near the western and southeastern borders of the site and c. 50 m. to the southeast. In general, site condition ranges from good to fair. The area of deep soil deposits directly to the west of the rock shelter is in good condition, while the outer portions of the site consisting of thin soils are somewhat eroded and in fair condition. Overall areal dimensions of Site 3529 are c. 14 m. N-S by 16 m. E-W (see Figure 1). The thicker *in situ* cultural deposits directly to the west or *makai* of the rock shelter appear to be c. 20 to 25 square meters in area.

Excavation at Site 3529

As noted earlier, one test unit (TU #1) and 17 shovel tests (STs #1 to #17) were excavated at Site 3529 in order to determine site extent and function. A discussion of subsurface results follows.

Test Unit #1

This unit was placed near the mouth of the small lava tube entrance, in order to investigate subsurface conditions (Figure 2). Surface observation had earlier revealed 2 pieces of echinoderm and 1 *pipipi* (Nerita picea) shell which had been unearthed by a mongoose burrowing into the soil under the rock overhang. Unit dimensions were 0.5 m. by 0.5 m. by 0.6 m. deep.

In all, four wind-sorted soil layers were encountered (Figure 3). The top soil layer yielded very low amounts of midden. Layer I (0 to 20 cmbs) consisted of reddish brown (5 YR 4/3) sandy clay and was slightly stony. Level I (0 to 10 cmbs) of this layer contained 2.5 gm. of marine invertebrates, and 3.3 gm. of bird bone that was close to the surface. Level II (10 to 20 cmbs) also yielded small amounts of marine invertebrate remains (1.5 gm.), a small piece of coral (0.3 gm.) and an unworked basalt flake.

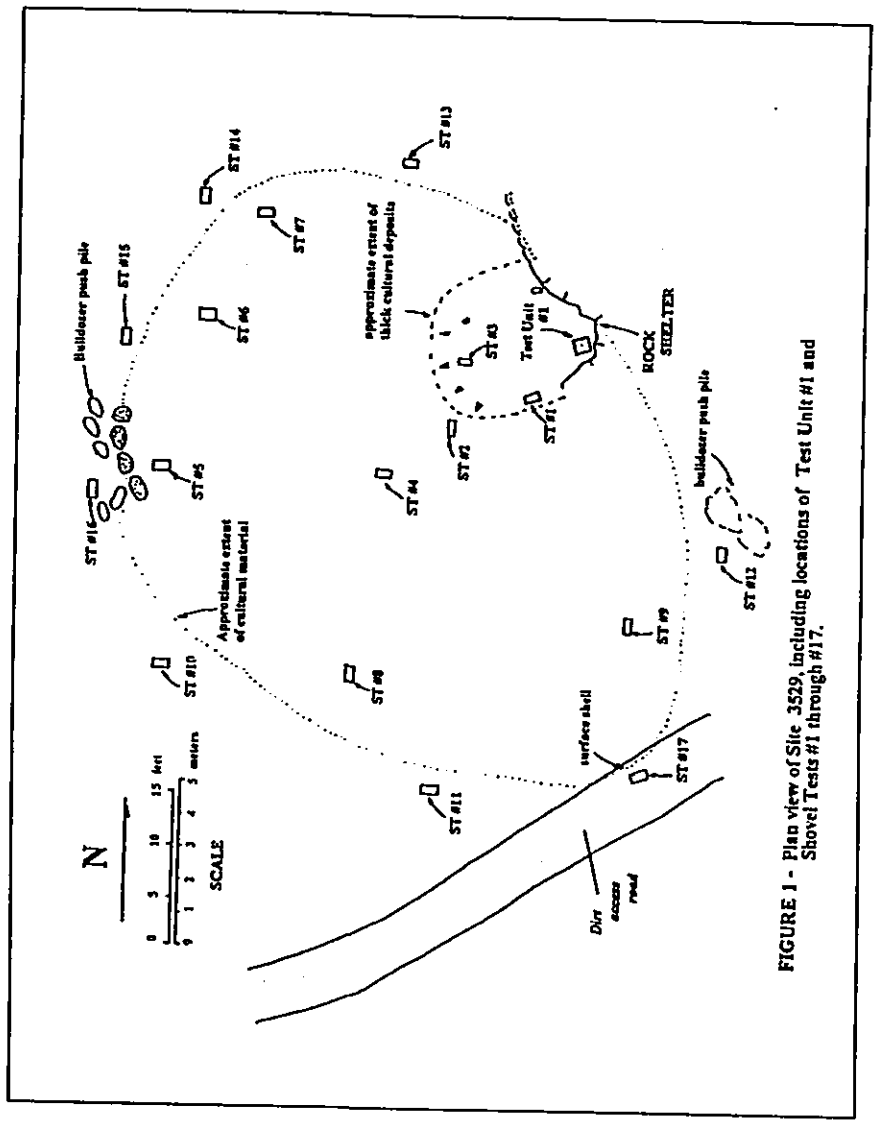


FIGURE 1 - Plan view of Site 3529, including locations of Test Unit #1 and Shovel Tests #1 through #17.

Layer II (c. 20 to 30 cmbs) was comprised of dark brown (7.5 YR 3/4) sandy clay and was moderately stony. This soil layer (i.e. Level I - 20 to 30 cmbs) contained a total of 55 gm. of marine invertebrate remains. *Pipipi* (Nerita picea) accounted for 57.6% of the total, followed by planaxids (7.1%), cowrie (Cypraea sp. - 6.0%) and lesser amounts of other marine invertebrates. In addition, four waste flakes of volcanic glass and 2 unworked basalt flakes were located in the screen. During excavation, it appeared that the lower 5 cm. of Level I (20 to 30 cmbs) contained the bulk of the cultural material found in Layer II.

Underlying Layer II was Layer III, an *in situ* cultural deposit which contained charcoal staining. Layer III (c. 30 to 50 cmbs) was dark grayish brown to dark brown (10 YR 3/2 to 3/3) sandy clay, and was moderately stony. This layer yielded a total of 183.1 gm. of common marine invertebrates, 3.8 gm. of crustacean, 2.2 gm. of fish bone, and 5.2 gm. of unidentified bone. Other portable remains located in Layer III included 2 possible utilized basalt flakes, a coral abrader, a coral file, an incised piece of bone, 19 waste flakes of volcanic glass, 5 unworked basalt flakes, a piece of coral, a bone pick, and a pencil urchin file. In addition, 3 firecracked rocks and charcoal flecking were encountered. Level I (c. 30 to 40 cmbs) yielded a total of 142.0 gm. of common marine shellfish, 11.7 gm. of echinoderm, 2.6 gm. of crustacean, 1.3 gm. of fish bone, 3.1 gm. of unidentified bird bone fragments, a small coral abrader, a small coral file, a small piece of incised bone, 5 unworked basalt flakes, 10 waste flakes of volcanic glass, and a piece of unworked coral. The most common marine shellfish included *pipipi* (Nerita picea-54%), cowrie (Cypraea sp.-27.8%), bivalves (Isognomon sp.-7.2%), and cone shell (Conus sp.-3.7%).

Indigenous artifacts recovered from Level I of Layer III included an incised piece of bone, a small coral file, and a small coral abrader (Photo 5). The small piece of incised bone (a) measures 13.9 mm. long by 6.9 mm. wide by 1.6 mm. thick and weighs 0.6 gm. It appears to have been filed at its tapered end, and an incision crosses the artifact near this end as well. It may be part of a fish hook blank which was discarded. The first coral artifact is a file (b) that weighs 0.8 gm. with dimensions of 22.1 mm. in length by 7.4 mm. in width by 6.1 mm. in thickness. This small, well-used file is roughly triangular in cross section, and appears to have been broken in the past. It also appears to have been used for detailed work, possibly fish hook manufacture. The coral abrader (c) weighs 1.2 gm. and is 27.2 mm. long by 12.8 mm. wide by 6.7 thick. It is roughly triangular shaped in cross-section and has one faceted edge. Its small size suggests that it was used for detailed work such as fish hook manufacture.

The 5 unworked basalt flakes weighed a total of 5.3 gm. and are of generally poor quality material, possibly the result of breakage due to intense heating by fires or natural exfoliation. The 10 waste flakes of volcanic glass weighed a total of 5.1 gm. and ranged in size from 2.5 by 5.5 by 7.1 mm. to 15.9 by 12.1 by 6.2 mm. Many of these volcanic glass flakes were of very poor quality and included an outer weathered "rind", indicating that reduction of raw material occurred at the site, prior to transport inland. In addition to the previously noted portable remains, 3 firecracked rocks and some charcoal flecking

were encountered in Level I. Unfortunately, it was not possible to collect enough charcoal flecks to obtain an adequate radiocarbon sample.

Level II (40 to 50 cmbs) of Layer III produced a total of 29.4 gm. of marine invertebrates. Nerita picea (31%) and echinoderm (50.7%) were most common and small amounts of crustacean, fish bone and unidentified bone were also located. In addition to the previously mentioned portable remains, 4 artifacts including 2 possible utilized basalt flakes, a bone pick and a pencil urchin file were recovered, along with 9 waste flakes of volcanic glass (see Photo 6). The first basalt flake recovered (d) may have been

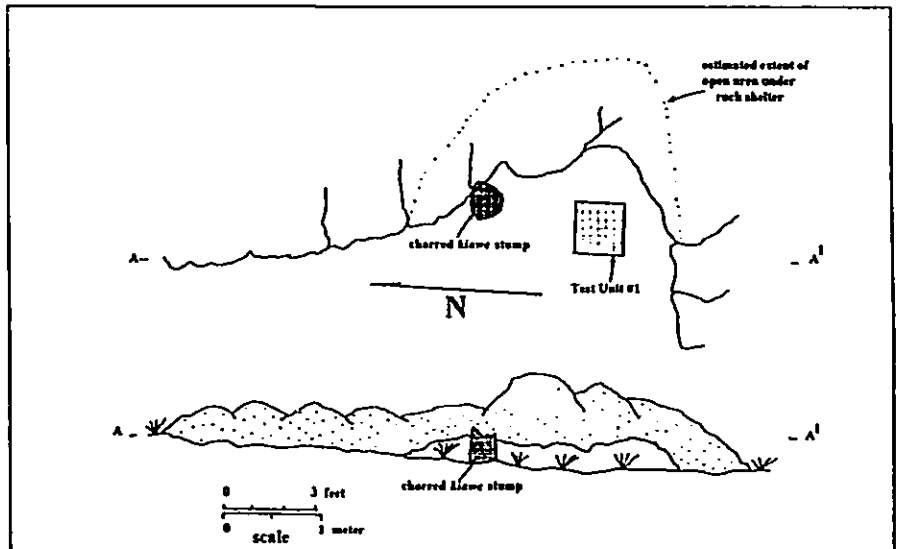


FIGURE 2 - Plan and profile views of Site 3529 rock shelter before excavation showing Test Unit #1.

utilized as a perforator. There appears to be some slight use wear on the tip of the flake. Its dimensions are 17.0 by 9.5 by 3.0 mm. and it weighs 1.8 gm. The second flake (e) may have some use wear along one of its edges. Its dimensions are 20.5 by 8.8 by 2.5 mm., and it weighs 2.2 gm. The bone pick (f) is a fish spine with use polish on its tip. It weighs 0.2 gm. and is 27.7 mm. long. The fourth artifact located in Level 2 is a broken pencil urchin spine (g) that appears to have been utilized as a file. It weighs 1.5 gm. and its dimensions are 29.0 by 8.8 by 7.9 mm. The 9 waste flakes of volcanic glass ranged in

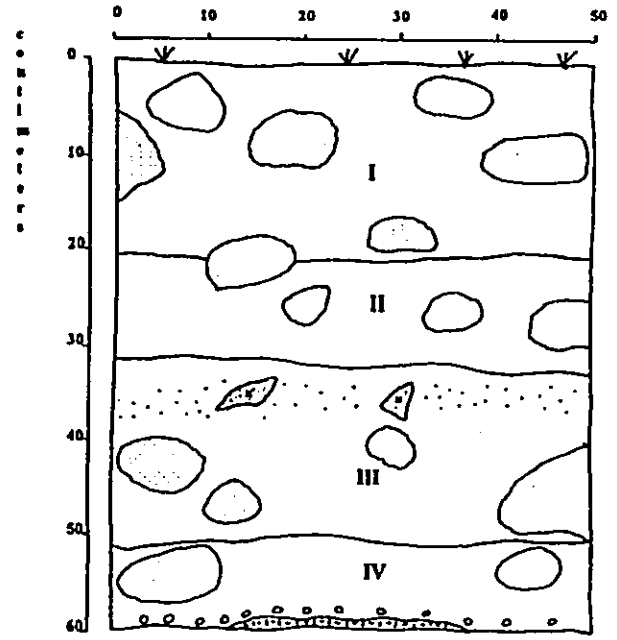


FIGURE 3 - East face profile Test Unit #1, Site 3529.

size from 8.3 by 6.6 by 1.1 mm. to 14.2 by 7.4 by 3.1 mm. and weighed a total of 4.3 gm. Layer III graded into Layer IV soil between 47 and 51 cmbs.

Layer IV (c. 50 to 60 cmbs) soil did not contain charcoal flecking and was dark yellowish brown (10 YR 3/4) sandy clay. It is likely that this soil layer rests on top of bedrock. It contained small amounts of midden and appears to grade to sterile. Level I (50 to 60 cmbs) of Layer IV yielded traces of cowrie (Cypraea sp.), *pipipi* (Nerita picea), fish bone, 1.1 gm. of echinoderm and 1.7 gm. of unidentified bone. Most of this midden material appeared to be associated with the overlying Layer III cultural deposit. However, the stony nature of Layer IV soil hampered efforts to determine whether or not cultural material was present throughout this layer. It appears likely that Layer IV soil grades to bedrock, because decayed bedrock increased as unit depth increased. However, it was not possible to excavate beyond 60 cmbs due to time constraints and test unit size.

Additional Subsurface Testing at Site 3529

Once it was determined that an intact subsurface cultural deposit was associated with the rock overhang, a series of shovel tests (ST) were placed in the general area, in an effort to determine overall site extent. In all, 17 shovel tests, each c. 30 cm. by 50 cm. and ranging in depth from c. 8 to 27 cm. , were excavated at Site 3529 (Figure 1). Of these, STs #1 to #9 contained some cultural materials, while STs #10 to #17 were sterile.

In general, most shovel tests did not exceed 20 cm. in depth, due to shallow soil conditions. Shovel Tests #1 and #3 contained stratigraphy similar to that encountered in TU #1. However, ST #1 was only c. 15 to 17 cm. deep and contained only Layers I and II, while ST #3 contained all 4 soil layers found in TU #1. Shovel Tests #2 and #4 through #17 contained 2 shallow soil layers. Layer I was typically less than 15 cm. thick in tested areas. It consisted of reddish brown (5 YR 5/4) sandy clay and was moderately stony. When present, cultural materials were found in only the top 10 cm. of this layer. Layer II consisted of sterile dark yellowish brown (10 YR 4/6) sandy clay which was very stony. This layer overlaid bedrock in tested areas and tended to be less than 10 cm. thick.

Shovel Test #1

This unit was located c. 3.5 m. southwest of the rock shelter entrance in an area that appeared to contain thick soil deposits. Layer I reddish brown (5 YR 4/3) sandy clay soil was located in this unit. As with Layer I in TU #1, there were relatively small amounts of midden located, adjusting for two large, unutilized pieces of somewhat weathered cone shell (Conus sp.-37.1 gm.) found near the surface of the unit. Layer I was approximately 10 to 12 cm. thick and was underlain by Layer II dark brown (7.5 YR 3/4) sandy clay. It was only possible to excavate c. 5 cm. into Layer II (i.e., c. 15 to 17 cmbs) due to extremely stony soil conditions. It appears probable that excavation could

proceed with a larger unit (i.e. 1.0 by 1.0 m.). Excavation was halted at c. 15 to 17 cmbs and no profile was drawn.

Shovel Test #2

This unit was placed c. 3 m. west of ST #1. Slightly different soil conditions were encountered, and are representative of those also found in STs #4 through #17. Two thin soil layers were noted in this unit (Figure 4). Layer I (0 to 10 cmbs) reddish brown (5 YR 5/4) sandy clay contained a total of 9.3 gm. of marine invertebrates. Cone shell (Conus sp.) was most common, accounting for 63.4% of the total, followed by echinoderm (30.1%) and traces of cowrie (Cypraea sp.) and bi-valve (Isognomon sp.). Layer I was underlain by sterile Layer II subsoil which consisted of dark yellowish brown (10 YR 4/6) sandy clay. This soil layer contained numerous pieces of decayed bedrock and extended from c. 10 cmbs to bedrock at c. 17 cmbs.

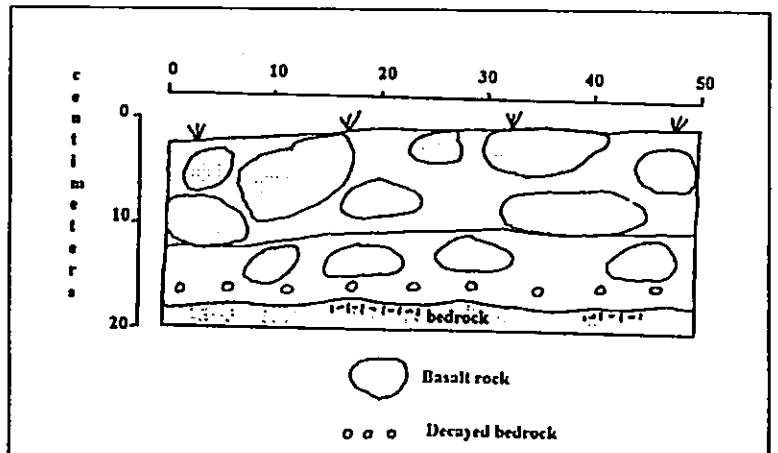


FIGURE 4 - East face profile, Shovel Test #2 .

Shovel Test #3

This unit was placed c. 4 m. from the partly filled-in rock shelter. It was excavated to c. 30 cmbs until very stony soil conditions halted further progress. It is likely that excavation could continue to bedrock with a larger unit size (i.e. 1.0 m. by 1.0

m.) Stratigraphy similar to that encountered in TU #1 was present in ST #3. In all, 4 soil layers were located (Figure 5).

Layer I (0 to 10 cmbs) reddish brown (5 YR 4/3) sandy clay was charcoal stained and yielded 9.3 gm. of common marine invertebrates, including cowrie (Cypraea sp. - 44.1%), cone shell (Conus sp.-38.7%) and bi-valve (Isognomon sp.-17.1%). The surface charcoal staining appears to be associated with recent brush fires in the area. This layer was underlain by soil similar to that found in TU #1. Layer II (c. 10 to 20 cmbs) dark brown (7.5 YR 3/4) sandy clay was moderately stony and appeared to be sterile.

Layer III (c. 18 to 20 cmbs to 26 cmbs) consisted of very dark grayish brown to dark brown (10 YR 3/2 to 3/3) sandy clay. However, this layer was stonier than the corresponding one in TU #1. This layer yielded 7.4 gm. of marine invertebrates. Cowrie (Cypraea sp.-31.1%) and echinoderm (50%) were most common. In addition, 3 waste flakes of volcanic glass were recovered from the screen. Some slight charcoal flecking was noted, but quantities were insufficient to collect for a radiocarbon sample. Layer III appeared to grade into Layer IV soil between 24 and 28 cmbs. However, very stony conditions hampered determination of the soil boundary.

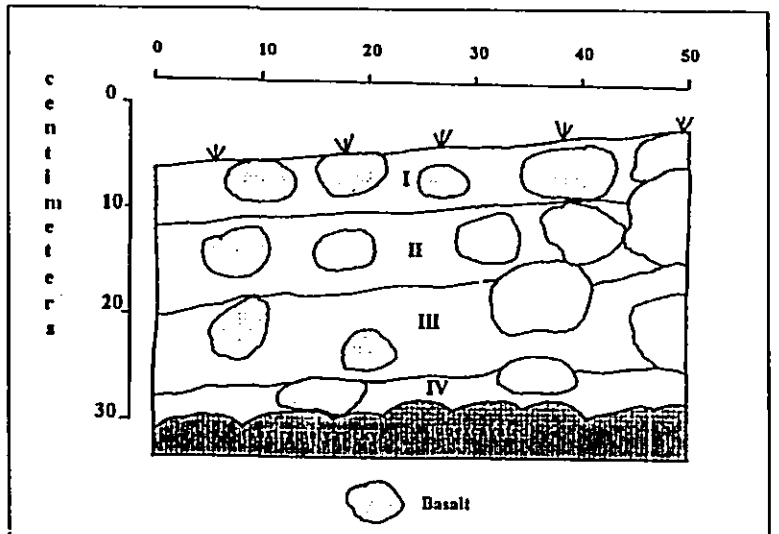


FIGURE 5 - North face profile, Shovel Test # 3.

Layer IV consisted of the dark yellowish brown (10 YR 3/4) sandy clay also noted in TU #1. However, this soil did not appear to have any cultural materials associated with it. Once again, very stony conditions were present in this layer, and excavation was abandoned at c. 30 to 32 cmbs.

Shovel Test #4

This unit was dug about 7 m. downslope from the rock shelter. Two shallow soil layers similar to those present in ST #2 were encountered (see Figure 4). Layer I soil consisted of weathered reddish brown (5 YR 5/4) sandy clay which was quite stony. Layer I (0 to 8-10 cmbs) contained a total of 18.8 gm. of marine invertebrates. Cowrie (Cypraea sp.) accounted for 75.5% of this total, followed by heavily weathered, unidentifiable shell fragments (16.5%), echinoderm (6.4%), and traces of bi-valves and planaxids. There was no evidence of charcoal flecking observed in the soil except near the surface. Layer I graded to Layer II subsoil at about 6 to 10 cmbs. Very stony conditions tended to obscure the soil boundary.

Layer II (8-10 to 18 cmbs) consisted of the dark yellowish brown (10 YR 4/6) sterile sandy clay subsoil. This layer was common in all shovel tests except STs #1 and #3 which were dug near the rock shelter in the area of thicker soil deposits. Excavation was halted when bedrock was reached c. 14 to 18 cmbs.

Shovel Test #5

This test was located c. 15 m. west or *makai* of the rock overhang in an area of shallow soil and exposed outcrop bedrock and apparent bulldozer push. Two stony soil layers were encountered in this 12 cm. deep unit.

Layer I (0 to 4 cmbs) consisted of the common somewhat weathered reddish brown (5 YR 5/4) sandy clay. This stony layer contained 10.8 gm. of common marine invertebrates. Cone shell (Conus sp.) was most common (48.1%), followed by *pipipi* (Nerita picea-24.1%), cowrie (Cypraea sp.-19.4%), and echinoderm (8.3%). In addition, the shank of a 2 piece bone fish hook was recovered (Photo 5). This artifact weighs 0.8 gm., and measures 31.5 mm. by 8.4 mm. by 10.1 mm. It is well made and appears to have been broken in the past. Efforts to locate the other piece(s) were not successful.

Layer I graded into Layer II common dark yellowish brown (10 YR 4/6) subsoil. This soil layer was c. 4 to 6 cm. thick and was sterile. No soil profile was recorded for this unit, due to very stony conditions.

Shovel Test #6

This unit contained 2 soil layers similar to those found in other test instances (see Figure 4). Soil conditions were very stony in ST #6. Layer I (c. 0 to 10 cmbs) consisted of the common weathered reddish brown (5 YR 5/4) sandy clay. A small amount of

common marine mollusks (2 gm.) were recovered in the screen [cowrie (Cypraea sp.), cone shell (Conus sp.) and bi-valve (Isognomon sp.)]. Layer I soil graded into Layer II subsoil between 8 and 10 cmbs.

Layer II (c. 10 to 16 cmbs) was composed of the common dark yellowish brown (10 YR 4/6) sandy clay subsoil. This very stony layer contained pieces of decayed bedrock and was sterile. Excavation was halted when bedrock was reached c. 14 to 16 cmbs. No unit profile was drawn.

Shovel Test #7

This test revealed the 2 common soil layers found elsewhere (see Figure 4). A low quantity of shell midden was recovered from the screen, primarily within c. 6 cm. of the surface. Layer I (0 to 14 cmbs) was comprised of the common reddish brown (5 YR 5/4) sandy clay. Just under 2 gm. of marine shellfish were recovered, including 1.3 gm. of *pipipi* (Nerita picea) and 0.6 gm. of unidentifiable, weathered shellfish remains. Level I (0 to 10 cmbs) contained the above noted materials. The lower 4 cm. of Layer I were sterile (i.e. 10 to 14 cmbs). Layer I soil graded into Layer II subsoil (10 YR 4/6) between 12 and 16 cmbs. Bedrock was encountered between c. 16 and 22 cmbs. No unit profile was recorded for ST #7.

Shovel Test #8

This unit was placed in an area of shallow soil and exposed bedrock. Subsurface results were similar to other tested portions of the site with thin soil deposits (see Figure 4). A small amount of shell was found in the upper 5 cm. of ST #8. Layer I consisted of reddish brown (5 YR 5/4) sandy clay and was moderately stony. This shallow soil layer was c. 8 to 10 cm. thick and contained a total of 1.2 gm. of cone shell (Conus sp.) fragments. These fragments were weathered and may have been exposed to surface conditions in the past. No other portable remains were encountered in ST #8.

Layer II soil was located c. 8 to 10 cmbs and was composed of the common dark yellowish brown (5 YR 4/6) sandy clay subsoil. This soil stratum was sterile. Excavation was halted when bedrock was located c. 12 to 16 cmbs and no unit profile was recorded.

Shovel Test #9

This test was also located in an area of shallow soil. Overall unit depth was c. 10 to 14 cmbs. Less than 1 gm. of common marine shellfish was present in Layer I of this unit. Stratigraphy was similar to other portions of the site with shallow soil deposits. Layer I reddish brown (5 YR 5/4) sandy clay was moderately stony and c. 6 to 8 cm. thick. A total of 0.8 gm. of cone shell (Conus sp.) fragments were recovered in the screen. No other portable remains were encountered. Layer I graded to sterile Layer II dark yellowish brown (10 YR 4/6) sandy clay subsoil. Layer II (c. 8 to 14 cmbs) was

very stony and overlaid bedrock which was encountered between 12 and 14 cmbs. No unit profile was prepared.

Shovel Test #10 through #17

As noted earlier in this report, only STs #1 through #9 contained portable remains. Shovel Tests #10 through #17 contained stratigraphy similar to the above units, but they lacked any cultural materials (see Figures 4 and 6). Layer I reddish brown (5 YR 5/4) sandy clay ranged from c. 4 to 12 cm. deep, while Layer II dark yellowish brown (10 YR 4/6) sandy clay subsoil ranged from c. 4 to 8 cm. deep.

In general, STs #10 through #17 contained shallow soil deposits. Shovel Tests #10, #11, #16 and #17 were less than 10 cm. deep, while STs #12 through #15 were between 10 and 20 cm. deep. As mentioned in the previous paragraph, stratigraphy was similar to other tested portions of the site with shallow soil deposits.

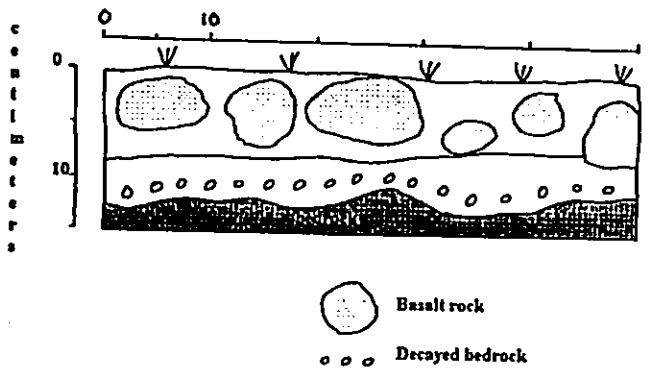


FIGURE 6 - North face profile, Shovel Test #11.

SUMMARY AND CONCLUSIONS

Site 3529 consists of a subsurface *in situ* cultural deposit associated with an overhang rock shelter. Inventory level survey work indicates that this site has not been utilized or disturbed during historic times. Overall site conditions range from good near the rock shelter to fair on the areas downslope. Subsurface investigation indicates that cultural materials are present in small quantities up to about 16 m. west, or *makai*, of the overhang shelter, while thicker cultural deposits, approximately 20 to 25 square meters in area, are present to the immediate west, or *makai*, of the rock shelter.

Limited subsurface testing at Site 3529 suggests that substantial cultural deposits are present in the approximate 20 to 25 square meter area in front of the shelter. Test Unit #1 yielded quantities of midden, including 212.6 gm. of common marine shellfish, 31.4 gm. of echinoderm, 3.8 gm. of crustacean, 2.4 gm. of fish bone, 6.4 gm. of bird bone and 3.8 gm. of unidentified bone fragments. This 0.5 m. by 0.5 m. by 0.6 m. deep test unit also produced several indigenous artifacts including a small coral abrader, a small coral file, a piece of incised bone, a bone pick, a pencil urchin file, 2 possible utilized basalt flakes, and 23 waste flakes of volcanic glass. It is possible that the small coral abrader and file were utilized for detailed work such as fish hook manufacture. It also appears possible that the incised bone is a discarded fish hook blank. Several of the volcanic glass waste flakes were of very poor quality, and possessed outer weathered crust or rind indicating that reduction of raw material took place at the site. The majority of marine shellfish remains (nearly 99%), echinoderm (nearly 92%) and other food material remains as well as almost all other portable remains came from the lower portion of Layer II (20 to 30 cmbs) and all of Layer III (30 to 50 cmbs).

In addition to the above noted portable remains, charcoal flecking and 3 firecracked rocks were encountered in TU #1. Although it was not possible to collect a sufficient amount of charcoal to submit for radiocarbon analysis, it appears probable that adequate quantities of charcoal could be collected from expanded excavation on this portion of the site.

While TU #1 was excavated in order to assess subsurface deposits near the rock shelter, the 17 shovel tests were dug in an effort to evaluate overall site extent. Subsurface results indicate that deposits of material culture remains extend for approximately 220 square meters. Approximately 80 to 90% of the subsurface deposits appear to be relatively thin and somewhat eroded (i.e. 10 cm. or less). In contrast, the area immediately west, or *makai*, of the rock shelter contains thick deposits of soil, possibly greater than 60 cm. in depth, and *in situ* cultural deposits of c. 20 to 25 cm. thick. Portable remains recovered from Shovel Tests #1 through #9 included a total of 89.5 gm. of common marine shellfish, 0.7 gm. of crustacean, 9.9 gm. of echinoderm, 1.9 gm. of bone, 3 waste flakes of volcanic glass and the shank of a 2-piece bone fish hook. These material culture remains are also suggestive of temporary habitation usage.

While it was not possible to recover any adequate radiocarbon samples from tested areas at Site 3529 to submit for analysis, it appears very probable that this site is a precontact one. It is important to note that no historic materials were located during intensive survey of the surface, or limited subsurface investigation. This site appears to be intact and undisturbed. Because Site 3529 is located in the "intermediate or barren zone", an area that has only relatively recently begun to be more closely examined, it is of special interest.

The authors have investigated 2 other rock shelters and a subsurface deposit in this region of Kihei (see Map 4). Site 50-50-10-3193, located on the grounds of Lokelani Intermediate School (Waiohuli *ahupua'a*, Makawao District), lies c. 600 m. to the south of the present study area. This site yielded a radiocarbon date of AD 1560 to 1800, and appears to have been utilized for temporary habitation (Fredericksen, et. al., September 1993). The second overhang shelter, Site 50-50-10-3541, lies in Kama'ole Gulch (Kama'ole *ahupua'a*, Wailuku District) c. 2.5 km. to the south. A radiocarbon date of 220 ± 60 BP, with calibrated results at 2 sigma of AD 1520 to 1570, 1630 to 1890 and AD 1910 to 1950 was obtained (Fredericksen et al, June 1994). The lack of any historic materials associated with this deposit tends to indicate the earlier date range. This site also was utilized for temporary habitation. The third site, Site 50-50-10-2636, is located c. 600 m. to the southwest of Site 50-50-10-3541, upslope from the Coast. It consists of 2 historic modified outcrop features, one possible indigenous feature heavily modified during historic times, and a subsurface *in situ* indigenous cultural deposit. This subsurface deposit produced 2 dates. While the first was based on scattered charcoal which may have been contaminated with charred *kiawe* root, the second was recovered from a subsurface fire hearth remnant and yielded a date of 530 ± 80 BP, with calibrated results at 2 sigma of AD 1295 to 1495 (Fredericksen et. al., November 1994). The first 2 sites suggest indigenous usage of the intermediate zone in the late precontact to early post-contact period, when population pressures stimulated increased utilization of this marginal area. The date from the third site is earlier, and indicates human activity in lower Kama'ole *ahupua'a* at a period considerably prior to contact.

Inventory level survey work identifies Site 3529 as an apparently undisturbed and very probably a precontact temporary habitation site. The undisturbed nature of this site offers a unique opportunity to investigate a precontact site in the intermediate zone, adding further to the body of knowledge for this area.

Site 3529 is deemed significant under Criterion "D" of Federal and State historic preservation guidelines. Because of the research potential of Site 3529 it is still considered significant for its information content and requires further mitigative measures. Site 3529 is in the Road "C" corridor and will likely be impacted by road construction activities. Consequently, data recovery work is recommended for this archaeological resource. A data recovery plan for this site was approved by the DLNR in June of 1994. At the writing of this inventory level report, the data recovery project is nearing completion and a report will be forthcoming.

REFERENCES

Brown, Roderick, and Alan E. Haun
1989 Archaeological Inventory Survey Keokea and Waiohuli Subdivisions, Lands of Keokea and Waiohuli, Makawao District, Island of Maui, prepared for the Department of Hawaiian Home Lands, by PHRI, Hilo.

Cordy, Ross
1977 Kihei Flood Control Project: Archaeological Reconnaissance and Literature Search, Fort Shafter, Hawaii, U.S. Army Corps of Engineers.

Cox, D.
1976 The Archaeology of Kula, Maui from Pulehu Nui Ahupuaa to Kamaole ahupuaa, Surface Survey, Piilani Highway, Department of Transportation, State of Hawaii, Honolulu.

Donham, Theresa
1989 Archaeological Inventory Survey, Piilani Residential Community, Phase I, Land of Waiohuli, Makawao District, Island of Maui (TMK: 2-2-02: por. 42), prepared for Baldwin Pacific, c/o Belt Collins and Associates, Honolulu, by PHRI, Hilo.

1990a Archaeological Data Recovery Program, Site 50-50-10-2475, Piilani Residential Community-Phase I, Land of Waiohuli, Makawao District, Island of Maui (TMK: 2-2-02: por 42), prepared for Belt Collins & Associates, by PHRI, Hilo.

1990b Archaeological Inventory Survey, Piilani Residential Community-Phase II, Land of Keokea, Makawao District, Island of Maui, prepared for Belt Collins & Associates, Honolulu, by PHRI, Hilo.

Environmental Impact Study Corporation
1982 Biological and Archaeological Reconnaissance TMK: 2-2-02: portion of 42, Kihei, Maui, Hawaii.

Fredericksen, Walter M. and Demaris L.
1990 An Archaeological Inventory Survey of an 8.5 Acre Parcel, TMK: 3-9-20: 07, Kihei, Maui, Hawaii, prepared for Richard Takase, Maui Realty, Lahaina, Hawaii, by Xamanek Researches, Pukalani.

July 1990a Report on Archaeological Monitoring of Azeka Place Commercial Center, Kihei, Maui, Hawaii, prepared for Rieke, Sunnland & Kono Architects, Ltd., Kahului, by Xamanek Researches, Pukalani.

July 1990b Report on Archaeological Monitoring of Longs Drug Project, Kihei, Maui, Hawaii, prepared for Rieke, Sunnland & Kono Architects, Ltd., Kahului, by Xamanek Researches, Pukalani.

1991 An Archaeological Inventory Survey of a 3.14 Acre Parcel in Kihei, Maui, Hawaii (TMK: 3-9-17: 26), prepared for Joseph Donaghy, MLH Development Co., Kahului, by Xamanek Researches, Pukalani.

1992 Additional Archaeological Research at Keawakapu View Subdivision (TMK: 3-9-04: 79), Kihei, Maui, prepared for Gresham and Associates, Inc., Kihei, by Xamanek Researches, Pukalani.

Fredericksen, Demaris L., Walter M. and Erik M.
September 1993 An Archaeological Inventory Survey and Data Recovery Report for Lokelani Intermediate School, located in the *Ahupua'a* of Waiohuli, Makawao District, Island of Maui, (TMK: 2-2-02: por. 43), prepared for Murayama, Kotake, Nunokawa & Associates, Honolulu, by Xamanek Researches, Pukalani.

Fredericksen, Demaris L., Erik M. and Walter M.
August 1994 An Archaeological Inventory Survey for Keala Hills Sub-Division, Kama'ole *Ahupua'a*, Wailuku District, Maui Island (TMK: 3-9-30: 21), prepared for Max D. and Ruth A. Soriano, Seattle, by Xamanek Researches, Pukalani.

Fredericksen, Erik M., Demaris L. and Walter M.
June 1994 An Archaeological Inventory Survey of a 24-Acre Parcel, Kama'ole *Ahupua'a*, Wailuku District, Island of Maui (TMK: 3-09-18: 1), prepared for Grant Y.M. Chun, Attorney, by Xamanek Researches, Pukalani.

November 1994 Archaeological Subsurface Testing at Site 50-50-10-2636, Kama'ole *Ahupua'a*, Wailuku District, Maui Island, prepared for Munekiyo and Arakawa, Inc., Wailuku, by Xamanek Researches, Pukalani.

Fredericksen, Erik M., Walter M., and Demaris L.
July 1994 Archaeological Inventory Survey and Botanical Survey Report, Kaonoulu Light Industrial Project, Kaonoulu *Ahupua'a*, Wailuku and Makawao Districts, Island of Maui (TMK: 3-9-01: 16 and 2-2-02: por. 15), prepared for Michael T. Munekiyo Consulting, Inc., Wailuku, by Xamanek Researches, Pukalani.

Fredericksen, Walter M., Erik M., and Demaris L.
February 1994 Archaeological Inventory Survey on Smith Trust Property (Kihei), in Waiohuli *Ahupua'a*, Wailuku District, Maui Island, Hawaii (TMK: 3-9-02: 91, 92, 93, 94, 133, 134, 135), Prepared for Milton Arakawa, MTM Consultants, Wailuku, by Xamanek Researches, Pukalani, Hawaii.

Hammatt, Hallett H. and David Shideler
1989 Archaeological Reconnaissance of a 54-acre parcel at Kama'ole, Wailuku District, Island of Maui, Prepared for Kama'ole Land Ventures by Cultural Surveys Hawaii.

1992 Archaeological Survey and Testing of a 54-Acre Parcel at Kama'ole. Wailuku District, Island of Maui, prepared for Kama'ole Land Ventures, by Cultural Surveys Hawaii.

Kennedy, Joseph
1986 Letter report on Preliminary Archaeological Reconnaissance of Proposed Golf Course. Archaeological Consultants of Hawaii, Honolulu. Prepared for Haleakala Greens Corporation.

1991 An Archaeological Inventory Survey for Keawakapu View Subdivision, located at TMK: 3-9-04: 79, Kama'ole Ahupua'a, Makawao District, Island of Maui, prepared for DKY Realty, Wailuku, Hawaii, by Archaeological Consultants of Hawaii, Haleiwa, Hawaii.

Neller, Earl
1992 An Archaeological Reconnaissance at the Kalama County Beach Park, Kamaole, Maui (TMK: 3-9-12: 13 and 3-9-05: 52).

Pantaleo, Jeffrey, et. al.
1991 Archaeological Inventory Survey of Proposed Kihei Elementary School Sites, Lots 1 and 2, Kama'ole, Wailuku, Maui Island, for Comprehensive Consulting Services of Hawaii, by Public Archaeology Section, Applied Research Group, Bishop Museum, Honolulu.

Rosendahl, Paul
1988 Subsurface Archaeological Reconnaissance Testing, Auhana Road Drainage Project Area, Land of Kama'ole, Wailuku District, Island of Maui, Contract No. 524, for County of Maui, Public Works.

Rotunno-Hazuka, Lisa and Jeffrey Pantaleo
1991 Diamond Resort Parcel--Final Report, for MTM Consulting, Inc., by Public Archaeology Section, Applied Research Group, Bishop Museum, Honolulu.

Sinoto, Aki
1989 Post field Summary of Surface Survey for the Residential Subdivision Development of TMK 3-9-18: 01, Letter report to Michael T. Munekiyo, MTM Consulting, Wailuku, by Bishop Museum Public Archaeology Section, Applied Research Group.

1991 Letter (April 25, 1991) to Martin Luna, Esq., Carlsmith, Ball, Wichman, Murray, Case, Mukai, & Ichiki, Wailuku.

Wong-Smith, Helen
1990 Limited Historical Documentary Research, in Donham, Theresa, Archaeological Inventory Survey, Piilani Residential Community, Phase II (listed above).

TABLE 1

Summary of Midden Recovered at Site 3529, TU #1

Depth in cmbs	0-10	10-20	20-30	30-40	40-50	50-60	TOTAL
Cypraea sp.	-	-	6.0	39.5	2.5	0.5	48.5
Conus sp.	-	-	2.7	5.3	0.9	-	8.9
Isognomon sp.	-	0.1	1.5	10.2	0.1	-	11.9
Granula sandwicensis	-	-	0.4	5.0	0.8	-	6.2
Nerita picea	0.3	0.1	31.7	77.0	9.1	0.3	118.5
Planaxis labiosa	-	-	7.1	0.1	-	-	7.2
Turbo sandwicensis	-	-	-	0.4	-	-	0.4
Thaididae	-	-	-	1.5	-	-	1.5
unidentified shell	0.7	1.2	3.5	3.0	1.1	-	9.5
Echinoderm	1.5	0.1	2.1	11.7	14.9	1.1	31.4
Crustacean	-	-	-	2.6	1.2	-	3.8
fish bone	-	-	-	1.3	0.9	0.2	2.4
bird bone	3.3	-	-	3.1	-	-	6.4
unidentified bone	-	-	-	-	2.1	1.7	3.8

Weight in grams

TABLE 2

Summary of Portable Remains Found at Site 3529

PORTABLE REMAINS	UNIT #	DEPTH (cmbs)	GM	PIECES	L x W x H (mm)
coral	TU #1	10-20	0.3	1	-
unworked basalt flake	TU #1	10-20	6.3	1	-
unworked basalt flakes	TU #1	20-30	1.4	2	-
volcanic glass flakes	TU #1	20-30	8.3	4	10.2 x 6.5 x 3.5 to 20.2 x 16.0 x 11.6
unworked basalt flakes	TU #1	30-40	5.3	5	-
coral abrader	TU #1	30-40	1.2	1	6.7 x 12.8 x 7.2
coral file	TU #1	30-40	0.8	1	22.1 x 7.4 x 6.1
volcanic glass flakes	TU #1	30-40	5.1	10	7.1 x 5.5 x 2.5 to 15.9 x 12.1 x 6.2
incised bone	TU #1	30-40	0.6	1	13.9 x 6.9 x 1.6
coral	TU #1	30-40	26.3	1	-
volcanic glass flakes	TU #1	40-50	4.3	9	8.3 x 6.6 x 1.1 to 14.2 x 7.4 x 3.1
possible utilized basalt flakes	TU #1	40-50	0.4	2	17.0 x 9.5 x 3.0 to 20.5 x 8.8 x 2.5
bone pick	TU #1	40-50	0.2	1	27.7 x 4.4 x 3.7
pencil urchin file	TU #1	40-50	1.5	1	29.0 x 8.8 x 7.9
fish hook shank	ST #5	0-10	0.8	1	31.5 x 8.4 x 10.1

TABLE 3

Summary of Shovel Test Results at Site 3529

Depth in cmbs	Cyprea sp.	Conus sp.	Isognomon sp.	Nerita picea	Planaxis labiosa	unidentified shell	Crustacea	Echinoderm	unidentified bone
ST 1 (0-10)	-	37.1	-	0.6	-	-	-	1.0	1.9
ST 2 (0-10)	0.5	5.9	0.1	-	-	-	-	2.8	-
ST 3 (0-10)	4.1	3.6	1.0	-	-	-	0.3	0.3	-
ST 3 (10-20)	-	-	-	-	-	-	-	-	-
ST 3 (20-30)	2.3	-	-	-	-	-	-	-	-
ST 4 (0-10)	14.2	-	0.1	-	-	-	-	-	-
ST 5 (0-10)	2.1	5.2	-	-	-	0.8	0.4	3.7	-
ST 6 (0-10)	0.8	0.9	0.3	-	-	-	-	1.2	-
ST 7 (0-10)	-	-	-	-	-	-	-	0.9	-
ST 8 (0-10)	-	1.2	-	-	-	0.6	-	-	-
ST 9 (0-10)	-	0.8	-	-	-	-	-	-	-
ST 10	sterile								
ST 11	sterile								
ST 12	sterile								
ST 13	sterile								
ST 14	sterile								
ST 15	sterile								
ST 16	sterile								
ST 17	sterile								
TOTAL	24.0	54.7	1.6	0.6	0.1	4.5	0.7	9.9	1.9

Weight in grams

TABLE 4

Radiocarbon dates from Kihei sites (Intermediate Zone)
(Beta Analytic, Inc.)

Site number	Location	Radiocarbon Date
50-50-10- 3193[2]	Lokelani Intermediate School (Waiohuli *ahupua'a*) Rock shelter	270 ± 120 RCYBP (AD 1560-1800)
50-50-10-3541[3]	Kama'ole Gulch Rock shelter (Kama'ole *ahupua'a*)	220 ± 60 RCYBP (calibrated results at 2 sigma- AD 1520-1570, 1630-1890 and 1910-1950)
50-50-10-2636[4]	Road "F" Corridor (Kama'ole *ahupua'a*) Open site (hearth remnant)	530 ± 80 RCYBP (calibrated results at 2 sigma- AD 1295-1495)
	Open site (scattered charcoal)	140 ± 60 RCYBP (calibrated results at 2 sigma- AD 1650-1950)

[2]Fredericksen, et. al, September 1993.
[3]Fredericksen, et. al., June 1994.
[4]Fredericksen, et. al., November, 1994.

APPENDIX A

Soil Profile Descriptions for TU #1, Site 3529

Layer I: Reddish brown (5 YR 4/3); sandy clay; slightly stony (common subangular pebbles and cobbles of basalt); apedal to very weakly developed subangular blocky structure; fine to medium texture; loose to soft, dry consistency; common live rootlets; contains small amounts of midden and some charcoal flecking (likely due to relatively recent brush fires). Layer I is c. 20 cm. thick in TU #1.

Layer II: Dark brown (7.5 YR 3/4); sandy clay; moderately stony (many subangular pebbles and cobbles of basalt); very weakly developed subangular blocky structure; fine to medium texture; soft, dry consistency; common live rootlets and dead woody roots present; contains common midden - especially in the lower 5 cm. of Layer II and small amounts of charcoal flecking. Layer II is c. 10 cm. thick in TU #1(i.e. c. 20 to 30 cmbs).

Layer III: Very dark grayish brown to dark brown (10 YR 3/2 to 3/3); sandy clay; moderately stony (many subangular pebbles and cobbles of basalt; weakly developed subangular blocky structure; fine to medium texture; soft, dry consistency; some live rootlets and dead woody roots present; contains quantities of midden, some artifacts, a few firecracked rocks, charcoal staining, and small amounts of charcoal flecking. Layer III is c. 20 cm. thick in TU #1 (i.e. c. 30 to 50 cmbs).

Layer IV: Dark yellowish brown (10 YR 3/4); sandy clay; moderately stony (many subangular pebbles and cobbles of basalt and decayed bedrock); weakly developed subangular blocky structure; fine texture; soft, dry consistency; few dead rootlets and dead woody roots present; contains small amounts of midden, appears to grade to sterile beyond excavation bottom. Layer IV is at least 10 cm. thick in TU #1 (i.e. c. 50 to 60 cmbs).

Soil Profile Descriptions for STs #2, and #4 to #17, Site 3529

Layer I: Reddish brown (5 YR 5/4) sandy clay; moderately stony (many subangular pebbles and cobbles of basalt and decayed bedrock); weakly developed subangular blocky structure; fine texture; soft to slightly hard,

dry consistency; common live rootlets and few dead woody roots present; contains charcoal staining from recent brush fires and, when present, small amounts of midden. Layer I is typically less than 15 cm. thick in tested areas.

Layer II: Dark yellowish brown (10 YR 4/6); sandy clay; very stony (abundant subangular pebbles and cobbles of decayed bedrock; weakly developed subangular blocky structure; fine texture; slightly hard, dry consistency; some live rootlets present; sterile in tested areas. Layer II subsoil was generally less than 10 cm. thick in tested areas.

APPENDIX B

BOTANICAL SURVEY

by
David Paul, B. A.

Introduction

A botanical survey was conducted by David Paul, B. A. (ethnobotanist and botanical consultant to Xamanek Researches) on May 21 and 22, 1994. The survey covered a 150 foot wide strip of land identified as Road "C" Corridor, running from South Kihei Road to Pi'ilani Highway, located on TMK: 3-9-2: por 109; and 2-2-02: por. 66 and 67 in Kihei, Maui, Hawai'i.

The purpose of this study is to describe the vegetation existing on the land and identify ecologically significant plants and biological communities which may be impacted by the project planned for the area. Careful consideration was taken in the search for rare and endangered species which are protected by law and might require mitigation.

Methods

The study was initiated by searching literature to point out any plant species which are listed as threatened or endangered by the U.S. Fish and Wildlife Service that might occur within the region. Those listed plants are protected by Federal and State law. Updated lists of threatened and endangered species were researched as prepared by the USFWS, Pacific Islands Office, Honolulu, HI. (March 28, 1994) and the plants geographical ranges were determined from the "Manual of the Flowering Plants of Hawai'i" (Wagner, et al. 1990).

The survey was executed by walking the perimeters of the proposed roadway, going up and down it's central area, and meandering through it. All species of vascular plants which were encountered, were recorded. The plant community was matched up with a general vegetation type, as provided by Gagne and Cuddihy (1990). Nomenclature for flowering plants follow Wagner, et al. (1990). Nomenclature for ferns and their allies follow Neal (1965).

Results

Vegetation Type- There are three distinct communities found along the survey area. Disturbance communities are found along the dirt road on the lower *(makai)* side of the survey area, and at the top of the survey area which meets at the Pi'ilani Highway and Lipoa Road intersection, adjacent to and including a drainage ditch there *(mauka)*.

A "Coastal Wet Herbland" (Gagne & Cuddihy, 1990) community flanks both sides of the dirt road on the lower (makai) side of the survey area. This area also includes a U.S. Fish and Wildlife Service, "Wetland Sanctuary" which is divided by the dirt road on the proposed roadway.

A "Coastal Dry Forest" (Gagne & Cuddihy, 1990) community covers the majority of the survey area. This community begins immediately above *(mauka)* the disturbance and wetland communities on the lower *(makai)* side of the survey area.

The disturbance community is composed mostly of alien species, including khaki weed (Alternanthera pungens), *pakai kuku* (Amaranthus spinosus), cow pea (Macroptilium lathyroides), and spurges (Chamaesyce spp.). There were a number of coastal indigenous species found too, because of the saline conditions there, especially in the lower (makai) side of the survey area. These include *'ilie'e* (Plumbago zeylanica), *nena* (Heliotropium currassavicum), and *'ihi* (Portulaca lutea). Of interest is an alien species known as tansy mustard (Descurainia sophia) which was found in the disturbance community by the Pi'ilani Highway and Lipoa Road intersection. This plant has previously only been found at higher altitudes on Haleakala, Maui and along Saddle Road on the island of Hawai'i (Wagner, et al. 1990).

The wetland community is dominated by pickleweed (Batis maritima), Indian fleabane (Pluchea indica), and other species which are "Regional Indicator" species of wetland habitats (Reed, 1988). This area also includes indigenous species such as *'akulikuli* (Sesuvium portulacastrum), *pohuehue* (Ipomoea pes-caprae), and *nena* (Heliotropium curassavicum).

The dry forest community is dominated by buffelgrass (Cenchrus ciliaris), which is estimated to cover more than 90% of the ground in that community. There is a dwindling canopy of *kiawe* (Prosopis pallida) across this area which suffers from occasional brush fires and cutting for firewood. *Koa haole* (Leucaena leucocephala) and slender mimosa (Desmanthus virgatus) are found scattered across this community, as well as two indigenous species, which are *'ilima* (Sida fallax) and *'uhaloa* (Waltheria indica).

There were no ferns or fern allies found in the survey area at the time of the survey. The species found represent some of the species normally associated with the communities found there. The number of species may change over time due to succession and climatic differences.

Rare or Endangered Plants- No plants which are listed as threatened or endangered by the U.S. Fish and Wildlife Service were found on the property. All of the communities found in the survey area contained either alien or indigenous plant species. No plants which are specifically found in Hawai'i (endemic) were found at the time of the survey.

Ophioglossum concinnum is an endangered species of fern which is found in lowland sandy soils. An Ophioglossum species was found in 1989 in Kihei, Maui, growing abundantly in sandy soil at the base of buffelgrass tufts (Fredericksen, et al. 1990). On May 22, 1994, an extensive search was made through the buffelgrass in the survey area for Ophioglossum species. No Ophioglossum species or any other ferns were found in the survey area.

Discussion and Recommendation

Biological Resource Value of the Vegetation- For the purpose of this report, alien dominated plant communities are considered to have no biological resource value. Plants and communities that are considered to have value are, 1) rare and endangered native plant species, and 2) native plant dominated communities. Plant communities are especially valuble when they contain a variety of plant species found nowhere else.

No legally protected threatened or endangered species were found in the survey area. Endemic plant species which are specific to the State of Hawai'i were not found either. The existing plant communities are dominated by alien species. Native plants which are located in the survey area are indigenous and are commonly found in the State of Hawai'i, and elsewhere in the world.

Recommendations- No plant species which was observed on this study requires priority for legal protection or conservation. Therefore, the actions of the proposed project will not impact any plant species with significant biological resource value. However, the wetland community found at the lower *(makai)* side of the project area provides significant biological resource value for animal life. Although there were no plants found in the wetland community (within the survey area) which require legal protection, the habitat is utilized by rare bird species. The impact of the proposed roadway on this habitat should be considered before undertaking the project.

Species List

Key- Botanical Name - comprised of the Genus and species of a plant as depicted by Western binomial

nomenclature.
Common Name - comprised of Hawaiian or local common terms.

Status - *E = endemic, specific to the immediate area.

I = indigenous, specific to a geographical region.

*P = Polynesian, introduced to Hawai'i prior to 1778.

A = alien, introduced into historical Hawai'i.

* Note, there were no endemic or Polynesian plants found in the survey area.

The following list is comprised of the plant species which were found during the botanical survey conducted on the 21st and 22nd of May, 1994.

Botanical Name	Common Name	Status
Class MAGNOLIOPSIDA	Dicots	
AIZOACEAE	Carpetweed family	
Sesuvium portulacastrum	*'akulikuli*	I
AMARANTHACEAE	Amaranth family	
Alternanthera pungens	khaki weed	A
Amaranthus spinosus	*pakai kuku*	A
ANACARDIACEAE	Mango family	
Schinus terebinthifolius	Christmas berry	A
ASTERACEAE	Sunflower family	
Bidens pilosa	*ki nehe*	A
Pluchea fosbergii	-	A
Pluchea indica	Indian fleabane	A
Pluchea symphytifolia	sourbush	A
Sonchus oleraceus	*pualele*	A
Tridax procumbens	coat buttons	A
Verbesina encelioides	golden crown beard	A
Xanthium strumarium	*kikania*	A

BATACEAE	Saltwort family	
Batis maritima	pickleweed	A
BORAGINACEAE	Borage family	
Heliotropium currasavicum	*nena*	I
BRASSICACEAE	Cabbage family	
Descurainia sophia	tansy mustard	A
CHENOPODIACEAE	Goosefoot family	
Atriplex suberecta	saltbush	A
Chenopodium murale	*'aheahea*	A
CONVULVULACEAE	Morning Glory family	
Ipomoea pes-caprae	*pohuehue*	I
Ipomoea triloba	little bell	A
Merremia aegyptia	*koali kua hulu*	I
CUCURBITACEAE	Cucumber family	
Cucumis dipsaceus	teasel gourd	A
EUPHORBIACEAE	Poinsettia family	
Chamaesyce hirta	garden spurge	A
Chamaesyce hypericifolia	graceful spurge	A
Chamaesyce prostrata	prostrate spurge	A
Euphobia heterophylla	*kaliko*	A
Ricinus communis	castor bean	
AFABACEAE	Bean family	
Crotalaria pallida	smooth rattlepod	A
Desmanthus virgatus	slender mimosa	A

Desmodium tortuosum	Florida beggarweed	A
Indigofera suffruticosa	indigo	A
Leucaena leucocephala	*koa haole*	A
Macroptilium atropurpureum	wild bean	A
Macroptilium lathyroides	cow pea	A
Prosopis pallida	*kiawe*	A
MALVACEAE	Hibiscus family	
Abutilon grandifolium	false *'ilima*	A
Malva parviflora	cheese weed	A
Malvastrum coromandellianum	false mallow	A
Sida fallax	*'ilima*	I
Sida rhombifolia	false *'ilima*	A
NYCTAGINACEAE	Four-o'clock family	
Boerhavia coccinea	false *alena*	A
PLUMBAGINACEAE	Leadwort family	
Plumbago zeylanica	*'ilie'e*	I
PORTULACACEAE	Purselane family	
Portulaca lutea	*'ihi*	I
SOLANACEAE	Potato family	
Nicandra physalodes	apple of Peru	A
Nicotianna glauca	tree tobacco	A
Solanum americanum	*popolo*	I
STERCULIACEAE	Chocolate family	
Waltheria indica	*'uhaloa*	I
ZYGOPHYLLACEAE	Creosote bush family	
Tribulus terrestris	puncture vine	A
Class LILOPSIDA	Monocots	

CYPERACEAE	Sedge family	
Cyperus rotundus	nut sedge	A
POACEAE	Grass family	
Cenchrus ciliaris	buffelgrass	A
Chloris barbata	fingergrass	A
Cynodon dactylon	manienie	A
Eragrostis pectinacea	Carolina lovegrass	A
Panicum maximum	Guinea grass	A

References

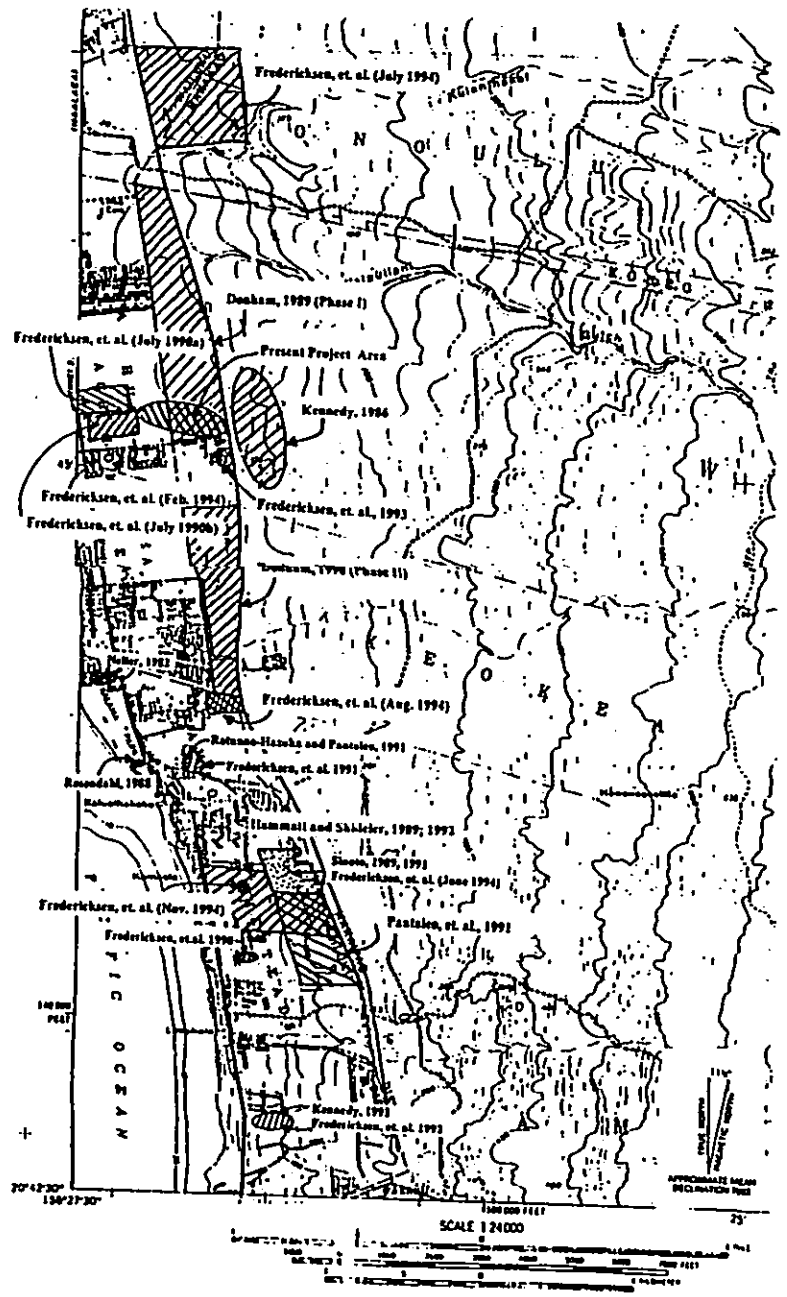
Gagne, W.C. & Cuddihy, L.W. 1990. "Vegetation". in Wagner, et al. Eds. "Manual of the Flowering Plants of Hawai'i". University of Hawaii Press. Honolulu, HI. pp.45-114.

Neal, M.C. 1965. "In Gardens of Hawai'i". Bishop Museum Press. Honolulu, HI. 924p.

Reed, P.B., Jr. 1988. "National List of Plant Species that Occur in Wetlands: Hawaii (Region H)". USFWS Biological Report 88(26.13). 88p.

U.S. Fish and Wildlife Service. 1994. "Hawaiian Islands Listed, Proposed or Candidate Species Under the U.S. Endangered Species Act. Updated: March 28, 1994". USFWS, Pacific Islands Office. H Honolulu, HI. 11p.

Wagner, W.L., Herbst, D.R. & Sohmer, S.H. 1990. "Manual of the Flowering Plants of Hawai'i". University of Hawaii Press. Honolulu, HI. 2 vol. 1853p.



Map 4 - Map showing locations of other archaeological work in general vicinity of current inventory survey.

INTRODUCTION

In October of 1993, Xamanek Researches was approached by MTM Consulting, Inc., on behalf of the County of Maui Public Works Division, regarding the undertaking of an archaeological inventory survey along the corridor of the proposed collector road, identified as Road "C". This proposed road would run from Azeka Place II and Longs Drug Store and meet Pi'ilani Highway at the intersection of Lipoa Street near the entrance to Kihei Elementary School and Lokelani Intermediate School. Since the proposed roadway would pass through an existing Federal Wetlands Sanctuary for a portion of its extent, a botanical survey was also requested. We prepared a proposal and it was accepted. The area of the roadway had been surveyed on at least 2 previous occasions by different archaeological firms, so it was not anticipated that significant archaeological finds would be located.

The eastern portion of the Road "C" corridor transects part of the Baldwin*Malama Partnership Pi'ilani Village 187-acre residential and commercial subdivision, and would direct the bulk of the traffic between South Kihei Road and Pi'ilani Highway that is now born by Lipoa Street. Lipoa would dead-end at Kihei Elementary School and Lokelani Intermediate School, taking school traffic out of the mix. The western part adjacent to the Baldwin*Malama property is designated as Lot 10-C "Road Reserve", and is 56 feet wide and consists of 2.480 acres and cuts through Waiohuli-Keokea Beach Homesteads. The final portion which intersects with South Kihei Road is made up of Easement "B" from Stewart Fern, et. al, for access and utility purposes, which bisects the wetlands sanctuaries, and Easement "A", also for access and roadway purposes, which crosses the shopping complex.

On May 21, 1994, our surface archaeological inventory work and botanical fieldwork started. The entire project area, which consisted of a corridor 150 feet in width and approximately three-quarters of a mile in length, was covered by observers.

SURVEY AREA

Natural History

The survey area is located in Kihei, in the *ahupua'a* of Waiohuli, Makawao and Wailuku District, on the island of Maui. It is comprised of a c. 150 foot wide corridor that begins at the Longs Drug and Azeka's Place II developments and ends at the intersection of Pi'ilani Highway and Lipoa Street (Map 3). The total land area is c. 4.5 acres. Elevations range from a low of c. 3 ft. AMSL near the western or *makai* boundary

to c. 66 ft. AMSL near the eastern or *mauka* boundary near the Pi'ilani Highway and Lipoa Street intersection.

This portion of the Kihei coastal plain is composed of eroded lava from the Kula Series, alluvium from Haleakala volcano, and aeolian deposits primarily associated with the prevailing trade winds. The study parcel is located in an area of generally thin, eroded soil deposits and exposed bedrock outcrops.

Annual rainfall in this area of Kihei is less than 20 inches. The vegetation tends to be dominated by xerophytic species such as buffelgrass (Cenchrus ciliaris), *kiawe* (Prosopis pallida) trees, and scattered *i'lima* (Sida fallax). However, a wetland plant community is present near the western or *makai* boundary of the study area, and there are disturbance plant communities on other portions of the project area (see Appendix B).

BACKGROUND RESEARCH

Previous archaeological work

The subject parcel (TMK 3-9-02: 109 and 2-2-02: por. 66, 67) is located within the large *ahupua'a* of Waiohuli. This land division has been studied by several archaeologists within the last 20 years, in conjunction with tourist resort and commercial development. After consultation with the State Historic Preservation Division, we found that the area that the proposed Road "C" corridor crosses had been part of 2 other, earlier archaeological inventory surveys. One was by Environmental Impact Study Corp. in 1982, and the other was by PHRI in July of 1989, for Baldwin Pacific's Pi'ilani Residential Community, Phase I (TMK 2-2-02: por 42).[1]

The EISC study located one site which was described as "a possible alignment of very loosely stacked basalt extending downslope from an outcrop knoll" (1982, pg. B-4), and did not recommend further work because of low research potential. The PHRI survey, conducted by Theresa Donham (July, 1989), encompassed 114 acres situated along the west side of Pi'ilani Highway, between Kihei Elementary School and Lokelani Intermediate School and the northern border of Waiohuli *ahupua'a*. During that survey 5 new sites were discovered, and 2 others relocated--Site 2476 identified by EISC, and Site 1705 initially recorded by Cordy during his reconnaissance survey for the Corps of Engineers (1977).

Donham's work on all 7 identified sites determined that 2 were bulldozer push piles, and were not assigned SIHP numbers. The other 5 sites were mapped and tested in order to determine their significance. Site 1705 was described as a biface wall, possibly a corral. Sites 2473 and 2475 are thought to be historic dependency structures associated

[1]This large parcel has subsequently been divided and now is identified as Parcels 66, 67 and 68.

with ranching activities. Site 2475 consists of 2 stone cairn features, one of which was recommended for data recovery, as it was thought it might contain human remains. The fifth site, Site 2476 is a complex of 5 rock alignments, which may have had an agricultural function (Donham, 1989, pp. 8-14).

Archaeological data recovery was undertaken in 1990 on Site 2475, to determine if it was a burial complex. Subsurface test excavations did not produce human remains, or evidence of cultural deposits, midden or charcoal. However, further data recovery "indicated that it was a terrace complex covering a major portion of the natural terrace crest and its slopes" (Donham, 1990, p. 10). The site was interpreted as an agricultural complex and appeared "to represent relatively intensive modification of natural slopes for purposes of planting" (Ibid.). The rock alignments that make up Site 2476, which lies nearby, may also be additional terracing. The location of the site, one-half mile *mauka* of the coastal zone, as defined by Cordy (1977), leads Donham to suggest a "coastal perimeter zone", an area which was exploitated more heavily than the "intermediate zone" in general. She suggests the possibility of seasonal usage during periods of increased rainfall, or simply the response to land availability pressures in the coastal zone (Donham, 1990, p. 10).

Two of the first studies in the lowland portion of the *ahupua'a*, were conducted in association with the construction of Pi'ilani Highway (Cox, 1976; Cordy, 1977). The studies by Cox (1976) along the coastal area included information about two *heiau*, Kalaihi Heiau (in the neighboring *ahupua'a* of Kaonoulu), and Kealaipoa Heiau in Waiohuli *ahupua'a*. He also mentions 3 fishponds noted from historic sources, one of which may have been rebuilt by Kamehameha I. Cordy found wall remnants at the mouth of Waipuilani Gulch (Site 1704), which may be the remains of one of these ponds (1977). He also located Site 1705, mentioned earlier, which was in the Pi'ilani Residential Subdivision, of which the present study area is a part.

In 1986, Kennedy conducted a surface reconnaissance survey for the Silversword Golf Course, and reported in a brief letter that no archaeological features were found in the approximate 125-acre survey area. This golf course lies directly to the east of the present project area, and will share the intersection on Pi'ilani Highway with the proposed Road "C".

On the grounds of Lokelani Intermediate School, about 500 meters southeast of the project area, Xamanek Researches excavated a rock shelter, Site 3193, in July of 1993 (Fredericksen, et. al., September, 1993). The shelter was 5.5 meters in length, extended a maximum of 1.6 meters inward, and had a maximum interior height was 0.85 m. The ceiling was dome shaped and dropped to the ground level at either side. A large *kiawe* tree, which had recently burned, had formerly grown at the drip line. The site appears to have been used intermittently, and contained midden, artifacts, and over 100 pieces of volcanic glass. Much of the volcanic glass was waste material, the by-product of knapping activity. Midden was made up primarily of *pipipi* (Nerita picea), cowrie

(Cypraea sp.), and cone shell (Conus sp.). Artifacts consisted of bone picks, coral abraders and a piece of worked bone. Three hearths were excavated, and charcoal from one produced a radiocarbon date of AD 1560-1800 (270 ± 120 RCYBP).

Other archaeological work west or *makai* of the study area in Waiohuli *ahupua'a* was conducted by Xamanek Researches for the Azeka II Shopping Center and Longs Drug Center (Fredericksen, et. al., 1990a and 1990b). No significant archaeological finds were made. However, identification of the wetland areas was established at this time, and subsequently the Federal and State Wetlands Sanctuary was developed. A parcel at the intersection of Lower Kihei Road and Lipoa was also surveyed (Fredericksen, et. al., February 1994), and no significant archaeological finds were made. The above study areas would have likely been within a wetlands area directly east or *mauka* of the coastal zone sand dunes in precontact times.

In the upland region of the *ahupua'a*, PHRI did an inventory survey of Keokea and Waiohuli Subdivision for the Department of Hawaiian Homes Lands (Brown and Haun, 1989). The University of Hawaii-Manoa held an archaeological field school there in the summer of 1994, under the direction of Michael Kolb. Both of these studies identified numerous precontact sites, indicating fairly extensive habitation and agricultural activity in the uplands region.

Historical Background Research

The *ahupua'a* of Waiohuli lies within Makawao District which was considered to be government lands after the Great Mahele. It was officially approved as being Crown Land in 1890 by King Kalakaua (Wong-Smith, 1990, B-3). While a good deal of agricultural activity took place in the mid- and latter 1800's in the upland Kula region, little activity is noted for the lower portions of the *ahupua'a*. No Land Commission Awards (LCA) of native *kuleana* (house and/or garden plots) are found within the project area, nor were any claimed (Donham, 1989, p. 6). The eastern portion of the project area is part of Apana I of Grant 9325 to Haleakala Ranch Company. During the early part of this century, the area had been used primarily for cattle grazing. The importation of grasses (i.e., buffelgrass) for livestock feed has altered the natural flora and ranching activities have no doubt impacted archaeological features that might have existed in the area. The western part of the corridor crosses through Waiohuli-Keokea Beach Homesteads, which were opened for sale in the 1930's.

During World War II, much military activity affected the Kihei area, including operations of the Naval Combat Demolition Training and Experimental Base, the Kamaole Amphibious Training Base, and the Puunene Naval Air Station. The present study area was also likely to have been impacted. Archaeological evidence of such militaty activity was found by the authors during an inventory survey in Kaonoulu *ahupua'a* approximately 1 mile to the north (Fredericksen, et. al., July 1994).

Since the beginning of the 1970s intensive commercial, resort and residential development has altered the landscape of Kihei. This pattern of development is scheduled to continue into the future.

Overview of settlement patterns

The study area lies within what is known as the "barren zone, or intermediate zone" as postulated by Cordy (1977). This is the area between the inhabited coastal and inland zones. Because of generally inhospitable conditions, little human activity is expected, with the exception of intermittent and/or transitory habitation. Donham's identification of agricultural terraces *mauka* of the study area, suggests that the perimeter of the coastal zone may have been more heavily utilized for food production activity than had been previously thought. However, she also noted that agricultural activity could have been intermittent during seasonal increases in rainfall, or periods of overall increased moisture. She proposed another zone, the "coastal perimeter zone" to designate this area.

At present there are relatively few clearly precontact archaeological sites identified in the "intermediate zone". A few radiocarbon dates have been obtained, the majority of which seem to fall within the late precontact to early post-contact period (refer to Table 4), suggesting that little human activity occurred in this region prior to that time. Again, given the somewhat harsh climatic conditions of the area, this is not surprising. As overall population of the island increased, it likely became necessary to begin exploitation of less desirable areas in the late precontact to early post-contact period.

Cordy also postulates (1977, p. 12) that the few sites that would be found in the "intermediate zone" would be temporary in nature, and would be "associated with transportation routes (e.g. trails)". The present study area may represent one of these transportation routes.

ARCHAEOLOGICAL SURVEY METHODS

The field director for the area inventory survey was Erik M. Fredericksen (M.A.), and project directors and coordinators were Walter M. Fredericksen (Professor emeritus) and Demaris L. Fredericksen (Ph.D., abd). Three to 5 persons participated in the inventory level archeological field work phases.

The archaeological inventory survey consisted of two phases. Initially, a pedestrian survey covering 100% of the Road "C" corridor was undertaken (Photos 1-3). The approximately 4.5 acre parcel was visually inspected by crew members spaced c. 5 m. apart. Visibility on the portion of the study area immediately to the east of the

enhanced water fowl habitat was generally poor, due to dense *kiawe* trees and undergrowth. The remainder of the survey area was primarily vegetated with moderate to dense buffelgrass cover and visibility was fair. During the course of the walk-over survey, Site 3529, a low rock shelter, was located in an area of dense buffelgrass cover (see Map 3). No other archaeological sites were identified during the pedestrian survey.

The second phase of the inventory level survey consisted of an evaluation of Site 3529. Initially, the area around the rock shelter was cleared of vegetation. A 0.5 m. by 0.5 m. by 0.6 m. deep test unit (TU #1) and 17 shovel tests (STs #1 to #17) were excavated at Site 3529, in an effort to determine site extent and function (Figure 1). Shovel Tests #15, #16 and #17 were placed at the site after initial fieldwork for the inventory level survey had been completed. These additional 3 tests were excavated to further investigate the shallow soil deposits near ST #5 and an area of exposed surface shell found eroding next to the dirt access road (see Figure 1). The shovel tests were c. 0.3 m. by 0.5 m. by 0.1 to 0.3 m. deep. It was not possible to utilize auger testing at the site because of very stony soil conditions. All units were excavated in 10 cm. levels. All soil from TU #1 was sifted with 1/8" hardware mesh screen, and all soil from the shovel tests was screened through 1/4" hardware mesh cloth. One hundred percent of material culture remains found in the screening process were saved from each 10 cm. level for later laboratory analysis.

A site map was prepared using a hand bearing electronic compass and metric survey tapes. Descriptive notes were kept in the field, and photographs were taken with T-Max 400, black and white film. All notes, photographs, cultural materials, and midden are curated by Xamanek Researches, Pukalani, Maui, Hawaii.

ARCHAEOLOGICAL FIELD RESULTS

The pedestrian survey located one archaeological site with two components. Site 3529 consists of a rock shelter and an associated subsurface *in situ* cultural deposit (Figure 1). Upon discovery, the rock shelter was identified by a low overhang with an exposed opening c. 3 m. wide by 0.4 m. at its highest point (Photo 4, Figure 2). The entrance to this small lava tube and the area in front of it appear to have been filled in over time by aeolian soil deposits. Intensive observation of the general area in front of the rock shelter did not reveal any surface evidence of historic disturbance. Limited subsurface testing at Site 3529 indicated that a relatively thick *in situ* cultural deposit was present in the area directly to the west, or *makai* of the rock overhang. This *in situ* cultural deposit appeared to be c. 20 to 25 square meters in area. In addition, the subsurface deposit fans out from the rock shelter further to the west, north and south, with thin, eroded soil deposits generally less than 15 cm. thick overall. Cultural materials recovered during limited excavation indicate that the rock shelter was likely used as a temporary habitation site. Overall areal dimensions of the Site 3529 subsurface cultural

layer are c. 14 m. N-S by c. 16 m. E-W. A discussion of the above findings follows. Refer to Table 1 for a summary of midden recovered from TU #1, Table 2 for a summary of artifacts recovered at Site 3529, Table 3 for a summary of shovel test results, and Appendix A for detailed descriptions of stratigraphic profiles.

Site 50-50-10-3529

This site is located on a gently sloping open grassland at c. 30 to 34 ft. AMSL (Photos 2 & 4). Surface evidence such as charred *kiawe* stumps and charcoal staining indicate that one or more brush fires have occurred in the general area in the relatively recent past. Xerophytic vegetation is dominated by buffelgrass. In general, soils are somewhat eroded and thin. However, a marked exception occurs in the immediate area west or *makai* of the rock shelter (Figure 1). It appears that the mouth of the small lava tube has served as a catchment for wind-born sediment over time. Initial testing indicates that aeolian soil deposits may exceed 60 cm. in depth on this portion of Site 3529. In addition, the small lava tube also appears to have been nearly filled in by wind-sorted soil over time. Intensive surface inspection of the site indicates that it has not been disturbed in historic times, although evidence of past bulldozing activity is present near the western and southeastern borders of the site and c. 50 m. to the southeast. In general, site condition ranges from good to fair. The area of deep soil deposits directly to the west of the rock shelter is in good condition, while the outer portions of the site consisting of thin soils are somewhat eroded and in fair condition. Overall areal dimensions of Site 3529 are c. 14 m. N-S by 16 m. E-W (see Figure 1). The thicker *in situ* cultural deposits directly to the west or *makai* of the rock shelter appear to be c. 20 to 25 square meters in area.

Excavation at Site 3529

As noted earlier, one test unit (TU #1) and 17 shovel tests (STs #1 to #17) were excavated at Site 3529 in order to determine site extent and function. A discussion of subsurface results follows.

Test Unit #1

This unit was placed near the mouth of the small lava tube entrance, in order to investigate subsurface conditions (Figure 2). Surface observation had earlier revealed 2 pieces of echinoderm and 1 *pipipi* (Nerita picea) shell which had been unearthed by a mongoose burrowing into the soil under the rock overhang. Unit dimensions were 0.5 m. by 0.5 m. by 0.6 m. deep.

In all, four wind-sorted soil layers were encountered (Figure 3). The top soil layer yielded very low amounts of midden. Layer I (0 to 20 cmbs) consisted of reddish brown (5 YR 4/3) sandy clay and was slightly stony. Level I (0 to 10 cmbs) of this layer contained 2.5 gm. of marine invertebrates, and 3.3 gm. of bird bone that was close to the surface. Level II (10 to 20 cmbs) also yielded small amounts of marine invertebrate remains (1.5 gm.), a small piece of coral (0.3 gm.) and an unworked basalt flake.

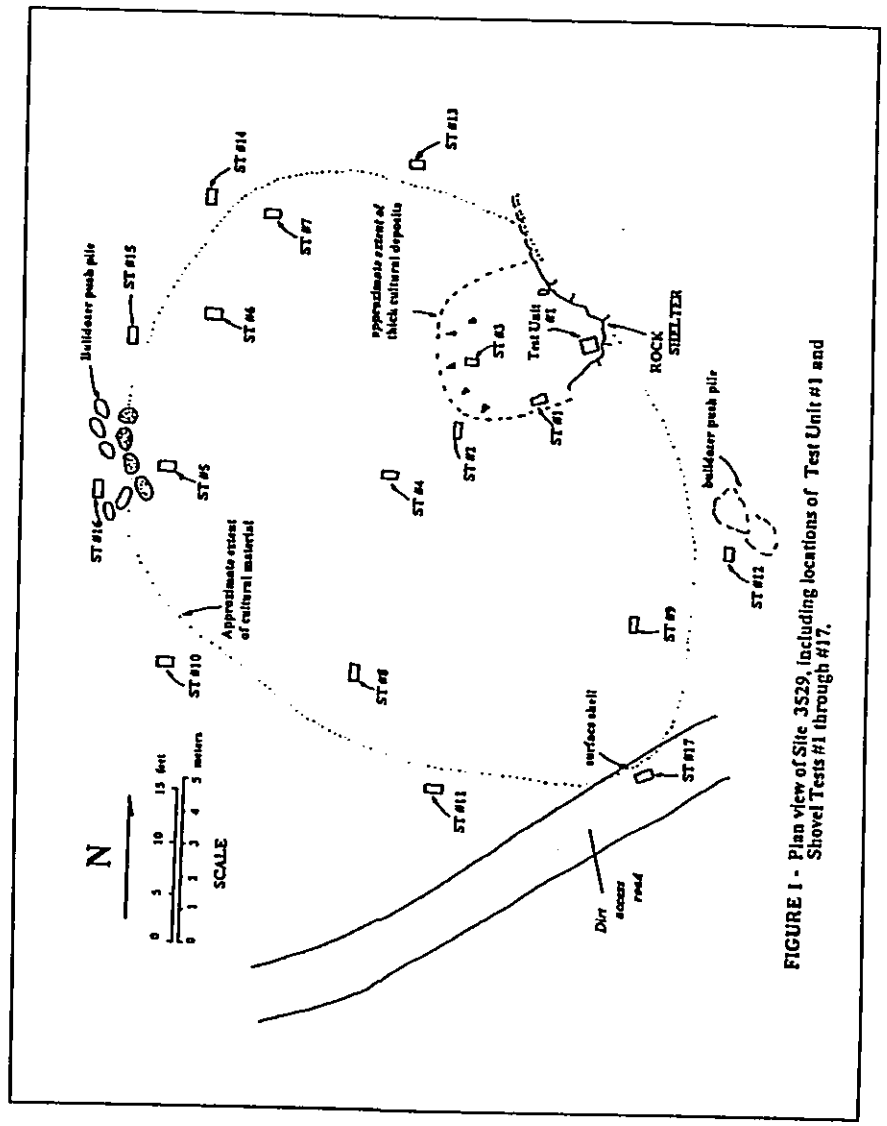


FIGURE 1 - Plan view of Site 3529, including locations of Test Unit #1 and Shovel Tests #1 through #17.

Layer II (c. 20 to 30 cmbs) was comprised of dark brown (7.5 YR 3/4) sandy clay and was moderately stony. This soil layer (i.e. Level I - 20 to 30 cmbs) contained a total of 55 gm. of marine invertebrate remains. *Pipipi* (Nerita picea) accounted for 57.6% of the total, followed by planaxids (7.1%), cowrie (Cypraea sp. - 6.0%) and lesser amounts of other marine invertebrates. In addition, four waste flakes of volcanic glass and 2 unworked basalt flakes were located in the screen. During excavation, it appeared that the lower 5 cm. of Level I (20 to 30 cmbs) contained the bulk of the cultural material found in Layer II.

Underlying Layer II was Layer III, an *in situ* cultural deposit which contained charcoal staining. Layer III (c. 30 to 50 cmbs) was dark grayish brown to dark brown (10 YR 3/2 to 3/3) sandy clay, and was moderately stony. This layer yielded a total of 183.1 gm. of common marine invertebrates, 3.8 gm. of crustacean, 2.2 gm. of fish bone, and 5.2 gm. of unidentified bone. Other portable remains located in Layer III included 2 possible utilized basalt flakes, a coral abrader, a coral file, an incised piece of bone, 19 waste flakes of volcanic glass, 5 unworked basalt flakes, a piece of coral, a bone pick, and a pencil urchin file. In addition, 3 firecracked rocks and charcoal flecking were encountered. Level I (c. 30 to 40 cmbs) yielded a total of 142.0 gm. of common marine shellfish, 11.7 gm. of echinoderm, 2.6 gm. of crustacean, 1.3 gm. of fish bone, 3.1 gm. of unidentified bird bone fragments, a small coral abrader, a small coral file, a small piece of incised bone, 5 unworked basalt flakes, 10 waste flakes of volcanic glass, and a piece of unworked coral. The most common marine shellfish included *pipipi* (Nerita picea-54%), cowrie (Cypraea sp.-27.8%), bivalves (Isognomon sp.-7.2%), and cone shell (Conus sp.-3.7%).

Indigenous artifacts recovered from Level I of Layer III included an incised piece of bone, a small coral file, and a small coral abrader (Photo 5). The small piece of incised bone (a) measures 13.9 mm. long by 6.9 mm. wide by 1.6 mm. thick and weighs 0.6 gm. It appears to have been filed at its tapered end, and an incision crosses the artifact near this end as well. It may be part of a fish hook blank which was discarded. The first coral artifact is a file (b) that weighs 0.8 gm. with dimensions of 22.1 mm. in length by 7.4 mm. in width by 6.1 mm. in thickness. This small, well-used file is roughly triangular in cross section, and appears to have been broken in the past. It also appears to have been used for detailed work, possibly fish hook manufacture. The coral abrader (c) weighs 1.2 gm. and is 27.2 mm. long by 12.8 mm. wide by 6.7 thick. It is roughly triangular shaped in cross-section and has one faceted edge. Its small size suggests that it was used for detailed work such as fish hook manufacture.

The 5 unworked basalt flakes weighed a total of 5.3 gm. and are of generally poor quality material, possibly the result of breakage due to intense heating by fires or natural exfoliation. The 10 waste flakes of volcanic glass weighed a total of 5.1 gm. and ranged in size from 2.5 by 5.5 by 7.1 mm. to 15.9 by 12.1 by 6.2 mm. Many of these volcanic glass flakes were of very poor quality and included an outer weathered "rind", indicating that reduction of raw material occurred at the site, prior to transport inland. In addition to the previously noted portable remains, 3 firecracked rocks and some charcoal flecking

were encountered in Level I. Unfortunately, it was not possible to collect enough charcoal flecks to obtain an adequate radiocarbon sample.

Level II (40 to 50 cmbs) of Layer III produced a total of 29.4 gm. of marine invertebrates. Nerita picea (31%) and echinoderm (50.7%) were most common and small amounts of crustacean, fish bone and unidentified bone were also located. In addition to the previously mentioned portable remains, 4 artifacts including 2 possible utilized basalt flakes, a bone pick and a pencil urchin file were recovered, along with 9 waste flakes of volcanic glass (see Photo 6). The first basalt flake recovered (d) may have been

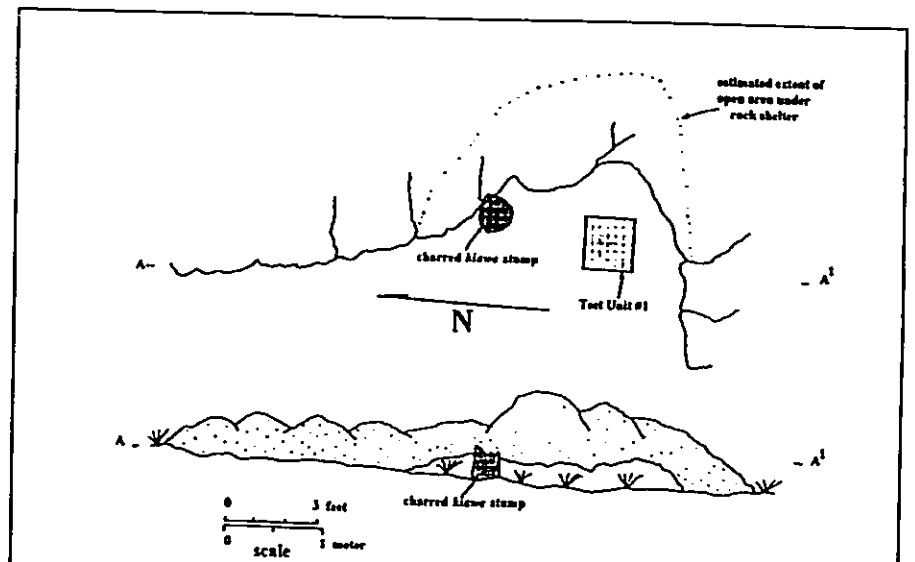


FIGURE 2 - Plan and profile views of Site 3529 rock shelter before excavation showing Test Unit #1.

utilized as a perforator. There appears to be some slight use wear on the tip of the flake. Its dimensions are 17.0 by 9.5 by 3.0 mm. and it weighs 1.8 gm. The second flake (e) may have some use wear along one of its edges. Its dimensions are 20.5 by 8.8 by 2.5 mm., and it weighs 2.2 gm. The bone pick (f) is a fish spine with use polish on its tip. It weighs 0.2 gm. and is 27.7 mm. long. The fourth artifact located in Level 2 is a broken pencil urchin spine (g) that appears to have been utilized as a file. It weighs 1.5 gm. and its dimensions are 29.0 by 8.8 by 7.9 mm. The 9 waste flakes of volcanic glass ranged in

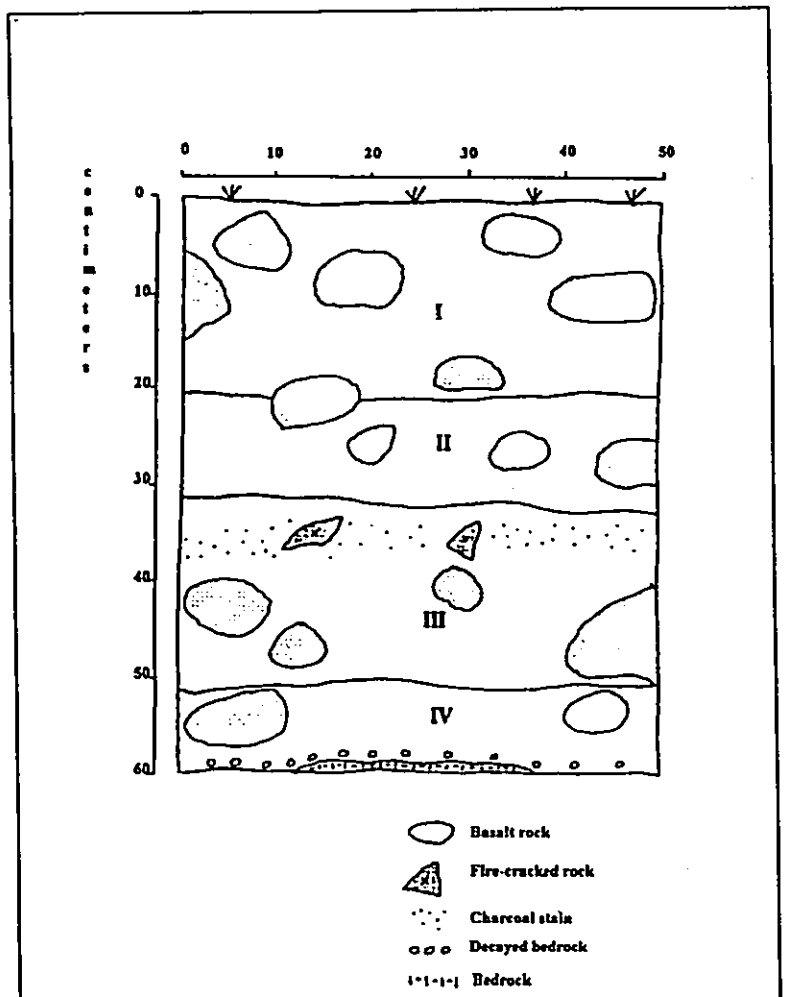


FIGURE 3 - East face profile Test Unit #1, Site 3529.

size from 8.3 by 6.6 by 1.1 mm. to 14.2 by 7.4 by 3.1 mm. and weighed a total of 4.3 gm. Layer III graded into Layer IV soil between 47 and 51 cmbs.

Layer IV (c. 50 to 60 cmbs) soil did not contain charcoal flecking and was dark yellowish brown (10 YR 3/4) sandy clay. It is likely that this soil layer rests on top of bedrock. It contained small amounts of midden and appears to grade to sterile. Level I (50 to 60 cmbs) of Layer IV yielded traces of cowrie (Cypraea sp.), *pipipi* (Nerita picea), fish bone, 1.1 gm. of echinoderm and 1.7 gm. of unidentified bone. Most of this midden material appeared to be associated with the overlying Layer III cultural deposit. However, the stony nature of Layer IV soil hampered efforts to determine whether or not cultural material was present throughout this layer. It appears likely that Layer IV soil grades to bedrock, because decayed bedrock increased as unit depth increased. However, it was not possible to excavate beyond 60 cmbs due to time constraints and test unit size.

Additional Subsurface Testing at Site 3529

Once it was determined that an intact subsurface cultural deposit was associated with the rock overhang, a series of shovel tests (ST) were placed in the general area, in an effort to determine overall site extent. In all, 17 shovel tests, each c. 30 cm. by 50 cm. and ranging in depth from c. 8 to 27 cm. , were excavated at Site 3529 (Figure 1). Of these, STs #1 to #9 contained some cultural materials, while STs #10 to #17 were sterile.

In general, most shovel tests did not exceed 20 cm. in depth, due to shallow soil conditions. Shovel Tests #1 and #3 contained stratigraphy similar to that encountered in TU #1. However, ST #1 was only c. 15 to 17 cm. deep and contained only Layers I and II, while ST #3 contained all 4 soil layers found in TU #1. Shovel Tests #2 and #4 through #17 contained 2 shallow soil layers. Layer I was typically less than 15 cm. thick in tested areas. It consisted of reddish brown (5 YR 5/4) sandy clay and was moderately stony. When present, cultural materials were found in only the top 10 cm. of this layer. Layer II consisted of sterile dark yellowish brown (10 YR 4/6) sandy clay which was very stony. This layer overlaid bedrock in tested areas and tended to be less than 10 cm. thick.

Shovel Test #1

This unit was located c. 3.5 m. southwest of the rock shelter entrance in an area that appeared to contain thick soil deposits. Layer I reddish brown (5 YR 4/3) sandy clay soil was located in this unit. As with Layer I in TU #1, there were relatively small amounts of midden located, adjusting for two large, unutilized pieces of somewhat weathered cone shell (Conus sp.-37.1 gm.) found near the surface of the unit. Layer I was approximately 10 to 12 cm. thick and was underlain by Layer II dark brown (7.5 YR 3/4) sandy clay. It was only possible to excavate c. 5 cm. into Layer II (i.e., c. 15 to 17 cmbs) due to extremely stony soil conditions. It appears probable that excavation could

proceed with a larger unit (i.e. 1.0 by 1.0 m.). Excavation was halted at c. 15 to 17 cmbs and no profile was drawn.

Shovel Test #2

This unit was placed c. 3 m. west of ST #1. Slightly different soil conditions were encountered, and are representative of those also found in STs #4 through #17. Two thin soil layers were noted in this unit (Figure 4). Layer I (0 to 10 cmbs) reddish brown (5 YR 5/4) sandy clay contained a total of 9.3 gm. of marine invertebrates. Cone shell (Conus sp.) was most common, accounting for 63.4% of the total, followed by echinoderm (30.1%) and traces of cowrie (Cypraea sp.) and bi-valve (Isognomon sp.). Layer I was underlain by sterile Layer II subsoil which consisted of dark yellowish brown (10 YR 4/6) sandy clay. This soil layer contained numerous pieces of decayed bedrock and extended from c. 10 cmbs to bedrock at c. 17 cmbs.

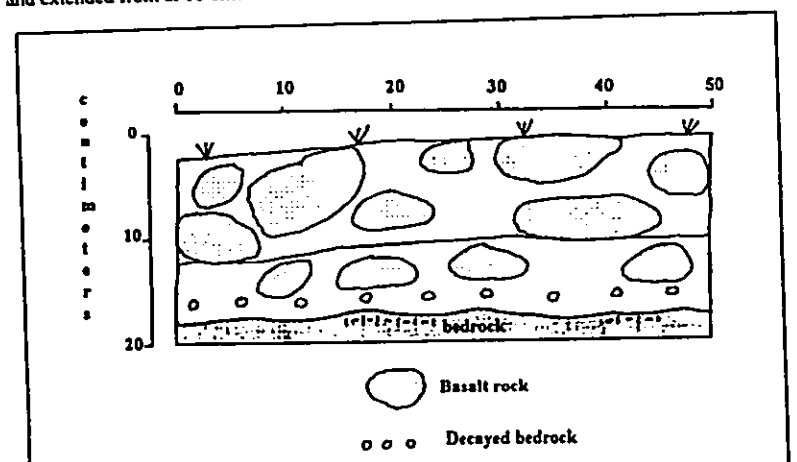


FIGURE 4 - East face profile, Shovel Test #2 .

Shovel Test #3

This unit was placed c. 4 m. from the partly filled-in rock shelter. It was excavated to c. 30 cmbs until very stony soil conditions halted further progress. It is likely that excavation could continue to bedrock with a larger unit size (i.e. 1.0 m. by 1.0

m.) Stratigraphy similar to that encountered in TU #1 was present in ST #3. In all, 4 soil layers were located (Figure 5).

Layer I (0 to 10 cmbs) reddish brown (5 YR 4/3) sandy clay was charcoal stained and yielded 9.3 gm. of common marine invertebrates, including cowrie (Cypraea sp. - 44.1%), cone shell (Conus sp.-38.7%) and bi-valve (Isognomon sp.-17.1%). The surface charcoal staining appears to be associated with recent brush fires in the area. This layer was underlain by soil similar to that found in TU #1. Layer II (c. 10 to 20 cmbs) dark brown (7.5 YR 3/4) sandy clay was moderately stony and appeared to be sterile.

Layer III (c. 18 to 20 cmbs to 26 cmbs) consisted of very dark grayish brown to dark brown (10 YR 3/2 to 3/3) sandy clay. However, this layer was stonier than the corresponding one in TU #1. This layer yielded 7.4 gm. of marine invertebrates. Cowrie (Cypraea sp.-31.1%) and echinoderm (50%) were most common. In addition, 3 waste flakes of volcanic glass were recovered from the screen. Some slight charcoal flecking was noted, but quantities were insufficient to collect for a radiocarbon sample. Layer III appeared to grade into Layer IV soil between 24 and 28 cmbs. However, very stony conditions hampered determination of the soil boundary.

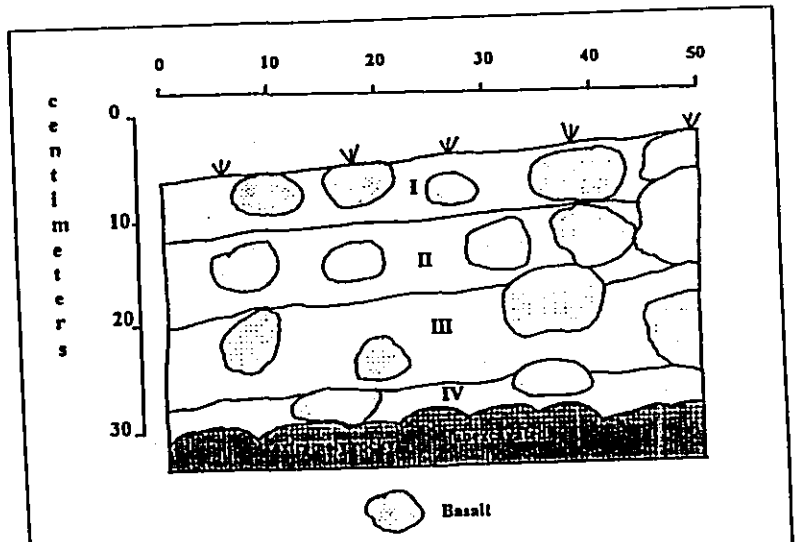


FIGURE 5 - North face profile, Shovel Test # 3.

Layer IV consisted of the dark yellowish brown (10 YR 3/4) sandy clay also noted in TU #1. However, this soil did not appear to have any cultural materials associated with it. Once again, very stony conditions were present in this layer, and excavation was abandoned at c. 30 to 32 cmbs.

Shovel Test #4

This unit was dug about 7 m. downslope from the rock shelter. Two shallow soil layers similar to those present in ST #2 were encountered (see Figure 4). Layer I soil consisted of weathered reddish brown (5 YR 5/4) sandy clay which was quite stony. Layer I (0 to 8-10 cmbs) contained a total of 18.8 gm. of marine invertebrates. Cowrie (Cypraea sp.) accounted for 75.5% of this total, followed by heavily weathered, unidentifiable shell fragments (16.5%), echinoderm (6.4%), and traces of bi-valves and planaxids. There was no evidence of charcoal flecking observed in the soil except near the surface. Layer I graded to Layer II subsoil at about 6 to 10 cmbs. Very stony conditions tended to obscure the soil boundary.

Layer II (8-10 to 18 cmbs) consisted of the dark yellowish brown (10 YR 4/6) sterile sandy clay subsoil. This layer was common in all shovel tests except STs #1 and #3 which were dug near the rock shelter in the area of thicker soil deposits. Excavation was halted when bedrock was reached c. 14 to 18 cmbs.

Shovel Test #5

This test was located c. 15 m. west or *makai* of the rock overhang in an area of shallow soil and exposed outcrop bedrock and apparent bulldozer push. Two stony soil layers were encountered in this 12 cm. deep unit.

Layer I (0 to 4 cmbs) consisted of the common somewhat weathered reddish brown (5 YR 5/4) sandy clay. This stony layer contained 10.8 gm. of common marine invertebrates. Cone shell (Conus sp.) was most common (48.1%), followed by *pipipi* (Nerita picea-24.1%), cowrie (Cypraea sp.-19.4%), and echinoderm (8.3%). In addition, the shank of a 2 piece bone fish hook was recovered (Photo 5). This artifact weighs 0.8 gm., and measures 31.5 mm. by 8.4 mm. by 10.1 mm. It is well made and appears to have been broken in the past. Efforts to locate the other piece(s) were not successful.

Layer I graded into Layer II common dark yellowish brown (10 YR 4/6) subsoil. This soil layer was c. 4 to 6 cm. thick and was sterile. No soil profile was recorded for this unit, due to very stony conditions.

Shovel Test #6

This unit contained 2 soil layers similar to those found in other test instances (see Figure 4). Soil conditions were very stony in ST #6. Layer I (c. 0 to 10 cmbs) consisted of the common weathered reddish brown (5 YR 5/4) sandy clay. A small amount of

common marine mollusks (2 gm.) were recovered in the screen [cowrie (Cypraea sp.), cone shell (Conus sp.) and bi-valve (Isognomon sp.)]. Layer I soil graded into Layer II subsoil between 8 and 10 cmbs.

Layer II (c. 10 to 16 cmbs) was composed of the common dark yellowish brown (10 YR 4/6) sandy clay subsoil. This very stony layer contained pieces of decayed bedrock and was sterile. Excavation was halted when bedrock was reached c. 14 to 16 cmbs. No unit profile was drawn.

Shovel Test #7

This test revealed the 2 common soil layers found elsewhere (see Figure 4). A low quantity of shell midden was recovered from the screen, primarily within c. 6 cm. of the surface. Layer I (0 to 14 cmbs) was comprised of the common reddish brown (5 YR 5/4) sandy clay. Just under 2 gm. of marine shellfish were recovered, including 1.3 gm. of *pipipi* (Nerita picea) and 0.6 gm. of unidentifiable, weathered shellfish remains. Level 1 (0 to 10 cmbs) contained the above noted materials. The lower 4 cm. of Layer I were sterile (i.e. 10 to 14 cmbs). Layer I soil graded into Layer II subsoil (10 YR 4/6) between 12 and 16 cmbs. Bedrock was encountered between c. 16 and 22 cmbs. No unit profile was recorded for ST #7.

Shovel Test #8

This unit was placed in an area of shallow soil and exposed bedrock. Subsurface results were similar to other tested portions of the site with thin soil deposits (see Figure 4). A small amount of shell was found in the upper 5 cm. of ST #8. Layer I consisted of reddish brown (5 YR 5/4) sandy clay and was moderately stony. This shallow soil layer was c. 8 to 10 cm. thick and contained a total of 1.2 gm. of cone shell (Conus sp.) fragments. These fragments were weathered and may have been exposed to surface conditions in the past. No other portable remains were encountered in ST #8.

Layer II soil was located c. 8 to 10 cmbs and was composed of the common dark yellowish brown (5 YR 4/6) sandy clay subsoil. This soil stratum was sterile. Excavation was halted when bedrock was located c. 12 to 16 cmbs and no unit profile was recorded.

Shovel Test #9

This test was also located in an area of shallow soil. Overall unit depth was c. 10 to 14 cmbs. Less than 1 gm. of common marine shellfish was present in Layer I of this unit. Stratigraphy was similar to other portions of the site with shallow soil deposits. Layer I reddish brown (5 YR 5/4) sandy clay was moderately stony and c. 6 to 8 cm. thick. A total of 0.8 gm. of cone shell (Conus sp.) fragments were recovered in the screen. No other portable remains were encountered. Layer I graded to sterile Layer II dark yellowish brown (10 YR 4/6) sandy clay subsoil. Layer II (c. 8 to 14 cmbs) was

very stony and overlaid bedrock which was encountered between 12 and 14 cmbs. No unit profile was prepared.

Shovel Test #10 through #17

As noted earlier in this report, only STs #1 through #9 contained portable remains. Shovel Tests #10 through #17 contained stratigraphy similar to the above units, but they lacked any cultural materials (see Figures 4 and 6). Layer I reddish brown (5 YR 5/4) sandy clay ranged from c. 4 to 12 cm. deep, while Layer II dark yellowish brown (10 YR 4/6) sandy clay subsoil ranged from c. 4 to 8 cm. deep.

In general, STs #10 through #17 contained shallow soil deposits. Shovel Tests #10, #11, #16 and #17 were less than 10 cm. deep, while STs #12 through #15 were between 10 and 20 cm. deep. As mentioned in the previous paragraph, stratigraphy was similar to other tested portions of the site with shallow soil deposits.

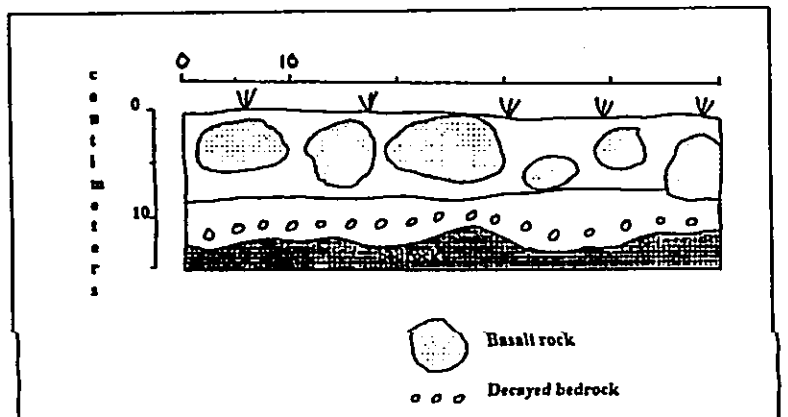


FIGURE 6 - North face profile, Shovel Test #11.

SUMMARY AND CONCLUSIONS

Site 3529 consists of a subsurface *in situ* cultural deposit associated with an overhang rock shelter. Inventory level survey work indicates that this site has not been utilized or disturbed during historic times. Overall site conditions range from good near the rock shelter to fair on the areas downslope. Subsurface investigation indicates that cultural materials are present in small quantities up to about 16 m. west, or *makai*, of the overhang shelter, while thicker cultural deposits, approximately 20 to 25 square meters in area, are present to the immediate west, or *makai*, of the rock shelter.

Limited subsurface testing at Site 3529 suggests that substantial cultural deposits are present in the approximate 20 to 25 square meter area in front of the shelter. Test Unit #1 yielded quantities of midden, including 212.6 gm. of common marine shellfish, 31.4 gm. of echinoderm, 3.8 gm. of crustacean, 2.4 gm. of fish bone, 6.4 gm. of bird bone and 3.8 gm. of unidentified bone fragments. This 0.5 m. by 0.5 m. by 0.6 m. deep test unit also produced several indigenous artifacts including a small coral abrader, a small coral file, a piece of incised bone, a bone pick, a pencil urchin file, 2 possible utilized basalt flakes, and 23 waste flakes of volcanic glass. It is possible that the small coral abrader and file were utilized for detailed work such as fish hook manufacture. It also appears possible that the incised bone is a discarded fish hook blank. Several of the volcanic glass waste flakes were of very poor quality, and possessed outer weathered crust or rind indicating that reduction of raw material took place at the site. The majority of marine shellfish remains (nearly 99%), echinoderm (nearly 92%) and other food material remains as well as almost all other portable remains came from the lower portion of Layer II (20 to 30 cmbs) and all of Layer III (30 to 50 cmbs).

In addition to the above noted portable remains, charcoal flecking and 3 firecracked rocks were encountered in TU #1. Although it was not possible to collect a sufficient amount of charcoal to submit for radiocarbon analysis, it appears probable that adequate quantities of charcoal could be collected from expanded excavation on this portion of the site.

While TU #1 was excavated in order to assess subsurface deposits near the rock shelter, the 17 shovel tests were dug in an effort to evaluate overall site extent. Subsurface results indicate that deposits of material culture remains extend for approximately 220 square meters. Approximately 80 to 90% of the subsurface deposits appear to be relatively thin and somewhat eroded (i.e. 10 cm. or less). In contrast, the area immediately west, or *makai*, of the rock shelter contains thick deposits of soil, possibly greater than 60 cm. in depth, and *in situ* cultural deposits of c. 20 to 25 cm. thick. Portable remains recovered from Shovel Tests #1 through #9 included a total of 89.5 gm. of common marine shellfish, 0.7 gm. of crustacean, 9.9 gm. of echinoderm, 1.9 gm. of bone, 3 waste flakes of volcanic glass and the shank of a 2-piece bone fish hook. These material culture remains are also suggestive of temporary habitation usage.

While it was not possible to recover any adequate radiocarbon samples from tested areas at Site 3529 to submit for analysis, it appears very probable that this site is a precontact one. It is important to note that no historic materials were located during intensive survey of the surface, or limited subsurface investigation. This site appears to be intact and undisturbed. Because Site 3529 is located in the "intermediate or barren zone", an area that has only relatively recently begun to be more closely examined, it is of special interest.

The authors have investigated 2 other rock shelters and a subsurface deposit in this region of Kihei (see Map 4). Site 50-50-10-3193, located on the grounds of Lokelani Intermediate School (Waiohuli *ahupua'a*, Makawao District), lies c. 600 m. to the south of the present study area. This site yielded a radiocarbon date of AD 1560 to 1800, and appears to have been utilized for temporary habitation (Fredericksen, et. al., September 1993). The second overhang shelter, Site 50-50-10-3541, lies in Kama'ole Gulch (Kama'ole *ahupua'a*, Wailuku District) c. 2.5 km. to the south. A radiocarbon date of 220 ± 60 BP, with calibrated results at 2 sigma of AD 1520 to 1570, 1630 to 1890 and AD 1910 to 1950 was obtained (Fredericksen et al, June 1994). The lack of any historic materials associated with this deposit tends to indicate the earlier date range. This site also was utilized for temporary habitation. The third site, Site 50-50-10-2636, is located c. 600 m. to the southwest of Site 50-50-10-3541, upslope from the Coast. It consists of 2 historic modified outcrop features, one possible indigenous feature heavily modified during historic times, and a subsurface *in situ* indigenous cultural deposit. This subsurface deposit produced 2 dates. While the first was based on scattered charcoal which may have been contaminated with charred *kiawe* root, the second was recovered from a subsurface fire hearth remnant and yielded a date of 530 ± 80 BP, with calibrated results at 2 sigma of AD 1295 to 1495 (Fredericksen et. al., November 1994). The first 2 sites suggest indigenous usage of the intermediate zone in the late precontact to early post-contact period, when population pressures stimulated increased utilization of this marginal area. The date from the third site is earlier, and indicates human activity in lower Kama'ole *ahupua'a* at a period considerably prior to contact.

Inventory level survey work identifies Site 3529 as an apparently undisturbed and very probably a precontact temporary habitation site. The undisturbed nature of this site offers a unique opportunity to investigate a precontact site in the intermediate zone, adding further to the body of knowledge for this area.

Site 3529 is deemed significant under Criterion "D" of Federal and State historic preservation guidelines. Because of the research potential of Site 3529, it is still considered significant for its information content and requires further mitigative measures. Site 3529 is in the Road "C" corridor and will likely be impacted by road construction activities. Consequently, data recovery work is recommended for this archaeological resource. A data recovery plan for this site was approved by the DLNR in June of 1994. At the writing of this inventory level report, the data recovery project is nearing completion and a report will be forthcoming.

REFERENCES

Brown, Roderick, and Alan E. Haun
1989 Archaeological Inventory Survey Keokea and Waiohuli Subdivisions, Lands of Keokea and Waiohuli, Makawao District, Island of Maui, prepared for the Department of Hawaiian Home Lands, by PHRI, Hilo.

Cordy, Ross
1977 Kihei Flood Control Project: Archaeological Reconnaissance and Literature Search, Fort Shafter, Hawaii, U.S. Army Corps of Engineers.

Cox, D.
1976 The Archaeology of Kula, Maui from Pulehu Nui Ahupuaa to Kamaole ahupuaa. Surface Survey, Piilani Highway. Department of Transportation, State of Hawaii, Honolulu.

Donham, Theresa
1989 Archaeological Inventory Survey, Piilani Residential Community, Phase I, Land of Waiohuli, Makawao District, Island of Maui (TMK: 2-2-02: por. 42), prepared for Baldwin Pacific, c/o Belt Collins and Associates, Honolulu, by PHRI, Hilo.

1990a Archaeological Data Recovery Program, Site 50-50-10-2475, Piilani Residential Community-Phase I, Land of Waiohuli, Makawao District, Island of Maui (TMK: 2-2-02: por 42), prepared for Belt Collins & Associates, by PHRI, Hilo.

1990b Archaeological Inventory Survey, Piilani Residential Community-Phase II, Land of Keokea, Makawao District, Island of Maui, prepared for Belt Collins & Associates, Honolulu, by PHRI, Hilo.

Environmental Impact Study Corporation
1982 Biological and Archaeological Reconnaissance TMK: 2-2-02: portion of 42, Kihei, Maui, Hawaii.

Fredericksen, Walter M. and Demaris L.
1990 An Archaeological Inventory Survey of an 8.5 Acre Parcel, TMK: 3-9-20: 07, Kihei, Maui, Hawaii, prepared for Richard Takase, Maui Realty, Lahaina, Hawaii, by Xamanek Researches, Pukalani.

July 1990a Report on Archaeological Monitoring of Azeka Place Commercial Center, Kihei, Maui, Hawaii, prepared for Rieke, Sunnland & Kono Architects, Ltd., Kahului, by Xamanek Researches, Pukalani.

July 1990b Report on Archaeological Monitoring of Longs Drug Project, Kihei, Maui, Hawaii, prepared for Rieke, Sunnland & Kono Architects, Ltd., Kahului, by Xamanek Researches, Pukalani.

1991 An Archaeological Inventory Survey of a 3.14 Acre Parcel in Kihei, Maui, Hawaii (TMK: 3-9-17: 26), prepared for Joseph Donaghy, MLH Development Co., Kahului, by Xamanek Researches, Pukalani.

1992 Additional Archaeological Research at Keawakapu View Subdivision (TMK: 3-9-04: 79), Kihei, Maui, prepared for Gresham and Associates, Inc., Kihei, by Xamanek Researches, Pukalani.

Fredericksen, Demaris L., Walter M. and Erik M.
September 1993 An Archaeological Inventory Survey and Data Recovery Report for Lokelani Intermediate School, located in the *Ahupua'a* of Waiohuli, Makawao District, Island of Maui, (TMK: 2-2-02: por. 43), prepared for Murayama, Kotake, Nunokawa & Associates, Honolulu, by Xamanek Researches, Pukalani.

Fredericksen, Demaris L., Erik M. and Walter M.
August 1994 An Archaeological Inventory Survey for Keala Hills Sub-Division, Kama'ole *Ahupua'a*, Wailuku District, Maui Island (TMK: 3-9-30: 21), prepared for Max D. and Ruth A. Soriano, Seattle, by Xamanek Researches, Pukalani.

Fredericksen, Erik M., Demaris L. and Walter M.
June 1994 An Archaeological Inventory Survey of a 24-Acre Parcel, Kama'ole *Ahupua'a*, Wailuku District, Island of Maui (TMK: 3-09-18: 1), prepared for Grant Y.M. Chun, Attorney, by Xamanek Researches, Pukalani.

November 1994 Archaeological Subsurface Testing at Site 50-50-10-2636, Kama'ole *Ahupua'a*, Wailuku District, Maui Island, prepared for Munekiyo and Arakawa, Inc., Wailuku, by Xamanek Researches, Pukalani.

Fredericksen, Erik M., Walter M., and Demaris L.
July 1994 Archaeological Inventory Survey and Botanical Survey Report, Kaonoulu Light Industrial Project, Kaonoulu *Ahupua'a*, Wailuku and Makawao Districts, Island of Maui (TMK: 3-9-01: 16 and 2-2-02: por. 15), prepared for Michael T. Munekiyo Consulting, Inc., Wailuku, by Xamanek Researches, Pukalani.

Fredericksen, Walter M., Erik M., and Demaris L.
February 1994 Archaeological Inventory Survey on Smith Trust Property (Kihei), in Waiohuli *Ahupua'a*, Wailuku District, Maui Island, Hawaii (TMK: 3-9-02: 91, 92, 93, 94, 133, 134, 135), Prepared for Milton Arakawa, MTM Consultants, Wailuku, by Xamanek Researches, Pukalani, Hawaii.

Hammatt, Hallett H. and David Shideler
1989 Archaeological Reconnaissance of a 54-acre parcel at Kama'ole, Wailuku District, Island of Maui, Prepared for Kama'ole Land Ventures by Cultural Surveys Hawaii.

1992 Archaeological Survey and Testing of a 54-Acre Parcel at Kama'ole. Wailuku District, Island of Maui, prepared for Kama'ole Land Ventures, by Cultural Surveys Hawaii.

Kennedy, Joseph
1986 Letter report on Preliminary Archaeological Reconnaissance of Proposed Golf Course. Archaeological Consultants of Hawaii, Honolulu. Prepared for Haleakala Greens Corporation.

1991 An Archaeological Inventory Survey for Keawakapu View Subdivision, located at TMK: 3-9-04: 79, Kama'ole Ahupua'a, Makawao District, Island of Maui, prepared for DKY Realty, Wailuku, Hawaii, by Archaeological Consultants of Hawaii, Haleiwa, Hawaii.

Neller, Earl
1992 An Archaeological Reconnaissance at the Kalama County Beach Park, Kamaole, Maui (TMK: 3-9-12: 13 and 3-9-05: 52).

Pantaleo, Jeffrey, et. al.
1991 Archaeological Inventory Survey of Proposed Kihei Elementary School Sites, Lots 1 and 2, Kama'ole, Wailuku, Maui Island, for Comprehensive Consulting Services of Hawaii, by Public Archaeology Section, Applied Research Group, Bishop Museum, Honolulu.

Rosendahl, Paul
1988 Subsurface Archaeological Reconnaissance Testing, Auhana Road Drainage Project Area, Land of Kama'ole, Wailuku District, Island of Maui, Contract No. 524, for County of Maui, Public Works.

Rotunno-Hazuka, Lisa and Jeffrey Pantaleo
1991 Diamond Resort Parcel--Final Report, for MTM Consulting, Inc., by Public Archaeology Section, Applied Research Group, Bishop Museum, Honolulu.

Sinoto, Aki
1989 Post field Summary of Surface Survey for the Residential Subdivision Development of TMK 3-9-18: 01, Letter report to Michael T. Munekiyo, MTM Consulting, Wailuku, by Bishop Museum Public Archaeology Section, Applied Research Group.

1991 Letter (April 25, 1991) to Martin Luna, Esq., Carlsmith, Ball, Wichman, Murray, Case, Mukai, & Ichiki, Wailuku.

Wong-Smith, Helen
1990 Limited Historical Documentary Research, in Donham, Theresa, Archaeological Inventory Survey, Piilani Residential Community, Phase II (listed above).

TABLE 1

Summary of Midden Recovered at Site 3529, TU #1

Depth in cmbs	0-10	10-20	20-30	30-40	40-50	50-60	TOTAL
Cypraea sp.	-	-	6.0	39.5	2.5	0.5	48.5
Conus sp.	-	-	2.7	5.3	0.9	-	8.9
Isognomon sp.	-	0.1	1.5	10.2	0.1	-	11.9
Granula sandwicensis	-	-	0.4	5.0	0.8	-	6.2
Nerita picea	0.3	0.1	31.7	77.0	9.1	0.3	118.5
Planaxis labiosa	-	-	7.1	0.1	-	-	7.2
Turbo sandwicensis	-	-	-	0.4	-	-	0.4
Thaididae	-	-	-	1.5	-	-	1.5
unidentified shell	0.7	1.2	3.5	3.0	1.1	-	9.5
Echinoderm	1.5	0.1	2.1	11.7	14.9	1.1	31.4
Crustacean	-	-	-	2.6	1.2	-	3.8
fish bone	-	-	-	1.3	0.9	0.2	2.4
bird bone	3.3	-	-	3.1	-	-	6.4
unidentified bone	-	-	-	-	2.1	1.7	3.8

Weight in grams

TABLE 2

Summary of Portable Remains Found at Site 3529

PORTABLE REMAINS	UNIT #	DEPTH (cmbs)	GM	PIECES	L x W x H (mm)
coral	TU #1	10-20	0.3	1	-
unworked basalt flake	TU #1	10-20	6.3	1	-
unworked basalt flakes	TU #1	20-30	1.4	2	-
volcanic glass flakes	TU #1	20-30	8.3	4	10.2 x 6.5 x 3.5 to 20.2 x 16.0 x 11.6
unworked basalt flakes	TU #1	30-40	5.3	5	-
coral abrader	TU #1	30-40	1.2	1	6.7 x 12.8 x 7.2
coral file	TU #1	30-40	0.8	1	22.1 x 7.4 x 6.1
volcanic glass flakes	TU #1	30-40	5.1	10	7.1 x 5.5 x 2.5 to 15.9 x 12.1 x 6.2
incised bone	TU #1	30-40	0.6	1	13.9 x 6.9 x 1.6
coral	TU #1	30-40	26.3	1	-
volcanic glass flakes	TU #1	40-50	4.3	9	8.3 x 6.6 x 1.1 to 14.2 x 7.4 x 3.1
possible utilized basalt flakes	TU #1	40-50	0.4	2	17.0 x 9.5 x 3.0 to 20.5 x 8.8 x 2.5
bone pick	TU #1	40-50	0.2	1	27.7 x 4.4 x 3.7
pencil urchin file	TU #1	40-50	1.5	1	29.0 x 8.8 x 7.9
fish hook shank	ST #5	0-10	0.8	1	31.5 x 8.4 x 10.1

TABLE 3

Summary of Shovel Test Results at Site 3529

Depth in cmbs	Cypraea sp.	Conus sp.	Isognomon sp.	Nerita picea	Planaxis labiosa	unidentified shell	Crustacean	Echinoderm	unidentified bone
ST 1 (0-10)	-	37.1	-	0.6	-	-	-	1.0	1.9
ST 2 (0-10)	0.5	5.9	0.1	-	-	-	-	2.8	-
ST 3 (0-10)	4.1	3.6	1.0	-	-	-	0.3	0.3	-
ST 3 (10-20)	-	-	-	-	-	-	-	-	-
ST 3 (20-30)	2.3	-	0.1	-	0.1	0.8	0.4	3.7	-
ST 4 (0-10)	14.2	-	0.1	0.1	-	3.1	-	1.2	-
ST 5 (0-10)	2.1	5.2	-	2.6	-	-	-	0.9	-
ST 6 (0-10)	0.8	0.9	0.3	-	-	-	-	-	-
ST 7 (0-10)	-	-	-	1.3	-	0.6	-	-	-
ST 8 (0-10)	-	1.2	-	-	-	-	-	-	-
ST 9 (0-10)	-	0.8	-	-	-	-	-	-	-
ST 10	sterile								
ST 11	sterile								
ST 12	sterile								
ST 13	sterile								
ST 14	sterile								
ST 15	sterile								
ST 16	sterile								
ST 17	sterile								
TOTAL	24.0	54.7	1.6	4.6	0.1	4.5	0.7	9.9	1.9

Weight in grams

TABLE 4

Radiocarbon dates from Kihei Sites (Intermediate Zone)
(Beta Analytic, Inc.)

Site number	Location	Radiocarbon Date
50-50-10- 3193[2]	Lokelani Intermediate School (Waiohuli *ahupua'a*) Rock shelter	270 ± 120 RCYBP (AD 1560-1800)
50-50-10-3541[3]	Kama'ole Gulch Rock shelter (Kama'ole *ahupua'a*)	220 ± 60 RCYBP (calibrated results at 2 sigma- AD 1520-1570, 1630-1890 and 1910-1950)
50-50-10-2636[4]	Road "F" Corridor (Kama'ole *ahupua'a*) Open site (hearth remnant)	530 ± 80 RCYBP (calibrated results at 2 sigma- AD 1295-1495)
	Open site (scattered charcoal)	140 ± 60 RCYBP (calibrated results at 2 sigma- AD 1650-1950)

[2]Fredericksen, et. al, September 1993.
[3]Fredericksen, et. al., June 1994.
[4]Fredericksen, et. al., November, 1994.

APPENDIX A

Soil Profile Descriptions for TU #1, Site 3529

Layer I: Reddish brown (5 YR 4/3); sandy clay; slightly stony (common subangular pebbles and cobbles of basalt); apedal to very weakly developed subangular blocky structure; fine to medium texture; loose to soft, dry consistency; common live rootlets; contains small amounts of midden and some charcoal flecking (likely due to relatively recent brush fires); Layer I is c. 20 cm. thick in TU #1.

Layer II: Dark brown (7.5 YR 3/4); sandy clay; moderately stony (many subangular pebbles and cobbles of basalt); very weakly developed subangular blocky structure; fine to medium texture; soft, dry consistency; common live rootlets and dead woody roots present; contains common midden - especially in the lower 5 cm. of Layer II and small amounts of charcoal flecking. Layer II is c. 10 cm. thick in TU #1(i.e. c. 20 to 30 cmbs).

Layer III: Very dark grayish brown to dark brown (10 YR 3/2 to 3/3); sandy clay; moderately stony (many subangular pebbles and cobbles of basalt; weakly developed subangular blocky structure; fine to medium texture; soft, dry consistency; some live rootlets and dead woody roots present; contains quantities of midden, some artifacts, a few firecracked rocks, charcoal staining, and small amounts of charcoal flecking. Layer III is c. 20 cm. thick in TU #1 (i.e. c. 30 to 50 cmbs).

Layer IV: Dark yellowish brown (10 YR 3/4); sandy clay; moderately stony (many subangular pebbles and cobbles of basalt and decayed bedrock); weakly developed subangular blocky structure; fine texture; soft, dry consistency; few dead rootlets and dead woody roots present; contains small amounts of midden, appears to grade to sterile beyond excavation bottom. Layer IV is at least 10 cm. thick in TU #1 (i.e. c. 50 to 60 cmbs).

Soil Profile Descriptions for STs #2, and #4 to #17, Site 3529

Layer I: Reddish brown (5 YR 5/4) sandy clay; moderately stony (many subangular pebbles and cobbles of basalt and decayed bedrock); weakly developed subangular blocky structure; fine texture; soft to slightly hard,

dry consistency; common live rootlets and few dead woody roots present; contains charcoal staining from recent brush fires and, when present, small amounts of midden. Layer I is typically less than 15 cm. thick in tested areas.

Layer II: Dark yellowish brown (10 YR 4/6); sandy clay; very stony (abundant subangular pebbles and cobbles of decayed bedrock; weakly developed subangular blocky structure; fine texture; slightly hard, dry consistency; some live rootlets present; sterile in tested areas. Layer II subsoil was generally less than 10 cm. thick in tested areas.

APPENDIX B

BOTANICAL SURVEY

by
David Paul, B. A.

Introduction

A botanical survey was conducted by David Paul, B. A. (ethnobotanist and botanical consultant to Xamanek Researches) on May 21 and 22, 1994. The survey covered a 150 foot wide strip of land identified as Road "C" Corridor, running from South Kihei Road to Pi'ilani Highway, located on TMK: 3-9-2: por 109; and 2-2-02: por. 66 and 67 in Kihei, Maui, Hawai'i.

The purpose of this study is to describe the vegetation existing on the land and identify ecologically significant plants and biological communities which may be impacted by the project planned for the area. Careful consideration was taken in the search for rare and endangered species which are protected by law and might require mitigation.

Methods

The study was initiated by searching literature to point out any plant species which are listed as threatened or endangered by the U.S. Fish and Wildlife Service that might occur within the region. Those listed plants are protected by Federal and State law. Updated lists of threatened and endangered species were researched as prepared by the USFWS, Pacific Islands Office, Honolulu, HI. (March 28, 1994) and the plants geographical ranges were determined from the "Manual of the Flowering Plants of Hawaii" (Wagner, et al. 1990).

The survey was executed by walking the perimeters of the proposed roadway, going up and down it's central area, and meandering through it. All species of vascular plants which were encountered, were recorded. The plant community was matched up with a general vegetation type, as provided by Gagne and Cuddihy (1990). Nomenclature for flowering plants follow Wagner, et al. (1990). Nomenclature for ferns and their allies follow Neal (1965).

Results

Vegetation Type- There are three distinct communities found along the survey area.

Disturbance communities are found along the dirt road on the lower *(makai)* side of the survey area, and at the top of the survey area which meets at the Pi'ilani Highway and Lipoa Road intersection, adjacent to and including a drainage ditch there *(mauka)*.

A "Coastal Wet Herbland" (Gagne & Cuddihy, 1990) community flanks both sides of the dirt road on the lower (makai) side of the survey area. This area also includes a U.S. Fish and Wildlife Service, "Wetland Sanctuary" which is divided by the dirt road on the proposed roadway.

A "Coastal Dry Forest" (Gagne & Cuddihy, 1990) community covers the majority of the survey area. This community begins immediately above *(mauka)* the disturbance and wetland communities on the lower *(makai)* side of the survey area.

The disturbance community is composed mostly of alien species, including khaki weed (Alternanthera pungens), *pakai kuku* (Amaranthus spinosus), cow pea (Macroptilium lathyroides), and spurges (Chamaesyce spp.). There were a number of coastal indigenous species found too, because of the saline conditions there, especially in the lower (makai) side of the survey area. These include *'ilie'e* (Plumbago zeylanica), *nena* (Heliotropium curassavicum), and *'ihi* (Portulaca lutea). Of interest is an alien species known as tansy mustard (Descurainia sophia) which was found in the disturbance community by the Pi'ilani Highway and Lipoa Road intersection. This plant has previously only been found at higher altitudes on Haleakala, Maui and along Saddle Road on the island of Hawai'i (Wagner, et al. 1990).

The wetland community is dominated by pickleweed (Batis maritima), Indian fleabane (Pluchea indica), and other species which are "Regional Indicator" species of wetland habitats (Reed, 1988). This area also includes indigenous species such as *'akulikuli* (Sesuvium portulacastrum), *pohuehue* (Ipomoea pes-caprae), and *nena* (Heliotropium curassavicum).

The dry forest community is dominated by buffelgrass (Cenchrus ciliaris), which is estimated to cover more than 90% of the ground in that community. There is a dwindling canopy of *kiawe* (Prosopis pallida) across this area which suffers from occasional brush fires and cutting for firewood. *Koa haole* (Leucaena leucocephala) and slender mimosa (Desmanthus virgatus) are found scattered across this community, as well as two indigenous species, which are *'ilima* (Sida fallax) and *'uhaloa* (Waltheria indica).

There were no ferns or fern allies found in the survey area at the time of the survey. The species found represent some of the species normally associated with the communities found there. The number of species may change over time due to succession and climatic differences.

Rare or Endangered Plants- No plants which are listed as threatened or endangered by the U.S. Fish and Wildlife Service were found on the property. All of the communities found in the survey area contained either alien or indigenous plant species. No plants which are specifically found in Hawai'i (endemic) were found at the time of the survey.

Ophioglossum concinnum is an endangered species of fern which is found in lowland sandy soils. An Ophioglossum species was found in 1989 in Kihei, Maui, growing abundantly in sandy soil at the base of buffelgrass tufts (Fredericksen, et al. 1990). On May 22, 1994, an extensive search was made through the buffelgrass in the survey area for Ophioglossum species. No Ophioglossum species or any other ferns were found in the survey area.

Discussion and Recommendation

Biological Resource Value of the Vegetation- For the purpose of this report, alien dominated plant communities are considered to have no biological resource value. Plants and communities that are considered to have value are, 1) rare and endangered native plant species, and 2) native plant dominated communities. Plant communities are especially valuble when they contain a variety of plant species found nowhere else.

No legally protected threatened or endangered species were found in the survey area. Endemic plant species which are specific to the State of Hawai'i were not found either. The existing plant communities are dominated by alien species. Native plants which are located in the survey area are indigenous and are commonly found in the State of Hawai'i, and elsewhere in the world.

Recommendations- No plant species which was observed on this study requires priority for legal protection or conservation. Therefore, the actions of the proposed project will not impact any plant species with significant biological resource value. However, the wetland community found at the lower *(makai)* side of the project area provides significant biological resource value for animal life. Although there were no plants found in the wetland community (within the survey area) which require legal protection, the habitat is utilized by rare bird species. The impact of the proposed roadway on this habitat should be considered before undertaking the project.

Species List

Key- Botanical Name - comprised of the Genus and species of a plant as depicted by Western binomial

nomenclature.
Common Name - comprised of Hawaiian or local common terms.

Status - *E = endemic, specific to the immediate area.

I = indigenous, specific to a geographical region.

*P = Polynesian, introduced to Hawai'i prior to 1778.

A = alien, introduced into historical Hawai'i.

* Note, there were no endemic or Polynesian plants found in the survey area.

The following list is comprised of the plant species which were found during the botanical survey conducted on the 21st and 22nd of May, 1994.

Botanical Name	Common Name	Status
Class MAGNOLIOPSIDA	Dicots	
AIZOACEAE	Carpetweed family	
Sesuvium portulacastrum	*'akulikuli*	I
AMARANTHACEAE	Amaranth family	
Alternanthera pungens	khaki weed	A
Amaranthus spinosus	*pakai kuku*	A
ANACARDIACEAE	Mango family	
Schinus terebinthifolius	Christmas berry	A
ASTERACEAE	Sunflower family	
Bidens pilosa	*ki nehe*	A
Pluchea fosbergii	-	A
Pluchea indica	Indian fleabane	A
Pluchea symphytifolia	sourbush	A
Sonchus oleraceus	*pualele*	A
Tridax procumbens	coat buttons	A
Verbesina encelioides	golden crown beard	A
Xanthium strumarium	*kikania*	A

BATACEAE	Saltwort family	
Batis maritima	pickleweed	A
BORAGINACEAE	Borage family	
Heliotroplum currasavicum	*nena*	I
BRASSICACEAE	Cabbage family	
Descurainia sophia	tansy mustard	A
CHENOPODIACEAE	Goosefoot family	
Atriplex suberecta	saltbush	A
Chenopodium murale	*'aheahea*	A
CONVULVULACEAE	Morning Glory family	
Ipomoea pes-caprae	*pohuehue*	I
Ipomoea triloba	little bell	A
Merremia aegyptia	*koali kua hulu*	I
CUCURBITACEAE	Cucumber family	
Cucumis dipsaceus	teasel gourd	A
EUPHORBIACEAE	Poinsettia family	
Chamaesyce hirta	garden spurge	A
Chamaesyce hypericifolia	graceful spurge	A
Chamaesyce prostrata	prostrate spurge	A
Euphobia heterophylla	*kaliko*	A
Ricinus communis	castor bean	
AFABACEAE	Bean family	
Crotalaria pallida	smooth rattlepod	A
Desmanthus virgatus	slender mimosa	A

Desmodium tortuosum	Florida beggarweed	A
Indigofera suffruticosa	indigo	A
Leucaena leucocephala	*koa haole*	A
Macroptilium atropurpureum	wild bean	A
Macroptilium lathyroides	cow pea	A
Prosopis pallida	*kiawe*	A
MALVACEAE	Hibiscus family	
Abutilon grandifolium	false *'ilima*	A
Malva parviflora	cheese weed	A
Malvastrum coromandellianum	false mallow	A
Sida fallax	*'ilima*	I
Sida rhombifolia	false *'ilima*	A
NYCTAGINACEAE	Four-o'clock family	
Boerhavia coccinea	false *alena*	A
PLUMBAGINACEAE	Leadwort family	
Plumbago zeylanica	*'ilie'e*	I
PORTULACACEAE	Purselane family	
Portulaca lutea	*'ihi*	I
SOLANACEAE	Potato family	
Nicandra physalodes	apple of Peru	A
Nicotianna glauca	tree tobacco	A
Solanum americanum	*popolo*	I
STERCULIACEAE	Chocolate family	
Waltheria indica	*'uhaloa*	I
ZYGOPHYLLACEAE	Creosote bush family	
Tribulus terrestris	puncture vine	A
Class LILOPSIDA	Monocots	

CYPERACEAE	Sedge family	
Cyperus rotundus	nut sedge	A
POACEAE	Grass family	
Cenchrus ciliaris	buffelgrass	A
Chloris barbata	fingergrass	A
Cynodon dactylon	manienie	A
Eragrostis pectinacea	Carolina lovegrass	A
Panicum maximum	Guinea grass	A

References

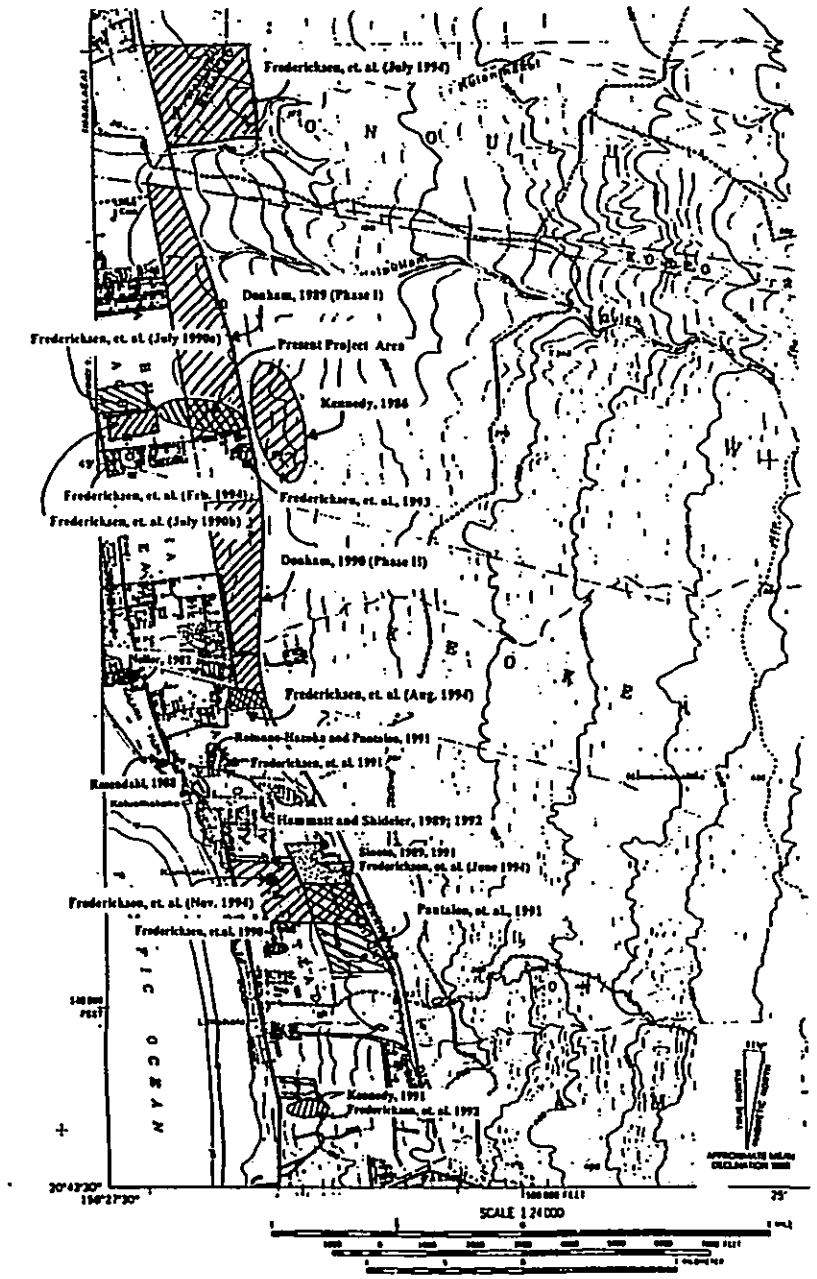
Gagne, W.C. & Cuddihy, L.W. 1990. "Vegetation". in Wagner, et al. Eds. "Manual of the Flowering Plants of Hawai'i". University of Hawaii Press. Honolulu, HI. pp.45-114.

Neal, M.C. 1965. "In Gardens of Hawai'i". Bishop Museum Press. Honolulu, HI. 924p.

Reed, P.B., Jr. 1988. "National List of Plant Species that Occur in Wetlands: Hawaii (Region H)". USFWS Biological Report 88(26.13). 88p.

U.S. Fish and Wildlife Service. 1994. "Hawaiian Islands Listed, Proposed or Candidate Species Under the U.S. Endangered Species Act, Updated: March 28, 1994". USFWS, Pacific Islands Office. H Honolulu, HI. 11p.

Wagner, W.L., Herbst, D.R. & Sohmer, S.H. 1990. "Manual of the Flowering Plants of Hawai'i". University of Hawaii Press. Honolulu, HI. 2 vol. 1853p.



Map 4 - Map showing locations of other archaeological work in general vicinity of current inventory survey.

Photo 1: General view of proposed Road "C" Corridor towards Longs Drug and Azeka's II developments. View to the west or *makai*. Note wetlands habitat in background.

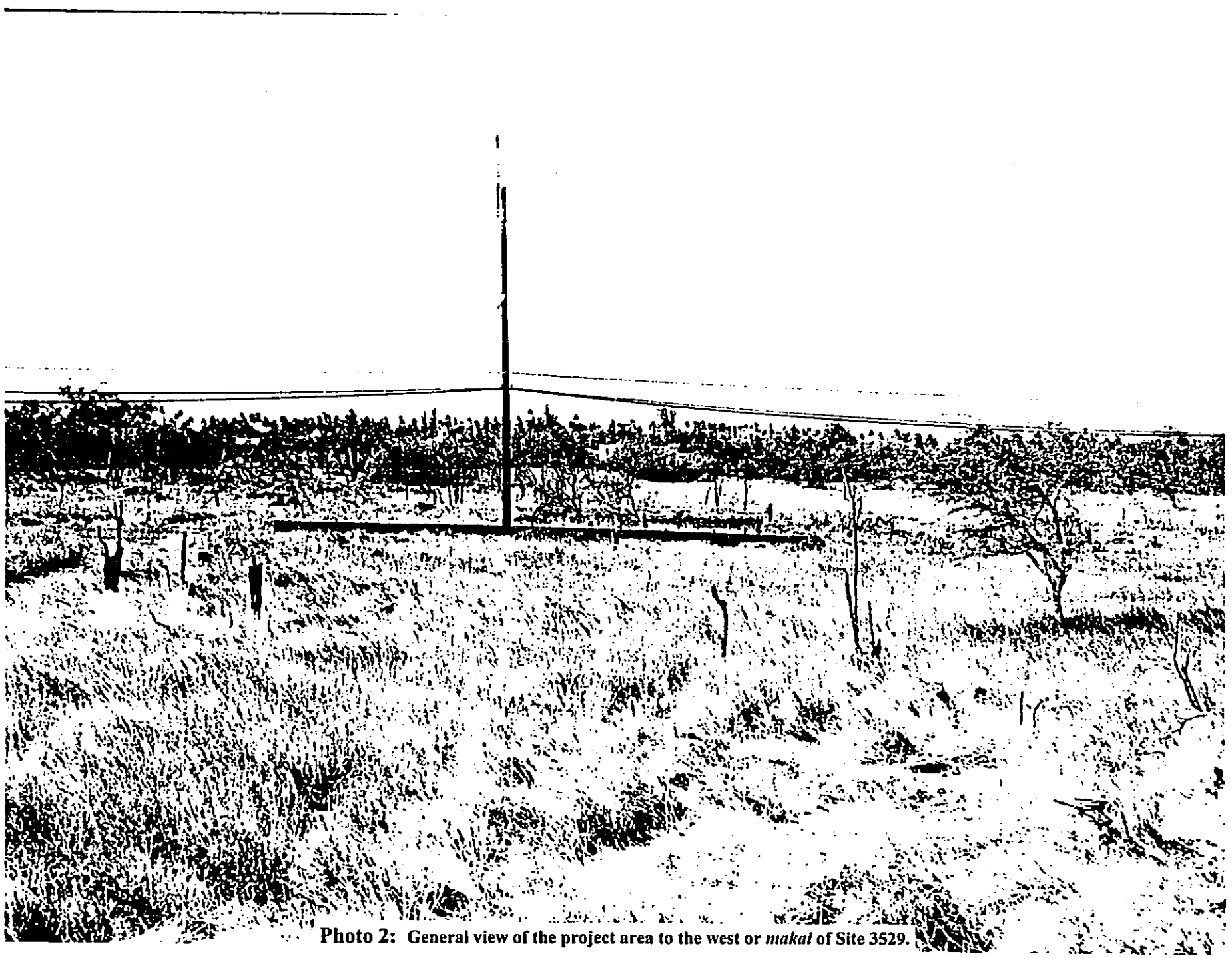


Photo 2: General view of the project area to the west or *makai* of Site 3529.

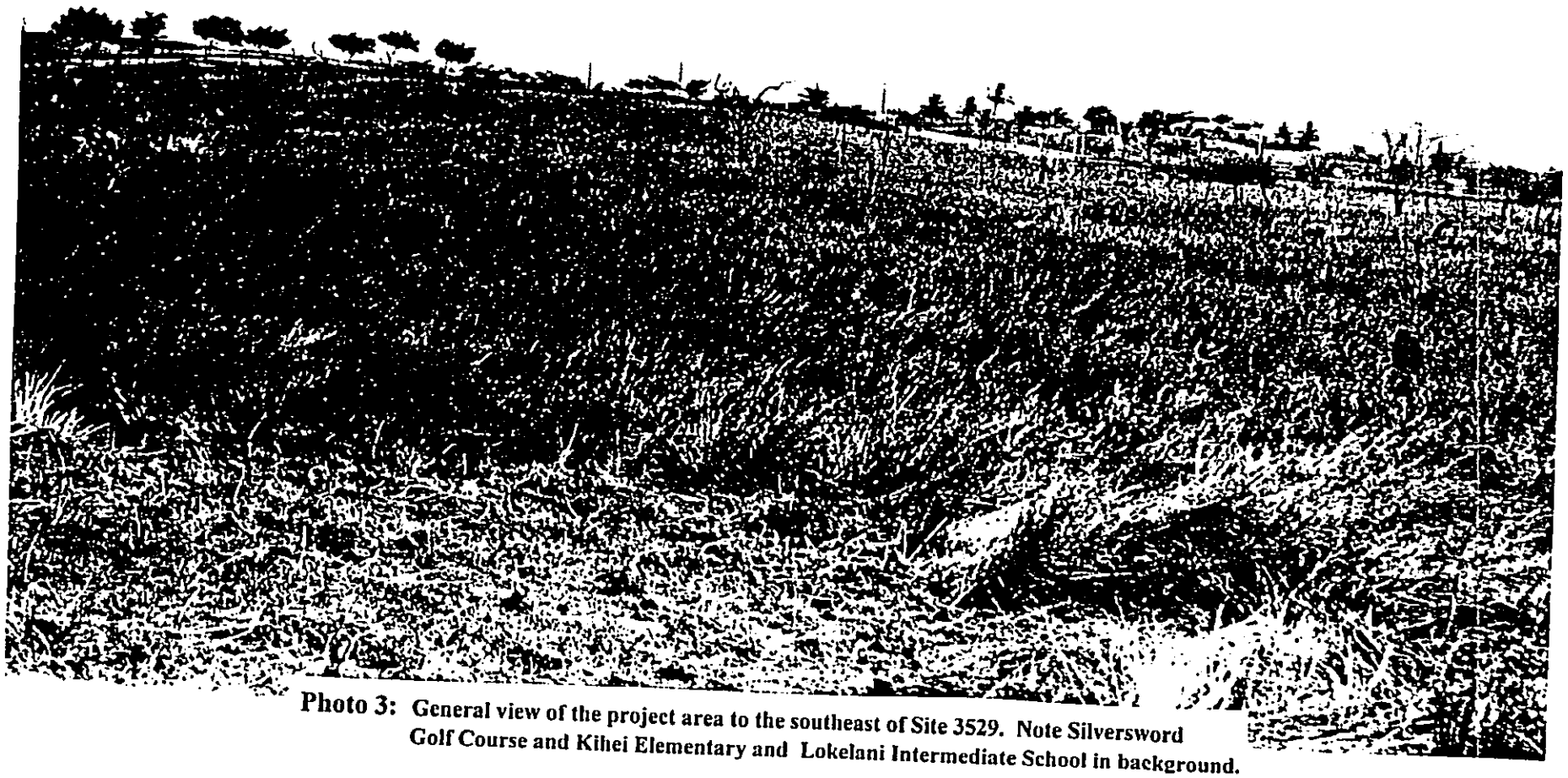


Photo 3: General view of the project area to the southeast of Site 3529. Note Silversword Golf Course and Kihei Elementary and Lokelani Intermediate School in background.

Photo 4: General view of Site 3529 rock shelter including location of Test Unit #1. View to the southeast.

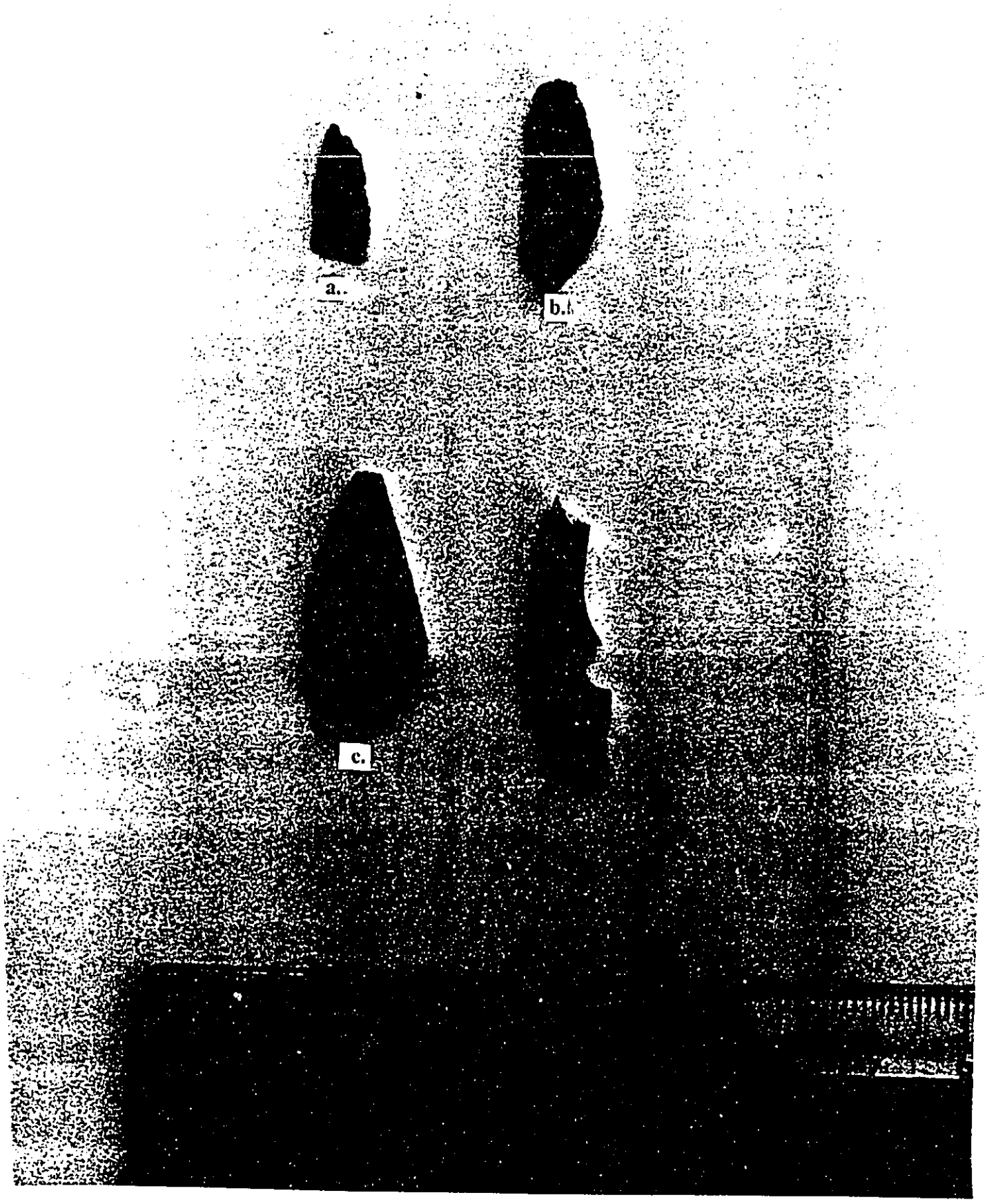


Photo 5: Indigenous artifacts located in Test Unit #1 - 30 to 40 cmbs (a. Incised bone, b. Coral file and c. Coral abrader) and in Shovel Test #5 - 0 to 10 cmbs (Bone fish hook shank)

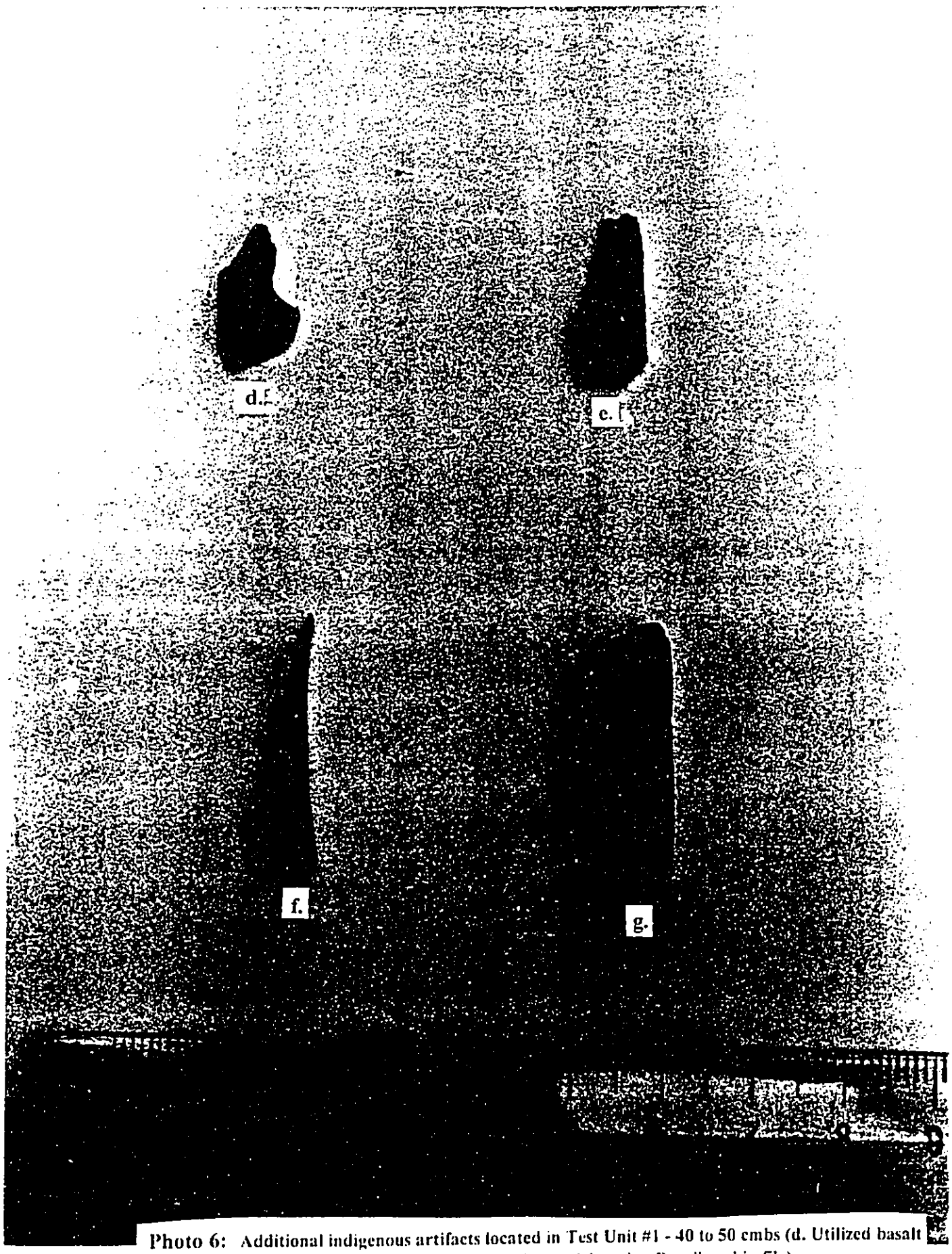


Photo 6: Additional indigenous artifacts located in Test Unit #1 - 40 to 50 cmbs (d. Utilized basalt flake, e. Utilized basalt flake, f. Fish bone pick and g. Pencil urchin file).

Appendix B-1

Letters from State Historic Preservation Division Dated June 13, 1994, July 25, 1994, September 12, 1996, and September 19,1996

JOHN WAIHEE
GOVERNOR OF HAWAII

94 JUN 16 P1:15

DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

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DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

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June 13, 1994

Mr. Brian Miskae, Director
Maui Planning Department
250 South High Street
Wailuku, Maui, Hawaii 96793

LOG NO: 11798
DOC NO: 9406KD15

Dear Mr. Miskae:

SUBJECT: County of Maui, Historic Preservation Review of the Piilani Village Amendment to Project District Ordinance (I.D. No. 94/PH1-02)
Waiohuli and Keokea, Makawao, Maui
TMK: 2-2-02: 42 (por), 66, 67, 68

Thank you for the opportunity to review the project report for proposed amendments to the Piilani Village Project District Ordinance. The Piilani project district comprises c. 187.8 acres along the *makai* side of Piilani Highway in Kihei. Amendments to the Project District Ordinance are being sought in order to accommodate the project to recent changes in land use in the area, and to provide for greater marketing and planning flexibility.

Concerning cultural resources within the project area, the Project Report states (pages 19,20):

> In addition, the project area does not contain any known significant archaeological or cultural sites, based on previous archaeological reports. Data recovery work has been completed for two sites previously recommended for mapping and subsurface testing.

This statement applies only to the portion of the project area north of Lipoa Street. An archaeological inventory survey was conducted of this area in 1989 (*Archaeological Inventory Survey, Piilani Residential Community - Phase I, Land of Waiohuli, Makawao District, Island of Maui*, T.K. Donham 1989). Data recovery at Site 50-10-2475 was conducted in this portion of the project area in 1990 (*Archaeological Data Recovery Program, Site 50-50-10-2475, Piilani Residential Community - Phase I*, T.K. Donham 1990).

In 1990, a second inventory survey was conducted of the project area south of Lipoa Street (*Archaeological Inventory Survey, Piilani Residential Community - Phase II, Land of Keokea, Makawao District, Island of Maui*, T.K. Donham 1990). Sixteen sites with 30 component features were identified during this second inventory survey. Formal feature types identified include terraces, low-walled enclosures, C-shaped walls, rock piles, platforms, midden scatters, an alignment, a high-walled enclosure and a modified outcrop. Among the 30 features identified, 23 were interpreted as agricultural features, five were interpreted as habitation features, one was thought to reflect both habitation and agriculture, and one was interpreted as a possible shrine.

Six of the sixteen sites were assessed as having significant information value, and were recommended for further data recovery. A data recovery plan was prepared which proposed specific excavation strategies and research questions for the project area (*Archaeological Data Recovery Plan, Piilani Residential Community - Phase II, Land of Keokea, Makawao District, Island of Maui*, T.K. Donham 1990). This plan was reviewed by the Historic Preservation Division, and after minor modifications, was found acceptable.

The data recovery plan calls for additional field work with excavation at Sites 50-10-1710, 2512, 2514, 2516, 2519, and 2522. These sites are located between the southern boundary of Kihei School and Keokea Gulch. To our knowledge, data recovery has not yet been conducted at these six sites. These sites will be adversely affected by construction of the park and of residential lots.

We request that the discussion on pages 19 and 20 of the Project Report be corrected to reflect the above information.

If the Project District Amendments are approved, we request that the following condition be applied:

> Prior to the approval of any further subdivision of the area south of Lipoa Street, and prior to the initiation of any vegetation grubbing, grading, general earthmoving, or other construction activities in this area:
>
> a) Data recovery work as specified in the archaeological data recovery plan shall be conducted at Sites 50-10-1710, 2512, 2514, 2516, 2519 and 2522.
>
> b) A final report of the data recovery findings shall be submitted to the Historic Preservation Division for review and approval.
>
> c) If applicable, a preservation plan shall be prepared

and submitted for review, and approved by the Historic Preservation Division.

d) If applicable, any recommended interim preservation measures, such as fencing of site buffers, shall be in place.

Please contact Ms. Theresa Donham at 243-5169 if you have any questions.

Sincerely,

DON HIBBARD, Administrator
State Historic Preservation Division

TD: rn

c: Roger Evans, OCEA (File No. 94-649)

JUL 27 1994

JOHN WAIHEE
GOVERNOR OF HAWAII

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STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

July 25, 1994

LOG NO: 12273
DOC NO: 9407KD17

Milton Arakawa
Munekiyo & Arakawa, Inc.
1823 Wells Street, Suite 3
Wailuku, Hawaii 96793

Dear Mr. Munekiyo:

SUBJECT: Historic Preservation Review of a North-South Collector Road - Road "C" to Lipoa Street
Waiohuli and Keokea, Makawao District, Maui
TMK: 2-2-02: 42, 43

Thank you for submitting a topographic map of the proposed Road "C" collector road for our review. The portion of the collector road that we are reviewing at this time is to be located between the proposed Road "C" and a point approximately 500 feet south of Lipoa Street.

The proposed collector road route was examined by State Historic Preservation Division staff July 6, 1994. Most of the proposed route to the north of Lipoa Street crosses previously graded areas that contain no vegetation and little to no topsoil. The portion of the route to the south of Lipoa Street follows an existing dirt road.

A known historic site (SIHP Site 50-50-10-1710) is located immediately south of the Kihei Elementary/Lokilani School site and adjacent to the dirt road which the proposed collector road will follow. This site, which consists of an enclosure and associated midden scatter, was determined to be significant for its information value and has been recommended for archaeological data recovery. (*Archaeological Inventory Survey, Piilani Residential Community Phase II, Land of Keokea, Makawao District, Island of Maui*, T. K. Donham 1990). The data recovery work, which is to precede development of a residential project, has not occurred at this site to date.

Historic Site 50-10-1710 does not appear to be within 500 feet from Lipoa Street, which is the current stated distance for the collector road. The construction staging area for the road may,

however, extend further south along the existing dirt road, and could potentially impact this site.

The proposed collector road route between Lipoa Street and the Road "C" corridor has been impacted by heavy machinery; no evidence of historic sites is present in this area. However, a significant historic site (50-50-10-3529) is located less than 50 feet north from the proposed intersection of Road "C" and the collector road. This site, which consists of a buried pre-contact period cultural deposit, was identified during inventory survey of the Road "C" corridor and is significant for its information value. Data recovery work at this site is pending.

In order for the north-south collector road project to have "no adverse effect" on historic sites, we recommend that Sites 50-50-10-1710 and -3529 (with appropriate buffer zones) be marked for avoidance with orange construction fencing prior to initiation of road construction work. Should the archaeological data recovery work be completed at either of these sites prior to road construction, the State Historic Preservation Division will notify your office that the work has been completed.

If you have any questions, please contact Ms. Theresa K. Donham at 243-5169.

Sincerely,

DON HIBBARD, Administrator
State Historic Preservation Division

KD:jen

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

September 12, 1996

Mr. Glen Ueno
Department of Public Works
Division of Land Use and Codes Administration
250 South High Street
Wailuku, Hawaii 96793

LOG NO: 18056
DOC NO: 9609KD11

Dear Mr. Ueno:

SUBJECT: Chapter 6E-42 Historic Preservation Review -- Piilani North II-A Large Lot Subdivision, Waiohuli, Makawao District, Island of Maui
TMK: 2-2-02: 66 (LUCA File No. 2.2381)

We have received the preliminary plat of the Piilani North II-A Large Lot Subdivision, which is located along the west side of Piilani Highway, between the existing Piilani Phase I subdivision and Lipoa Street in Kihei. Three lots are proposed; a 17.3 acre lot for Phase II residential development (LUCA File 2.1863), a lot for the Walpuilani Street extension, and a 59.7 acre lot for future residential development.

Our office has previously reviewed the Project District Ordinance approval and Special Management Area permit for this project, as well as an amended Project District application (letter to B. Miskae June 13, 1994). As part of our original review of this project, an inventory survey was requested and successfully completed by the applicant (Donham 1989). Subsequent to acceptance of the inventory survey report by our office, a data recovery plan was approved and executed. The report on data recovery excavations at Site 50-50-10-2475 was reviewed and approved as well.

The area included within the II-A Large Lot Subdivision is within the area encompassed by the former Piilani Village Phase I project area. Historic preservation review has been concluded for this area. The proposed large lot subdivision will have "no effect" on historic sites.

Please contact Ms. Theresa K. Donham at 243-5169 if you have any questions.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

KD:jen

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
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September 19, 1996

Mr. Milton Arakawa
Munekiyo & Arakawa, Inc.
305 High Street, Suite 104
Wailuku, Hawaii 96793

LOG NO: 18120
DOC NO: 9609KD16

SUBJECT: **Chapter 6E-8 Historic Preservation Review of the Road "C" Realignment, Waiohuli, Makawao District, Island of Maui**
TMK: 2-2-02: por. 66

Thank you for the opportunity to comment on the proposed realignment of the Road "C" corridor in Kihei. This County of Maui Public Works project is located between Piilani Highway and South Kihei Road, just north of Lipoa Street. The road corridor has been realigned to proceed in an east-west orientation from the proposed N-S collector road, rather than the original NW-WE orientation. An archeological inventory survey was conducted of the original corridor alignment (Fredericksen and Fredericksen 1995), and a single historic site consisting of a subsurface midden and artifact deposit was identified (SIHP Site 50-50-10-3529) adjacent to a rock outcrop. Data recovery was recommended at this site, and the fieldwork was completed in 1995. The draft data recovery report has been reviewed by our office, and a revised report is being prepared.

The western portion of Road "C" follows its original corridor between South Kihei Road and the proposed N-S collector road. From this point, it gradually moves to the north of the original corridor, and appears to avoid Site 3529. Approximately 70% of the revised corridor is within the area previously surveyed for the original alignment. The remainder of the alignment is within the area previously surveyed for the Piilani Village Subdivision (Donham 1989). No historic sites were identified within this area during the previous survey.

An inspection of the eastern portion of the new corridor was conducted by SHPD staff on September 11, 1996, in order to verify the findings of the previous survey. The centerline of this c. 720 ft long section of the new alignment was staked, and clearly visible in the field. A 200 ft wide corridor (100 ft on either side of the center line) was examined during the inspection. Evidence of bulldozing, associated with recent fire control, was present within the area. No evidence of historic sites was observed.

Based on the findings of a prior inventory survey and a recent field inspection, it appears that there are no historic sites within the revised corridor of Road "C". We believe that the revised alignment will have "no effect" on historic sites.

If the N-S collector road is constructed in connection with this project, our previous recommendations regarding protective fencing around Site 50-50-09-1170 are still in effect (letter date July 25, 1994; LOG 12273, DOC 9407KD17).

Please contact Ms. Theresa E. Donham at 243-5169 if you have any questions.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

KD:jen

Appendix C

Acoustic Study

ACOUSTIC STUDY
FOR THE
KIHEI COLLECTOR ROAD "C" PROJECT
KIHEI, MAUI, HAWAII

Prepared for:

MUNEKIYO AND ARAKAWA, INC.

Prepared by:

Y. EBISU & ASSOCIATES
1126 12th Avenue, Room 305
Honolulu, Hawaii 96816

JUNE 1995

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CHAPTER I. SUMMARY

This study evaluated the potential noise impacts in the immediate vicinity of and attributable to the proposed construction of the Kihei Collector Road "C" and the interim North-South Collector Road section between Kihei Elementary School and Road "C" on the island of Maui, Hawaii. The possible changes in traffic volumes and noise levels along the existing roadways adjacent to Road "C" were also investigated.

Existing noise sensitive properties along the project corridor include scattered single-family residences, classroom and library buildings of Kihei Elementary School, and the former Maui Hotel structure which is planned to be converted to an instructional facility. These noise sensitive properties are not expected to be adversely impacted by Road "C" traffic noise levels following its construction by CY 1998, or following construction of the entire North-South Collector Road by CY 2005. The reason for this conclusion is that the traffic volumes and noise levels along the existing roadways are not anticipated to increase significantly as the result of the construction of the Road "C" Project, and existing noise sensitive structures have adequate setback distances from the Road "C" Right-of-Way. A redistribution of traffic volumes among the existing roadways is expected to occur as a result of the Road "C" Project, but the differential volumes and resulting changes in traffic noise levels are anticipated to be 2.8 dB or less, which are not considered to be significant. The redistribution of traffic volumes and resulting traffic noise away from the existing residential area fronting Lipoa Street between South Kihei Road and Kihei Elementary School is expected to occur, which is a positive benefit resulting from the project. For these reasons, traffic noise mitigation measures should not be required in conjunction with this project.

Short-term noise impacts associated with construction activities along the project corridor may occur. These impacts can

occur as a result of the short distances (less than 100 feet [30.5 meters]) between existing receptors and the anticipated construction sites, particularly in the vicinity of the commercial area at the South Kihei Road intersection, in the area near Kihei Elementary School, and near the interim North-South Collector Road intersection at Lipoa Street.

CHAPTER II. NOISE DESCRIPTORS AND THEIR RELATIONSHIP TO LAND USE COMPATIBILITY

A general consensus has developed for use of the Day-Night Sound Level (Ldn) in describing environmental noise in general, and for relating the acceptability of the noise environment for various land uses. The Day-Night Sound Level represents the 24-hour average sound level for a typical day, with nighttime noise levels (10:00 P.M. to 7:00 A.M.) increased by 10 decibels prior to computation of the 24-hour average.

The Ldn descriptor employs a process of averaging instantaneous A-Weighted sound levels as read on a standard Sound Level Meter, which are normally referred to as meter readings in dBA. A brief description of the acoustic terminology and symbols used are provided in APPENDIX B. The average noise level during a one hour period is called the Hourly Equivalent Sound Level, and is designated as Leq(h) or Leq. The maximum A-Weighted sound level occurring during an intermittent event (or single event) is referred to as the Lmax value. The mathematical product (or integral) of the instantaneous sound level times the duration of the event is known as the Sound Exposure Level, or Lse, and is analogous to the energy of the time varying sound levels associated with the intermittent noise event. Current noise standards and criteria which associate land use compatibility or adverse health and welfare effects with various levels of environmental noise are normally described in terms of Ldn rather than the single event (Lmax or Lse) noise descriptors. The reasons for this are based on the relatively good correlation between the cumulative Ldn descriptor and annoyance reactions of the exposed population. However, at very low levels of environmental noise (55 Ldn or less), other attitudinal variables and biases (besides noise) of the exposed population tend to influence annoyance reactions, and the correlation between annoyance reactions and Ldn levels deteriorates.

TABLE 1, extracted from Reference 1, categorizes the various

TABLE 1

EXTERIOR NOISE EXPOSURE CLASSIFICATION
(RESIDENTIAL LAND USE)

NOISE EXPOSURE CLASS	DAY-NIGHT SOUND LEVEL	EQUIVALENT SOUND LEVEL	FEDERAL[1] STANDARD
Minimal Exposure	Not Exceeding 55 L_{dn}	Not Exceeding 55 L_{eq}	Unconditionally Acceptable
Moderate Exposure	Above 55 L_{dn} But Not Above 65 L_{dn}	Above 55 L_{eq} But Not Above 65 L_{eq}	Acceptable[2]
Significant Exposure	Above 65 L_{dn} But Not Above 75 L_{dn}	Above 65 L_{eq} But Not Above 75 L_{eq}	Normally Unacceptable
Severe Exposure	Above 75 L_{dn}	Above 75 L_{eq}	Unacceptable

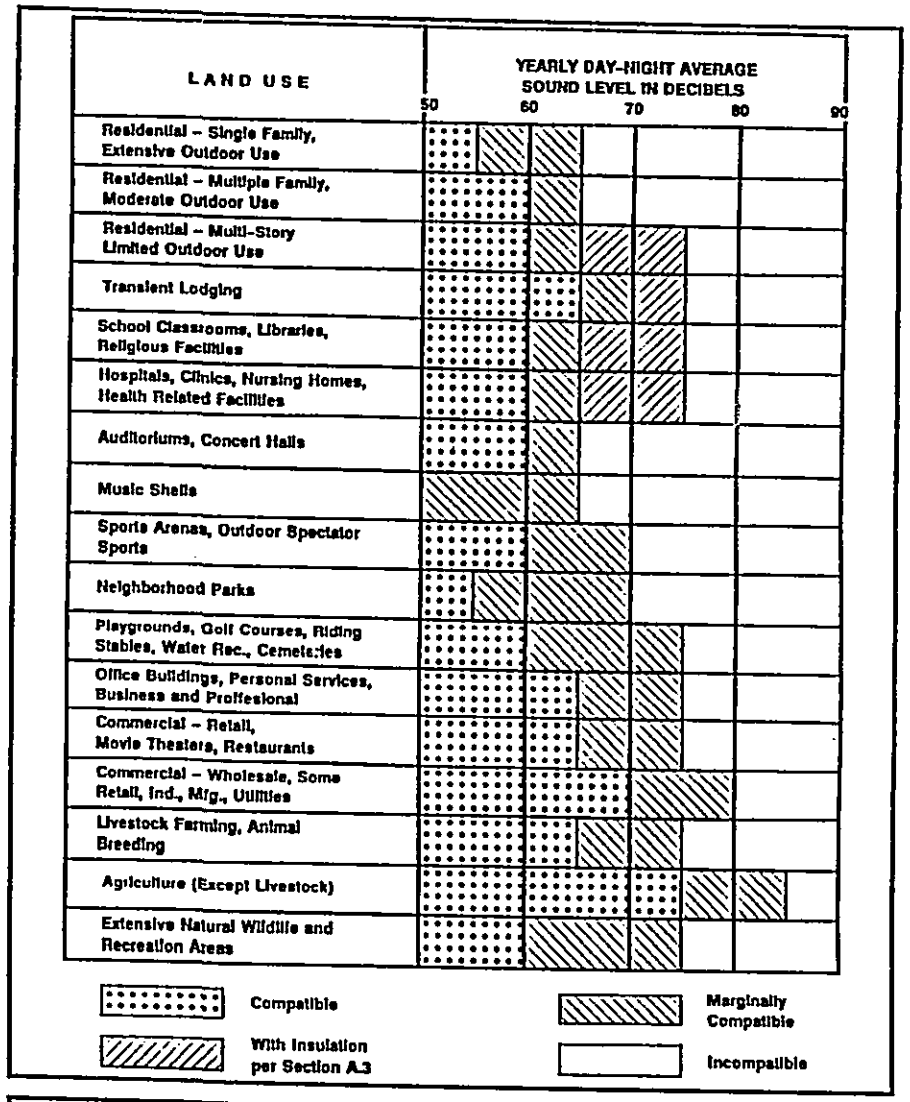
Notes: (1) Federal Housing Administration, Veterans Administration, Department of Defense, and Department of Transportation.

(2) FHWA uses the L_{eq} instead of the L_{dn} descriptor. For planning purposes, both are equivalent if: (a) heavy trucks do not exceed 10 percent of total traffic flow in vehicles per 24 hours, and (b) traffic between 10:00 PM and 7:00 AM does not exceed 15 percent of average daily traffic flow in vehicles per 24 hours. The noise mitigation threshold used by FHWA for residences is 67 L_{eq}.

Ldn levels of outdoor noise exposure with severity classifications. Land use compatibility guidelines for various levels of environmental noise as measured by the Ldn descriptor system are shown in **FIGURE 1.** A general consensus among federal agencies has developed whereby residential housing development is considered acceptable in areas where exterior noise does not exceed 65 Ldn. This value of 65 Ldn is used as a federal regulatory threshold for determining the necessity for special noise abatement measures when applications for federal funding assistance are made.

Federal agencies (HUD and EPA) recognize 55 Ldn as a desirable goal for exterior noise in residential areas for protecting the public health and welfare with an adequate margin of safety (**References 2 and 3**). Although 55 Ldn is significantly quieter than 65 Ldn, the lower level has not been adopted for regulatory purposes by federal agencies due to economic and technical feasibility considerations.

The U.S. Federal Highway Administration (FHWA) uses the Leq or L10 descriptors rather than the Ldn noise descriptor in assessing highway noise impacts and noise mitigation requirements (**Reference 4**). The L10 descriptor represents the noise level exceeded ten percent of the time during the peak traffic hour of interest. The Leq is normally evaluated during the peak traffic hour. For traffic noise levels in the project area, the Leq and Ldn levels are essentially identical (within 1 dB). **TABLE 2**, which was extracted from **Reference 4**, presents the current FHWA Noise Abatement Criteria which are normally applied in evaluations of potential noise impacts on federally-sponsored roadway improvement projects. In general, the 67 Leq threshold for Activity Category B is applied at all residences in the vicinity of these roadway improvement projects. Where use of the 67 Leq threshold would result in a significant increase in background ambient noise levels at residences which are located in quiet communities, the FHWA 57 Leq criteria can be used as a more conservative noise abatement threshold. For FHWA-sponsored projects, the Hawaii State Depart-



LAND USE COMPATIBILITY
WITH YEARLY DAY–NIGHT AVERAGE SOUND LEVEL
AT A SITE FOR BUILDINGS AS COMMONLY CONSTRUCTED
(Source: American National Standards Institute S12.40–1990)

FIGURE 1

TABLE 2

FHWA NOISE ABATEMENT CRITERIA
[Hourly A–Weighted Sound Level––Decibels (dBA)]

ACTIVITY CATEGORY	LEQ (H)	DESCRIPTION OF ACTIVITY CATEGORY
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the areas are to continue to serve their intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, activity sports areas, parks, residences, motels, hotels, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	------	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

ment of Transportation's interim definition of "substantial increase" in traffic noise levels which require noise mitigation measures is an increase greater than 15 dB (Reference 5).

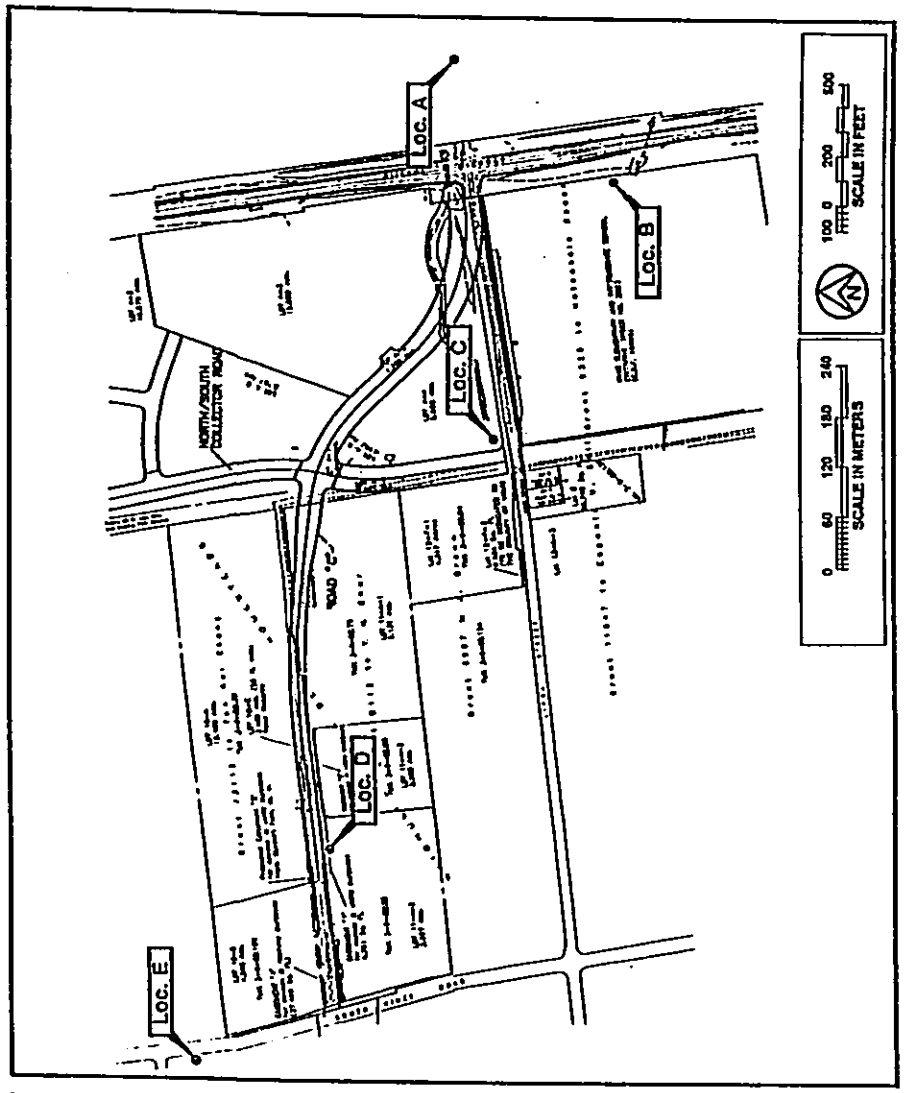
For schools, where the primary educational activities occur indoors, the FHWA 52 Leq interior noise standard may be used in order to minimize potential traffic noise impacts on classroom activities. For planning purposes, use of a 60 Leq exterior criteria level at school buildings which are naturally ventilated can be considered to be equivalent to the FHWA 52 Leq interior criteria. For commercial, industrial, and other non-noise sensitive land uses, exterior noise levels as high as 75 Ldn are generally considered acceptable. Exceptions to this occur when naturally ventilated office and other commercial establishments are exposed to exterior levels which exceed 65 Ldn.

CHAPTER III. GENERAL STUDY METHODOLOGY

Existing traffic and background ambient noise levels were measured at five locations in the project environs to provide a basis for describing the existing background ambient noise levels and for calibrating the Federal Highway Administration (FHWA) Highway Noise Model. The FHWA model was used to predict the traffic noise levels along the existing roadway sections, along the future Road "C" section between South Kihei Road and Piilani Highway, and along the future North-South Collector Road. The noise measurements were performed during the month of June 1994. The noise measurement Locations A thru E are shown in FIGURE 2, and the measurement results are included in TABLE 3 and FIGURES 3 thru 7. TABLE 3 also includes a comparison of the measured traffic noise levels with predictions of the FHWA Highway Noise Model.

The Federal Highway Administration (FHWA) Traffic Noise Prediction Model (Reference 6) was used as the primary method of calculating the existing and future traffic noise levels, with model parameters adjusted to reflect terrain, ground cover, and local shielding conditions. The measured traffic noise levels at Locations A, B, C, and E were compared with model predictions to insure that measured and calculated noise levels for the existing conditions were consistent and in general agreement. As indicated in TABLE 3, spot counts of existing traffic volumes were obtained during the measurement periods and were used to generate the Equivalent Sound Level (Leq) predictions shown in the table. The agreement between measured and predicted traffic noise levels was considered to be good and sufficiently accurate to justify use of the highway noise model to calculate the existing and future traffic noise levels.

The potential noise impacts associated with the planned construction of the Collector Road "C" were evaluated. Future traffic noise levels for CY 1998 and CY 2005 conditions with and without the implementation of the Road "C" Project were developed



LOCATIONS OF NOISE MEASUREMENT SITES

FIGURE 2

TABLE 3

TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)/(KMPH)	---Hourly Traffic Volume--- AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
A. 25 FT (7.6 M) from the centerline of Lipoa Parkway. (6/1/94)	1525 TO 1625	30 / 48.3	74	0	0	58.2	58.1
B. 50 FT (15.2 M) from the centerline of Piilani Hwy. (6/1/94)	1415 TO 1515	54 / 86.9	1,587	22	33	70.2	70.3
C. 50 FT (15.2 M) from the centerline of Lipoa St. (6/1/94)	0915 TO 1015	30 / 48.3	546	10	5	62.4	60.6
D. 640 FT (195.1 M) east of the intersection of Rd. "C" & S. Kihei Rd. (6/1/94)	1255 TO 1355	N/A	N/A	N/A	N/A	50.3	N/A
E. 50 FT (15.2 M) from the centerline of S. Kihei Rd. (6/1/94)	1035 TO 1135	35 / 56.3	1,195	13	18	62.4	62.3

FIGURE 3

HISTOGRAM OF MEASURED SOUND LEVELS AT LOCATION "A"

DATE: JUNE 1, 1994
TIME: 1525-1625 HOURS

METER RESPONSE: FAST

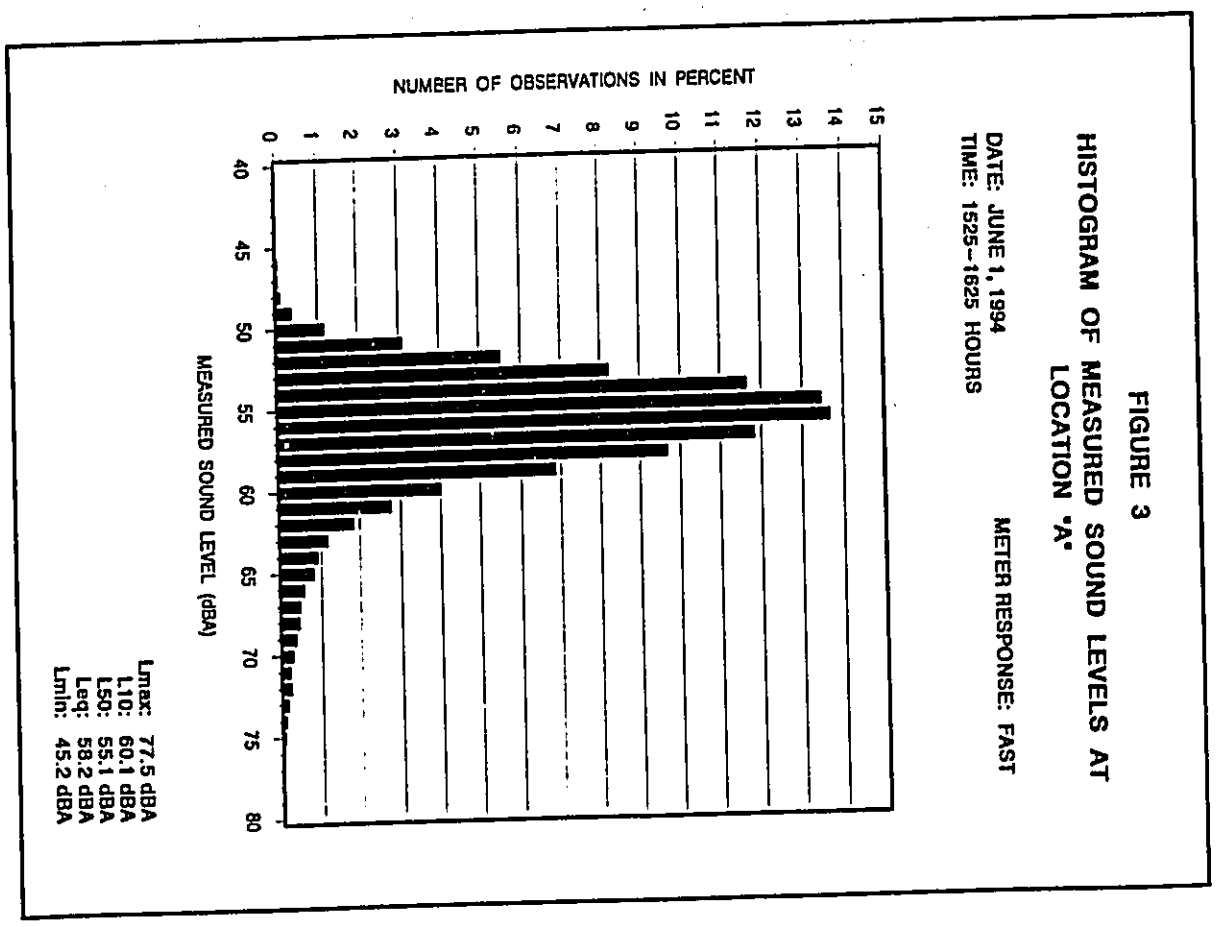
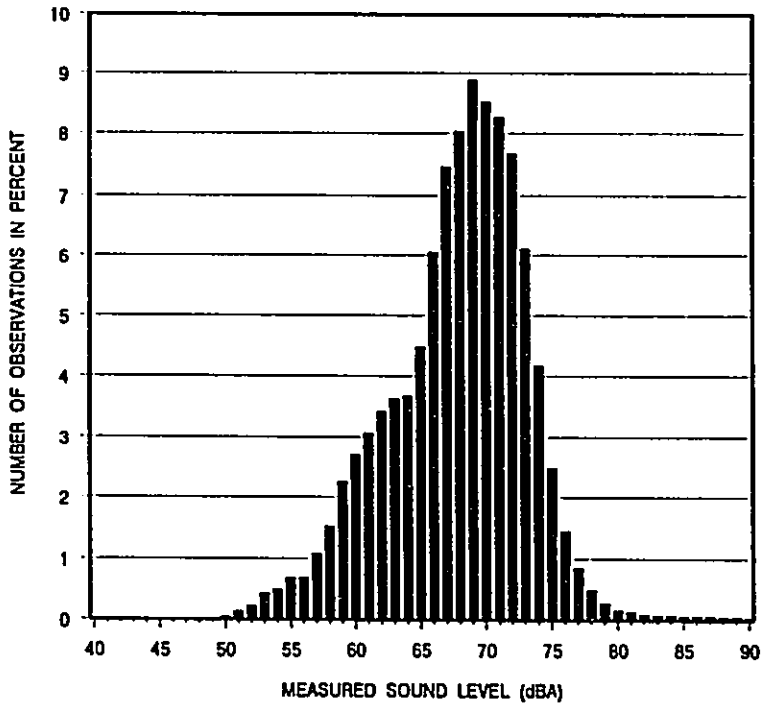


FIGURE 4

HISTOGRAM OF MEASURED SOUND LEVELS AT LOCATION "B"

DATE: JUNE 1, 1994
TIME: 1415–1515 HOURS

METER RESPONSE: FAST



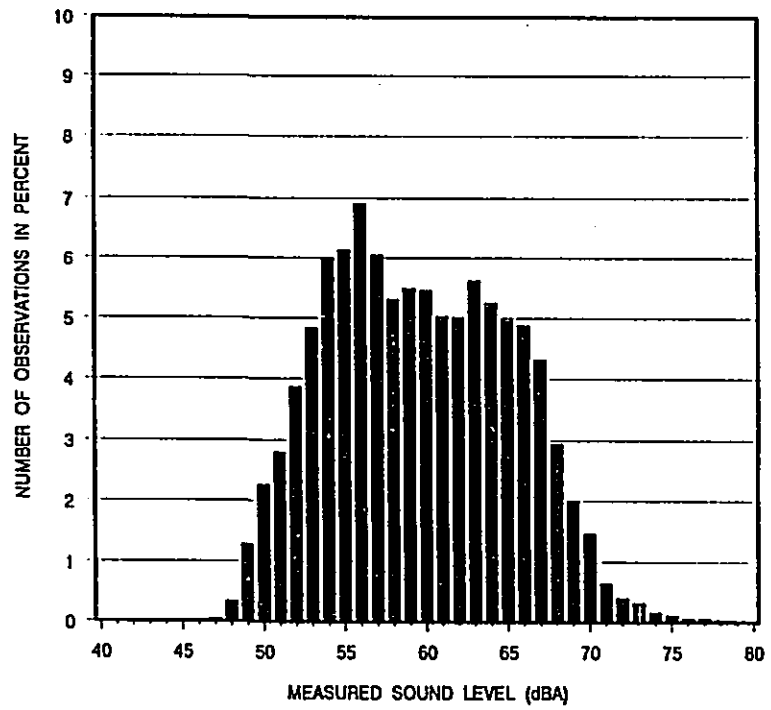
Lmax: 89.9 dBA
L10: 73.1 dBA
L50: 67.6 dBA
Leq: 70.2 dBA
Lmin: 49.4 dBA

FIGURE 5

HISTOGRAM OF MEASURED SOUND LEVELS AT LOCATION "C"

DATE: JUNE 1, 1994
TIME: 0915–1015 HOURS

METER RESPONSE: FAST



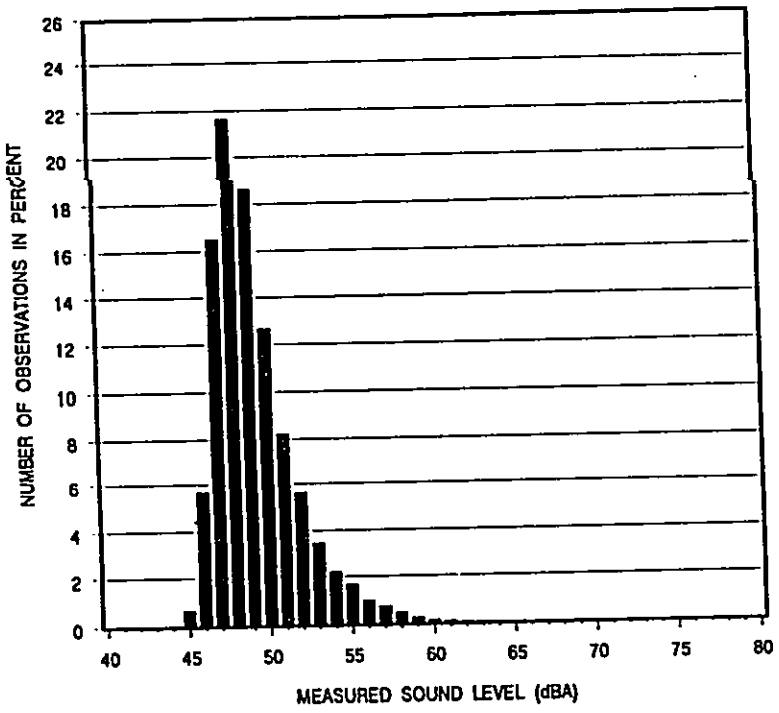
Lmax: 77.7 dBA
L10: 66.6 dBA
L50: 58.6 dBA
Leq: 62.4 dBA
Lmin: 46.3 dBA

FIGURE 6

HISTOGRAM OF MEASURED SOUND LEVELS AT LOCATION "D"

DATE: JUNE 1, 1994
TIME: 1255–1355 HOURS

METER RESPONSE: FAST



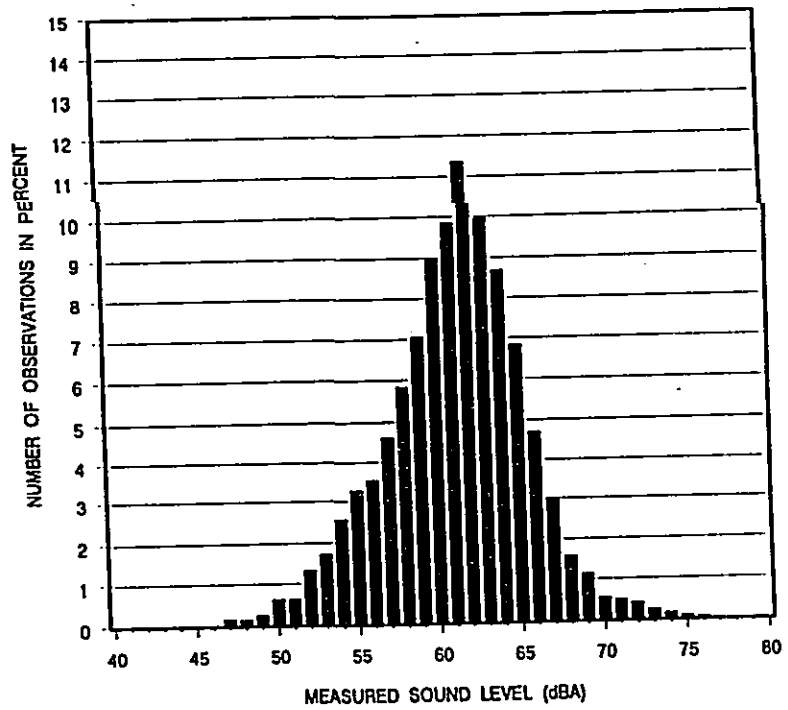
Lmax: 76.7 dBA
L10: 52.1 dBA
L50: 48.1 dBA
Leq: 50.3 dBA
Lmin: 43.7 dBA

FIGURE 7

HISTOGRAM OF MEASURED SOUND LEVELS AT LOCATION "E"

DATE: JUNE 1, 1994
TIME: 1035–1135 HOURS

METER RESPONSE: FAST



Lmax: 77.4 dBA
L10: 65.1 dBA
L50: 60.6 dBA
Leq: 62.4 dBA
Lmin: 45.7 dBA

along the existing and new roadways in the environs of the project.

Reference 7 was used to develop the existing (CY 1994) and future (CY 1998 and CY 2005) peak hour traffic volumes with and without the project along the roadways within the immediate environs of the project. It was assumed that Road "C" could be constructed by CY 1998, with an interim connector road provided between Road "C" and the southwest corner of Kihei Elementary School. The connector road would be constructed along the alignment of the planned North-South Collector Road. By CY 2005, it was assumed that the North-South Collector Road would be completed under a separate project, with a connection to Road "C".

Reference 8 was used to estimate the relationship between the PM peak hour Leq's and the 24-hour Ldn's along the roadways of interest. Traffic vehicle mixes along the existing and new roadways were assumed to be remain constant between CY 1994 and CY 2005. The Day-Night Sound Level (Ldn) noise descriptor was used in addition to the hourly Leq descriptor to evaluate potential traffic noise impacts and to allow for direct comparisons of the existing and future traffic noise levels with the 65 Ldn FHA/HUD noise standard.

The predicted CY 1998 and CY 2005 traffic noise levels at noise sensitive receptors in the project environs were evaluated. The predicted future traffic noise levels were compared with existing noise levels as well as with the 65 Ldn FHA/HUD and 67 Leq FHWA noise abatement criteria to identify specific locations where noise abatement measures might be necessary. These evaluations were performed along the proposed Road "C" as well as along the interim connector road, but did not include evaluations of potential noise impacts along the North-South Collector Road in CY 2005. Evaluations of potential noise impacts and possible mitigation measures at the existing Kihei Elementary School were also performed due to the possible increase in traffic noise from the curved section of Road "C" near Piilani Highway.

CHAPTER IV. EXISTING TRAFFIC NOISE ENVIRONMENT

For the purposes of this study, CY 1994 was used as the Base Year for computing changes in traffic noise levels among the various Alternatives in CY 1998 and CY 2005. The Base Year noise levels were described by computing the Hourly Equivalent Sound Levels [Leq(h)] along the existing roadway sections in the project environs for the 1994 time period. These sound levels, expressed in decibels, represent the average level of traffic noise for a given hour of the day. The PM peak hour was used as the hour with the highest traffic noise levels. The 24-hour Ldn can be estimated by adding 1 dB to the PM peak hour Leq (see FIGURE 8).

TABLES 4A and 4B present the traffic volume, speed, and mix assumptions used to calculate the Base Year noise levels along the various sections of the existing roadway system. Also shown in TABLES 4A and 4B are the calculated PM Peak Hour Leq(h)'s at a reference distance of 100 feet (30.5 meters) from the centerline of the various roadway segments. The calculated distances in feet to the various noise contour lines (60, 67, and 72 Leq) under unobstructed, line-of-sight conditions are shown in TABLES 5A(E) and 5B(E). The metric distances to the same noise contour lines are shown in TABLES 5A(M) and 5B(M). The actual distances to the contour lines will generally be less than indicated in the tables when intervening structures or walls exist between the roadway and a receptor. This reduction (or shrinkage) of the traffic noise contour distances from the roadway centerline is the result of noise shielding (or attenuation) affects caused by the intervening structures or walls.

By using the traffic assumptions of TABLE 4A and 4B, an aerial photo of the existing improvements in the project environs, and roadway maps, the relationship of the existing free-field traffic noise contours to noise sensitive properties in the project environs were obtained.

A list of existing noise sensitive properties along the Road

FIGURE 8

HOURLY VARIATIONS OF TRAFFIC NOISE AT 100 FT SETBACK DISTANCE FROM THE CENTERLINE OF PIILANI HIGHWAY NORTH OF LIPOA STREET (JUNE 21–22, 1993)

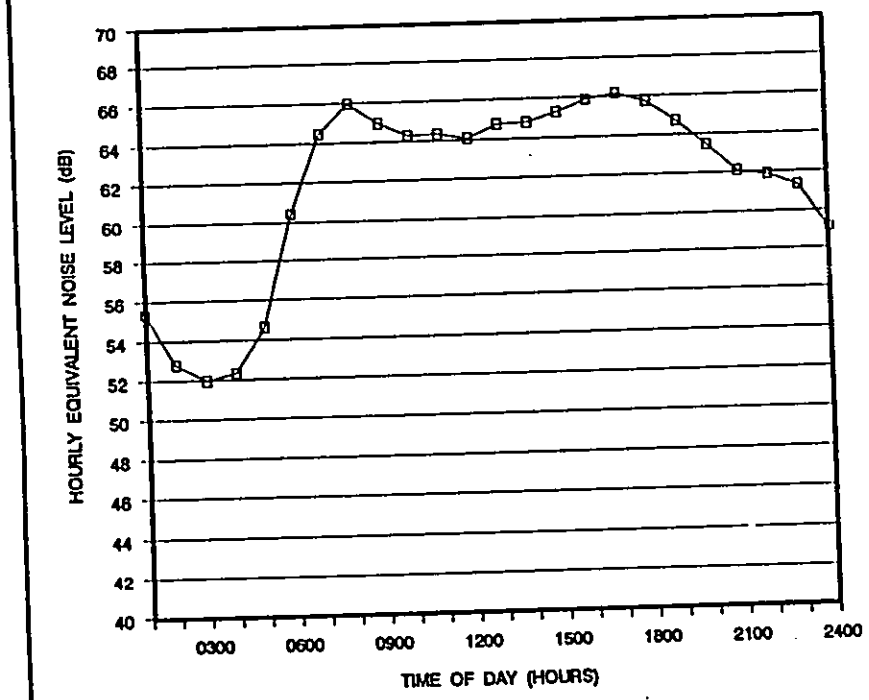


TABLE 4A

COMPARISONS OF EXISTING AND CY 1998
TRAFFIC NOISE LEVELS IN PROJECT ENVIRONS
(PM PEAK HOUR & 100 FT (30.5 M) FROM ROADWAY CENTERLINES)

LOCATION	** SPEED ** (MPH)	(KMPH)	VPH	**** HOURLY LEQ IN dB **** AUTO	MT	HT	ALL VEH
EXISTING (CY 1994) PM PEAK HR. TRAFFIC:							
Piilani Hwy. North of Lipoa St.	54	86.9	2,149	65.8	60.9	64.0	68.8
Piilani Hwy. South of Lipoa St.	54	86.9	2,037	65.6	60.6	63.7	68.5
Lipoa St. West of Piilani Hwy.	30	48.3	796	55.9	50.9	56.1	59.8
Lipoa St. East of South Kihei Rd.	30	48.3	863	56.2	51.3	56.5	60.0
South Kihei Rd. North of Lipoa St.	35	56.3	1,723	57.8	52.6	57.1	61.1
S. Kihei Rd. South of Waipuilani St.	35	56.3	1,421	56.9	51.7	56.3	60.3
FUTURE (CY 1998) PM PEAK HR. TRAFFIC WITH PROJECT:							
Piilani Hwy. North of Road "C"	54	86.9	2,621	66.7	61.7	64.8	69.6
Piilani Hwy. South of Road "C"	54	86.9	2,465	66.4	61.5	64.6	69.4
Lipoa St. West of N–S Collector Road	30	48.3	191	49.7	44.7	49.9	53.4
Lipoa St. East of South Kihei Rd.	30	48.3	171	49.2	44.3	49.4	53.0
Road "C" West of Piilani Hwy.	35	56.3	1,150	57.9	52.7	57.3	61.3
Road "C" East of South Kihei Rd.	35	56.3	876	56.7	51.5	56.1	60.1
South Kihei Rd. South of Road "C"	35	56.3	1,881	58.1	52.9	57.5	61.5
South Kihei Rd. North of Road "C"	35	56.3	2,137	58.7	53.5	58.1	62.1
Interim N–S Collector North of Lipoa St.	35	56.3	238	49.2	44.0	48.5	52.5
Interim N–S Collector South of Lipoa St.	35	56.3	409	51.5	46.3	50.9	54.9

Notes:

The following assumed traffic mix of autos, medium trucks, and heavy vehicles were used for existing and future conditions:

(a) Piilani Highway: 95.5% autos, 2.5% medium trucks, and 2.0% heavy trucks and buses.
(b) Lipoa Street: 96.5% autos, 2.0% medium trucks, and 1.5% heavy trucks and buses.
(c) South Kihei Road, Road "C", and North–South Collector: 96.5% autos, 2.0% medium trucks, and 1.5% heavy trucks and buses.

TABLE 4B

COMPARISONS OF EXISTING AND CY 2005
TRAFFIC NOISE LEVELS IN PROJECT ENVIRONS
(PM PEAK HOUR & 100 FT (30.5 M) FROM ROADWAY CENTERLINES)

LOCATION	** SPEED ** (MPH)	(KMPH)	VPH	**** HOURLY LEQ IN dB **** AUTO	MT	HT	ALL VEH
EXISTING (CY 1994) PM PEAK HR. TRAFFIC:							
Pillani Hwy. North of Lipoa St.	54	86.9	2,149	65.8	60.9	64.0	68.8
Pillani Hwy. South of Lipoa St.	54	86.9	2,037	65.6	60.6	63.7	68.5
Lipoa St. West of Pillani Hwy.	30	48.3	796	55.9	50.9	56.1	59.6
Lipoa St. East of South Kihei Rd.	30	48.3	863	56.2	51.3	56.5	60.0
South Kihei Rd. North of Lipoa St.	35	56.3	1,723	57.8	52.6	57.1	61.1
S. Kihei Rd. South of Waipuilani St.	35	56.3	1,421	56.9	51.7	56.3	60.3
FUTURE (CY 2005) PM PEAK HR. TRAFFIC WITH PROJECT:							
Pillani Hwy. North of Road "C"	54	86.9	3,905	68.4	63.5	66.6	71.4
Pillani Hwy. South of Road "C"	54	86.9	3,710	68.2	63.2	66.3	71.2
Lipoa St. West of N-S Collector Road	30	48.3	675	55.2	50.2	55.4	58.9
Lipoa St. East of South Kihei Rd.	30	48.3	485	53.7	48.8	54.0	57.5
Road "C" West of Pillani Hwy.	35	56.3	2,045	60.4	55.2	59.8	63.8
Road "C" East of South Kihei Rd.	35	56.3	1,495	59.0	53.8	58.4	62.4
South Kihei Rd. South of Road "C"	35	56.3	1,895	58.2	53.0	57.5	61.5
South Kihei Rd. North of Road "C"	35	56.3	2,110	58.6	53.4	58.0	62.0
N-S Collector Rd. North of Lipoa St.	35	56.3	1,448	57.0	51.8	56.4	60.4
N-S Collector Rd. South of Lipoa St.	35	56.3	1,240	56.3	51.1	55.7	59.7

Notes:

The following assumed traffic mix of autos, medium trucks, and heavy vehicles were used for existing and future conditions:

(a) Pillani Highway: 95.5% autos, 2.5% medium trucks, and 2.0% heavy trucks and buses.
(b) Lipoa Street: 96.5% autos, 2.0% medium trucks, and 1.5% heavy trucks and buses.
(c) South Kihei Road, Road "C", and North-South Collector: 96.5% autos, 2.0% medium trucks, and 1.5% heavy trucks and buses.

TABLE 5A(E)

EXISTING AND CY 1998 DISTANCES TO 60, 67, AND 72 Leq CONTOURS

STREET SECTION	60 Leq SETBACK (FT) EXISTING	CY 1998	67 Leq SETBACK (FT) EXISTING	CY 1998	72 Leq SETBACK (FT) EXISTING	CY 1998
Pillani Hwy. North of Lipoa/Road "C"	754	920	151	184	48	58
Pillani Hwy. South of Lipoa/Road "C"	715	865	143	173	45	55
Lipoa St./Road "C" West of Pillani Hwy.	92	134	18	27	6	8
Road "C" East of S. Kihei Rd.	N/A	102	N/A	20	N/A	6
Lipoa St. East of South Kihei Rd.	100	20	20	4	6	1
South Kihei Rd. South of Road "C"	129	141	26	28	8	9
South Kihei Rd. North of Road "C"	107	160	21	32	7	10
Interim N-S Collector North of Lipoa St.	N/A	18	N/A	4	N/A	1
Interim N-S Collector South of Lipoa St.	N/A	31	N/A	6	N/A	2

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See TABLE 4A for traffic volume, speed, and mix assumptions.
(3) Setback distances are for unobstructed line-of-sight conditions.
(4) Hard ground conditions assumed along all roadways.

CORRECTION

THE PRECEDING DOCUMENT(S) HAS BEEN REPHOTOGRAPHED TO ASSURE LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

TABLE 4B

COMPARISONS OF EXISTING AND CY 2005 TRAFFIC NOISE LEVELS IN PROJECT ENVIRONS (PM PEAK HOUR & 100 FT (30.5 M) FROM ROADWAY CENTERLINES)

LOCATION	** SPEED ** (MPH)	(KMPH)	VPH	**** HOURLY LEQ IN dB **** AUTO	MT	HT	ALL VEH
EXISTING (CY 1994) PM PEAK HR. TRAFFIC:							
Pillani Hwy. North of Lipoa St.	54	86.9	2,149	65.8	60.9	64.0	68.8
Pillani Hwy. South of Lipoa St.	54	86.9	2,037	65.6	60.8	63.7	68.5
Lipoa St. West of Pillani Hwy.	30	48.3	796	55.9	50.9	56.1	59.6
Lipoa St. East of South Kihei Rd.	30	48.3	863	56.2	51.3	56.5	60.0
South Kihei Rd. North of Lipoa St.	35	56.3	1,723	57.8	52.6	57.1	61.1
S. Kihei Rd. South of Waipuilani St.	35	56.3	1,421	56.9	51.7	56.3	60.3
FUTURE (CY 2005) PM PEAK HR. TRAFFIC WITH PROJECT:							
Pillani Hwy. North of Road "C"	54	86.9	3,905	68.4	63.5	66.6	71.4
Pillani Hwy. South of Road "C"	54	86.9	3,710	68.2	63.2	66.3	71.2
Lipoa St. West of N-S Collector Road	30	48.3	675	55.2	50.2	55.4	58.9
Lipoa St. East of South Kihei Rd.	30	48.3	485	53.7	48.8	54.0	57.5
Road "C" West of Pillani Hwy.	35	56.3	2,045	60.4	55.2	59.8	63.8
Road "C" East of South Kihei Rd.	35	56.3	1,495	59.0	53.8	58.4	62.4
South Kihei Rd. South of Road "C"	35	56.3	1,895	58.2	53.0	57.5	61.5
South Kihei Rd. North of Road "C"	35	56.3	2,110	58.6	53.4	58.0	62.0
N-S Collector Rd. North of Lipoa St.	35	56.3	1,448	57.0	51.8	56.4	60.4
N-S Collector Rd. South of Lipoa St.	35	56.3	1,240	56.3	51.1	55.7	59.7

Notes:

The following assumed traffic mix of autos, medium trucks, and heavy vehicles were used for existing and future conditions:

(a) Pillani Highway: 95.5% autos, 2.5% medium trucks, and 2.0% heavy trucks and buses.
(b) Lipoa Street: 96.5% autos, 2.0% medium trucks, and 1.5% heavy trucks and buses.
(c) South Kihei Road, Road "C", and North-South Collector: 96.5% autos, 2.0% medium trucks, and 1.5% heavy trucks and buses.

TABLE 5A(E)

EXISTING AND CY 1998 DISTANCES TO 60, 67, AND 72 Leq CONTOURS

STREET SECTION	60 Leq SETBACK (FT) EXISTING	CY 1998	67 Leq SETBACK (FT) EXISTING	CY 1998	72 Leq SETBACK (FT) EXISTING	CY 1998
Pillani Hwy. North of Lipoa/Road "C"	754	920	151	184	48	58
Pillani Hwy. South of Lipoa/Road "C"	715	865	143	173	45	55
Lipoa St./Road "C" West of Pillani Hwy.	92	134	18	27	6	8
Road "C" East of S. Kihei Rd.	N/A	102	N/A	20	N/A	6
Lipoa St. East of South Kihei Rd.	100	20	20	4	6	1
South Kihei Rd. South of Road "C"	129	141	26	28	8	9
South Kihei Rd. North of Road "C"	107	160	21	32	7	10
Interim N-S Collector North of Lipoa St.	N/A	18	N/A	4	N/A	1
Interim N-S Collector South of Lipoa St.	N/A	31	N/A	6	N/A	2

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See TABLE 4A for traffic volume, speed, and mix assumptions.
(3) Setback distances are for unobstructed line-of-sight conditions.
(4) Hard ground conditions assumed along all roadways.

TABLE 5A(M)

EXISTING AND CY 1998 DISTANCES TO 60, 67, AND 72 Leq CONTOURS

STREET SECTION	60 Leq SETBACK (M) EXISTING	60 Leq SETBACK (M) CY 1998	67 Leq SETBACK (M) EXISTING	67 Leq SETBACK (M) CY 1998	72 Leq SETBACK (M) EXISTING	72 Leq SETBACK (M) CY 1998
Piilani Hwy. North of Lipoa/Road "C"	230	280	46	56	15	18
Piilani Hwy. South of Lipoa/Road "C"	218	264	44	53	14	17
Lipoa St./Road "C" West of Piilani Hwy.	28	41	5	8	2	2
Road "C" East of S. Kihei Rd.	N/A	31	N/A	6	N/A	2
Lipoa St. East of South Kihei Rd.	30	6	6	1	2	0
South Kihei Rd. South of Road "C"	39	43	8	9	2	3
South Kihei Rd. North of Road "C"	33	49	6	10	2	3
Interim N-S Collector North of Lipoa St.	N/A	5	N/A	1	N/A	0
Interim N-S Collector South of Lipoa St.	N/A	9	N/A	2	N/A	1

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See TABLE 4A for traffic volume, speed, and mix assumptions.
(3) Setback distances are for unobstructed line-of-sight conditions.
(4) Hard ground conditions assumed along all roadways.

TABLE 5B(E)

EXISTING AND CY 2005 DISTANCES TO 60, 67, AND 72 Leq CONTOURS

STREET SECTION	60 Leq SETBACK (FT) EXISTING	60 Leq SETBACK (FT) CY 2005	67 Leq SETBACK (FT) EXISTING	67 Leq SETBACK (FT) CY 2005	72 Leq SETBACK (FT) EXISTING	72 Leq SETBACK (FT) CY 2005
Piilani Hwy. North of Lipoa/Road "C"	754	1,371	151	274	48	86
Piilani Hwy. South of Lipoa/Road "C"	715	1,302	143	260	45	82
Lipoa St./Road "C" West of Piilani Hwy.	92	238	18	47	6	15
Road "C" East of S. Kihei Rd.	N/A	174	N/A	35	N/A	11
Lipoa St. East of South Kihei Rd.	100	58	20	11	6	4
South Kihei Rd. South of Road "C"	129	142	26	28	8	9
South Kihei Rd. North of Road "C"	107	158	21	32	7	10
N-S Collector Rd. North of Lipoa St.	N/A	109	N/A	22	N/A	7
N-S Collector Rd. South of Lipoa St.	N/A	93	N/A	19	N/A	6

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See TABLE 4B for traffic volume, speed, and mix assumptions.
(3) Setback distances are for unobstructed line-of-sight conditions.
(4) Hard ground conditions assumed along all roadways.

TABLE 5B(M)

EXISTING AND CY 2005 DISTANCES TO 60, 67, AND 72 Leq CONTOURS

STREET SECTION	60 Leq SETBACK (M) EXISTING	60 Leq SETBACK (M) CY 2005	67 Leq SETBACK (M) EXISTING	67 Leq SETBACK (M) CY 2005	72 Leq SETBACK (M) EXISTING	72 Leq SETBACK (M) CY 2005
Piilani Hwy. North of Lipoa/Road "C"	230	418	46	84	15	26
Piilani Hwy. South of Lipoa/Road "C"	218	397	44	79	14	25
Lipoa St./Road "C" West of Piilani Hwy.	28	73	5	14	2	5
Road "C" East of S. Kihei Rd.	N/A	53	N/A	11	N/A	3
Lipoa St. East of South Kihei Rd.	30	17	6	3	2	1
South Kihei Rd. South of Road "C"	39	43	8	9	2	3
South Kihei Rd. North of Road "C"	33	48	6	10	2	3
N-S Collector Rd. North of Lipoa St.	N/A	33	N/A	7	N/A	2
N-S Collector Rd. South of Lipoa St.	N/A	28	N/A	6	N/A	2

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See TABLE 4B for traffic volume, speed, and mix assumptions.
(3) Setback distances are for unobstructed line-of-sight conditions.
(4) Hard ground conditions assumed along all roadways.

"C" alignment and their existing background ambient noise levels are provided in TABLE 6. These include classroom buildings of Kihei Elementary School, the Maui Sun Hotel building, which is planned to be converted to a instructional facility, and scattered dwelling units. The locations of these noise sensitive properties listed in TABLE 6 are shown in FIGURE 9. As indicated in TABLE 6 existing background ambient noise levels at these noise sensitive properties range between 58 to 66 Leq, or between 59 to 67 Ldn.

Traffic noise levels outside the existing classroom and library buildings of Kihei Elementary School currently range from approximately 62 to 64 Leq. Inside the naturally ventilated school buildings, existing interior noise levels may exceed the 52 FHWA interior noise criteria for Activity Category E if those buildings are within 700 feet (213 meters) of the centerline of Piilani Highway. Current traffic noise levels at the Maui Sun Hotel building are considered to be compatible for instructional uses, and are below the FHWA noise standard of 67 Leq. Existing traffic noise levels at dwelling units in the project environs are also less than the FHWA standard of 67 Leq for Activity Category B.

TABLE 6

SUMMARY OF EXISTING AND FUTURE TRAFFIC NOISE LEVELS AT NOISE SENSITIVE LOCATIONS (Leq, PM PEAK HOUR)

FIGURE 9 LOCATIONS	NOISE SENSITIVE RECEPTOR	ROADWAY	EXISTING CY 1994	FUTURE WITH PROJECT CY 1999	FUTURE WITH PROJECT CY 2005
1	Lot 10-A Residence #1	Pilani Hwy.	57.8	58.4	60.1
		N-S Collector Rd.	N/A	48.4	56.2
		Road "C"	N/A	54.5	57.0
		Total Leq:	57.8	60.2	62.9
2	Lot 10-A Residence #2	Pilani Hwy.	57.8	58.5	60.2
		N-S Collector Rd.	N/A	49.1	56.9
		Road "C"	N/A	55.7	58.2
		Total Leq:	57.8	60.8	63.4
3	Lot B Residence	Pilani Hwy.	57.7	58.5	60.3
		Road "C"	N/A	53.1	55.6
		N-S Collector Rd.	N/A	57.1	61.9
		Lipoa Street	63.6	57.4	62.9
		Total Leq:	64.6	63.0	66.9
4	Lot A Residence	Pilani Hwy.	57.4	58.2	60.0
		Road "C"	N/A	52.6	55.1
		N-S Collector Rd.	N/A	53.1	57.9
		Lipoa Street	64.9	56.7	64.2
		Total Leq:	65.6	62.5	66.6
5	Maui Sun Building	Pilani Hwy.	57.6	58.4	60.2
		Road "C"	N/A	55.0	57.5
		N-S Collector Rd.	N/A	50.8	58.6
		Lipoa Street	53.3	47.1	52.8
		Total Leq:	59.0	60.7	64.0
6	Maui Sun Building	Pilani Hwy.	57.7	58.6	60.3
		Road "C"	N/A	54.9	57.4
		N-S Collector Rd.	N/A	52.5	60.4
		Lipoa Street	53.7	47.5	53.0
		Total Leq:	59.2	61.0	64.6
7	Maui Sun Building	Pilani Hwy.	57.7	58.6	60.3
		Road "C"	N/A	53.8	56.3
		N-S Collector Rd.	N/A	51.7	59.6
		Lipoa Street	56.0	49.8	55.3
		Total Leq:	59.9	60.8	64.4

TABLE 6 (CONTINUED)

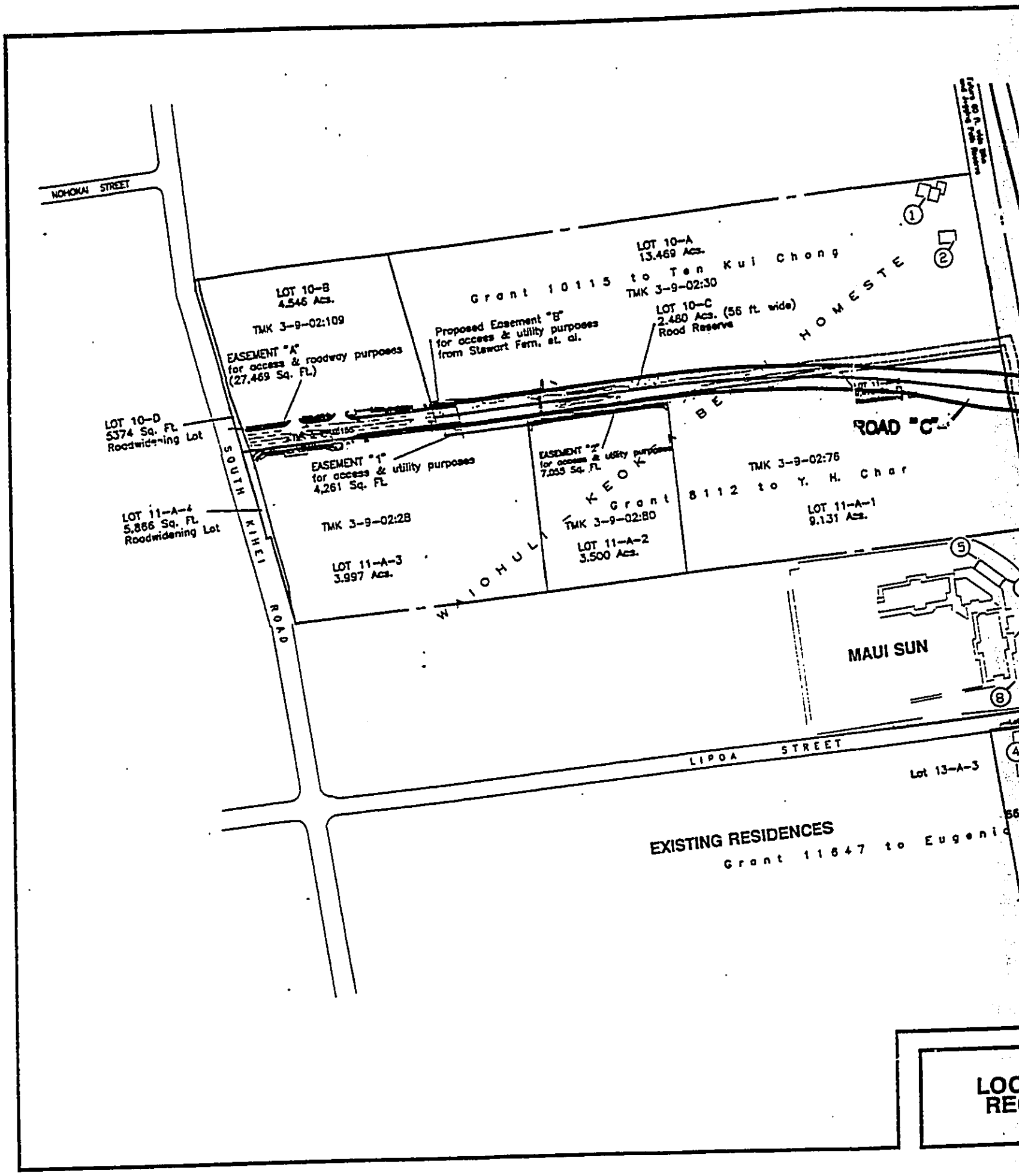
SUMMARY OF EXISTING AND FUTURE TRAFFIC NOISE LEVELS AT NOISE SENSITIVE LOCATIONS (Leq, PM PEAK HOUR)

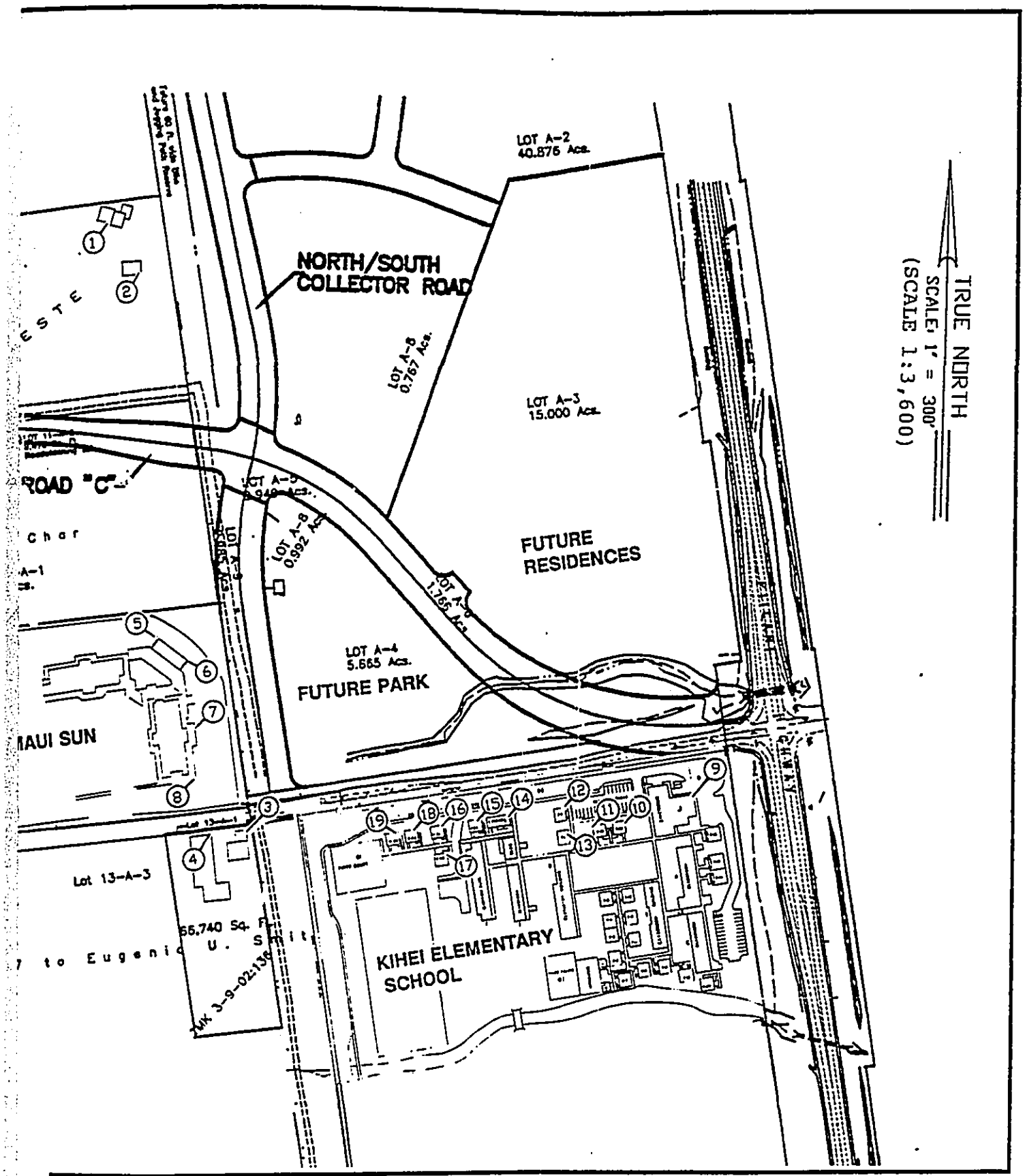
FIGURE 9 LOCATIONS	NOISE SENSITIVE RECEPTOR	ROADWAY	EXISTING CY 1994	FUTURE WITH PROJECT CY 1999	FUTURE WITH PROJECT CY 2005
8	Maui Sun Building	Pilani Hwy.	57.8	58.5	60.2
		Road "C"	N/A	53.1	55.6
		N-S Collector Rd.	N/A	50.8	58.6
		Lipoa Street	60.1	53.9	59.4
		Total Leq:	62.0	61.1	64.8
9	School Cafeteria	Pilani Hwy.	65.5	66.4	68.1
		Road "C"	N/A	60.1	62.6
		Lipoa Street	59.0	N/A	N/A
		N-S Collector Rd.	N/A	45.1	49.9
		Total Leq:	66.4	67.3	69.2
10	Portable Classroom (P-19)	Pilani Hwy.	62.8	63.6	65.4
		Road "C"	N/A	57.8	60.3
		Lipoa Street	57.9	N/A	N/A
		N-S Collector Rd.	N/A	46.0	50.8
		Total Leq:	64.0	64.7	66.7
11	Portable Classroom (P-18)	Pilani Hwy.	62.3	63.1	64.9
		Road "C"	N/A	57.5	60.0
		Lipoa Street	58.2	N/A	N/A
		N-S Collector Rd.	N/A	46.2	51.0
		Total Leq:	63.7	64.2	66.2
12	Portable Classroom (P-1)	Pilani Hwy.	61.5	62.3	64.1
		Road "C"	N/A	57.8	60.3
		Lipoa Street	60.1	N/A	N/A
		N-S Collector Rd.	N/A	46.7	51.6
		Total Leq:	63.9	63.7	65.8
13	Portable Classroom (P-2)	Pilani Hwy.	61.5	62.3	64.1
		Road "C"	N/A	57.0	59.5
		Lipoa Street	58.2	N/A	N/A
		N-S Collector Rd.	N/A	46.7	51.6
		Total Leq:	63.2	63.5	65.6
14	School Library	Pilani Hwy.	60.7	61.5	63.3
		Road "C"	N/A	57.0	59.5
		Lipoa Street	60.6	N/A	N/A
		N-S Collector Rd.	N/A	47.6	52.4
		Total Leq:	63.7	62.9	65.1

TABLE 6 (CONTINUED)

SUMMARY OF EXISTING AND FUTURE TRAFFIC NOISE LEVELS
AT NOISE SENSITIVE LOCATIONS
(Leq, PM PEAK HOUR)

FIGURE 9 LOCATIONS	NOISE SENSITIVE RECEPTOR	ROADWAY	EXISTING CY 1994	FUTURE WITH PROJECT CY 1999	FUTURE WITH PROJECT CY 2005
15	Portable Classroom (P-24)	Pillani Hwy.	60.2	61.0	62.8
		Road "C"	N/A	56.5	59.0
		Lipoa Street	60.6	N/A	N/A
		N-S Collector Rd.	N/A	48.2	53.0
		Total Leq:	63.4	62.5	64.6
16	Portable Classroom (P-20)	Pillani Hwy.	59.7	60.5	62.3
		Road "C"	N/A	55.1	57.6
		Lipoa Street	57.9	N/A	N/A
		N-S Collector Rd.	N/A	49.0	53.8
		Total Leq:	61.9	61.8	64.0
17	Portable Classroom (P-21)	Pillani Hwy.	59.7	60.5	62.3
		Road "C"	N/A	55.7	58.2
		Lipoa Street	60.1	N/A	N/A
		N-S Collector Rd.	N/A	49.0	53.8
		Total Leq:	62.9	62.0	64.1
18	Portable Classroom (P-22)	Pillani Hwy.	59.4	60.2	62.0
		Road "C"	N/A	55.2	57.7
		Lipoa Street	60.1	N/A	N/A
		N-S Collector Rd.	N/A	49.7	54.5
		Total Leq:	62.8	61.7	63.9
19	Portable Classroom (P-23)	Pillani Hwy.	59.1	59.9	61.7
		Road "C"	N/A	54.8	57.3
		Lipoa Street	60.1	N/A	N/A
		N-S Collector Rd.	N/A	50.4	55.2
		Total Leq:	62.6	61.4	63.7


NOHOKAI STREET
LOT 10-B
4.546 Acs.
TMK 3-9-02:109
EASEMENT "A"
for access & roadway purposes
(27,469 Sq. Ft.)
Grant 10115 to Ten Kui Chong
LOT 10-A
13.469 Acs.
TMK 3-9-02:30
Proposed Easement "B"
for access & utility purposes
from Stewart Farm, et. al.
LOT 10-C
2.480 Acs. (56 ft. wide)
Road Reserve
HOMESTE
LOT 10-D
5374 Sq. Ft.
Roadwidening Lot
EASEMENT "1"
for access & utility purposes
4,261 Sq. Ft.
TMK 3-9-02:28
LOT 11-A-3
3.997 Acs.
EASEMENT "2"
for access & utility purposes
7,055 Sq. Ft.
Grant
TMK 3-9-02:80
LOT 11-A-2
3.500 Acs.
ROAD "C"
TMK 3-9-02:76
8112 to Y. H. Char
LOT 11-A-1
9.131 Acs.
LOT 11-A-4
5,866 Sq. Ft.
Roadwidening Lot
SOUTH KIHEI ROAD
WAIOHULI
KEOKE
BE
MAUI SUN
LIPOA STREET
Lot 13-A-3
EXISTING RESIDENCES
Grant 11647 to Eugeni
LOC
RE



LOCATIONS OF EXISITING NOISE SENSITIVE RECEPTOR LOCATIONS	FIGURE 9

CHAPTER V. COMPARISONS OF FUTURE TRAFFIC NOISE LEVELS UNDER THE VARIOUS ALTERNATIVES

The future traffic noise levels along the roadway sections which would connect to the proposed Collector Road "C" were evaluated for the various study alternatives. These alternatives were: No Build or Base Condition Alternative in both CY 1998 and CY 2005; Construction of the Collector Road "C" Plus An Interim Two-Lane Section of the North-South Collector Road Between Kihei Elementary School and Collector Road "C" in CY 1998; and Construction of the Collector Road "C" by CY 2005 with the North-South Collector Road In Place. The location of the various new roadway sections in relationship to the existing roadway system are shown in FIGURES 2 and 9. The same methodology that was used to calculate the Base Year noise levels was also used to calculate the CY 1998 and CY 2005 noise levels for the alternatives listed above.

The traffic volume, speed, and mix assumptions used for the CY 1998 and CY 2005 conditions are shown in TABLE 4A and TABLE 4B, respectively. Also shown in TABLES 4A and 4B are the future traffic noise levels at a reference distance of 100 FT from the roadways' centerlines during the PM peak hour. The future setback distances to the 60, 67, and 72 Leq noise contours and their changes from Base Year values for unobstructed, line-of-sight conditions for the Build Alternatives in CY 1998 and CY 2005 are shown in TABLES 5A(E), 5A(M), 5B(E), and 5B(M). The contour line setback distances do not take into account noise shielding effects from walls or buildings, or the additive contributions of traffic noise from intersecting street sections.

TABLE 6 presents a comparison of the predicted increases in traffic noise levels at the existing noise sensitive properties within the project environs for the Build Conditions in CY 1998 and CY 2005. TABLES 7A and 7B present the calculated increases in future traffic noise levels attributable to project (Build Alternatives) and non-project (No-Build Alternative) traffic, for CY

TABLE 7A

CALCULATIONS OF PROJECT AND NON–PROJECT TRAFFIC NOISE CONTRIBUTIONS (PM PEAK HOUR, CY 1998)

STREET SECTION	NOISE LEVEL INCREASE (Leq) NON–PROJECT TRAFFIC	DUE TO PROJECT TRAFFIC
Pillani Hwy. North of Lipoa/Road "C"	0.9	0.0
Pillani Hwy. South of Lipoa/Road "C"	0.8	0.0
Lipoa St./Road "C" West of Pillani Hwy.	1.6	0.0
Road "C" East of S. Kihei Rd.	N/A	60.1 *
Lipoa St. West of N–S Collector Road	1.6	–7.8
Lipoa St. East of South Kihei Rd.	0.9	–7.9
South Kihei Rd. South of Road "C"	1.0	–0.6
South Kihei Rd. North of Road "C"	–1.1	2.8
Interim N–S Collector North of Lipoa St.	N/A	52.5 *
Interim N–S Collector South of Lipoa St.	N/A	54.9 *

---

* North–South Collector Road and Road "C" noise levels at 100 feet (30.5 meters) from roadway centerlines.

TABLE 7B

CALCULATIONS OF PROJECT AND NON-PROJECT TRAFFIC NOISE CONTRIBUTIONS (PM PEAK HOUR, CY 2005)

STREET SECTION	NOISE LEVEL INCREASE (Leq) NON-PROJECT TRAFFIC	DUE TO PROJECT TRAFFIC
Piilani Hwy. North of Lipoa/Road "C"	2.6	0.0
Piilani Hwy. South of Lipoa/Road "C"	2.6	0.0
Lipoa St./Road "C" West of Piilani Hwy.	4.1	0.0
Road "C" East of S. Kihei Rd.	N/A	62.4 *
Lipoa St. West of N-S Collector Rd.	4.3	-5.0
Lipoa St. East of South Kihei Rd.	3.2	-5.7
South Kihei Rd. South of Road "C"	1.8	-1.4
South Kihei Rd. North of Road "C"	0.7	1.0
N-S Collector Rd. North of Lipoa St.	61.2 *	-0.8
N-S Collector Rd. South of Lipoa St.	61.2 *	-1.5

---

* North-South Collector Road and Road "C" noise levels at 100 feet (30.5 meters) from roadway centerlines.

1998 and 2005, respectively.

The following general conclusions can be made in respect to the effects of the various alternatives on the existing traffic noise levels along the sections of the existing and future roadway system:

A. From TABLE 7A, under the No Build Alternative in CY 1998, traffic noise levels are predicted to increase no more than 1.6 dB or Leq(h) along the existing roadways, which is not considered to be significant.

B. Following construction of Collector Road "C" and the interim two-lane section of the North-South Collector Road in CY 1998, a maximum increase of 1.7 Leq is predicted to occur along the section of South Kihei Road north of the Road "C" intersection. Traffic noise levels at the existing residences fronting Lipoa Street between South Kihei Road and Kihei Elementary School should experience a 6 to 7 Leq reduction in noise levels. No significant increases in traffic noise levels along Piilani Highway are expected by CY 1998 following the construction of the Collector Road "C" Project.

C. From TABLE 7B, under the No Build Alternative in CY 2005, traffic noise levels are predicted to increase by as much as 4.3 dB or Leq(h) along the existing roadways. The four-lane, North-South Collector Road was assumed to be in-place, with a reference noise level of 61.2 Leq during the PM peak hour.

D. Following construction of Collector Road "C" by CY 2005 with the four-lane, North-South Collector Road in-place, a maximum increase of 1.0 Leq is predicted to occur along the section of South Kihei Road north of the Collector Road "C" intersection. Traffic noise levels at the existing residences fronting Lipoa Street and east of the South Kihei Road intersection should ex-

perience a 5 to 6 Leq reduction in noise levels if the Collector Road "C" is constructed after the North-South Collector Road. No significant increases in traffic noise levels along Piilani Highway are expected by CY 2005 following the construction of the Collector Road "C" Project.

E. From TABLE 6, following the construction of the Collector Road "C" Project in either CY 1998 or CY 2005, no existing noise sensitive properties should experience a 15 dB or more increase in background ambient noise levels.

F. From TABLE 6, following the construction of the Collector Road "C" Project in CY 1998, no noise sensitive property should experience traffic noise levels greater than 67 Leq, except for the Cafeteria Building of Kihei Elementary School. This condition would exist in CY 1998 with or without the Collector Road "C" Project due to the proximity of the Cafeteria Building to Piilani Highway and Lipoa Street.

G. From TABLE 6, following the construction of the Collector Road "C" Project in CY 2005, only the Cafeteria Building is predicted to experience traffic noise levels above 67 Leq. Again, this condition would exist in CY 2005 with or without the Collector Road "C" Project due to the proximity of the Cafeteria Building to Piilani Highway and Lipoa Street.

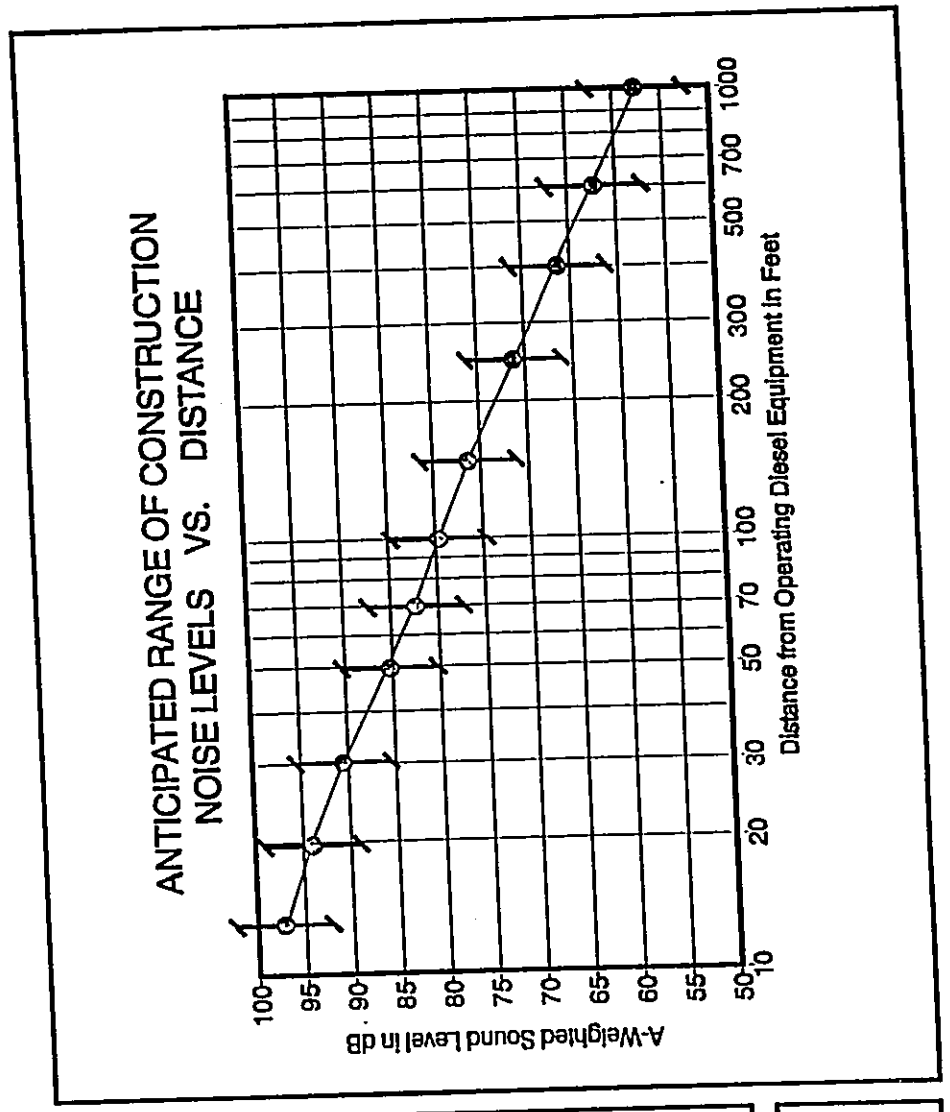
H. From TABLE 6 and TABLE 7B, with or without the Collector Road "C" Project, traffic noise levels at noise sensitive receptor locations are expected to exceed the FHA/HUD standard of 65 Ldn where noise shielding effects are absent. However, the anticipated transfer of east-west traffic from Lipoa Street to Road "C" should reduce the potential traffic noise impacts along Lipoa Street. This is a major benefit which would occur as a result of the Collector Road "C" Project due to the relatively high concentration of residences at short setback distances from Lipoa Street.

CHAPTER VI. FUTURE NOISE IMPACTS AND POSSIBLE NOISE MITIGATION MEASURES

Traffic Noise. Existing noise sensitive properties in the project environs are not expected to be adversely impacted by the construction of Collector Road "C" or the interim two-lane section of the North-South Collector Road. This conclusion is based on the results shown in TABLES 6, 7A, and 7B. A redistribution of traffic volumes and resulting traffic noise away from the existing residential area fronting Lipoa Street east of the South Kihei Road intersection is expected to occur, and this is a positive benefit resulting from the project. For these reasons, traffic noise mitigation measures should not be required in conjunction with this project.

Construction Noise. Short-term noise impacts associated with construction activities along the project corridor may occur. These impacts can occur as a result of the short distances (less than 100 feet [30.5 meters]) between existing receptors and the anticipated construction sites, particularly in the vicinity of the commercial area at the South Kihei Road intersection, in the area near Kihei Elementary School, and near the interim North-South Collector Road intersection at Lipoa Street. The total duration of the construction period for the proposed project is not known, but noise exposure from construction activities at any one receptor location is not expected to be continuous during the total construction period.

Noise levels of diesel powered construction equipment typically range from 80 to 90 dB at 50 FT distance. Typical levels of noise from construction activity (excluding pile driving activity) are shown in FIGURE 10. The impulsive noise levels of impact pile drivers are approximately 15 dB higher than the levels shown in FIGURE 10, while the intermittent noise levels of vibratory pile drivers are at the upper end of the noise level ranges depicted in



CONSTRUCTION NOISE LEVELS VS. DISTANCE

FIGURE 10

the figure. Adverse impacts from construction noise are not expected to be in the "public health and welfare" category due to the temporary nature of the work and due to the administrative controls available for its regulation. Instead, these impacts will probably be limited to the temporary degradation of the quality of the acoustic environment in the immediate vicinity of the project site.

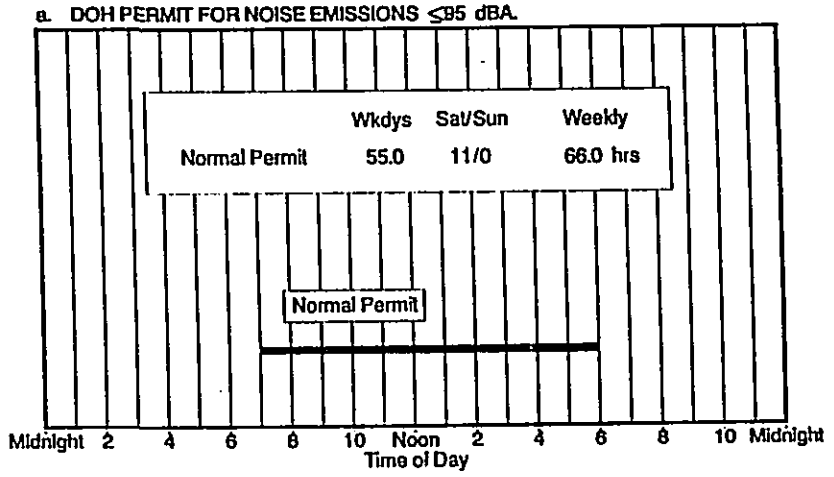
Construction noise levels at existing structures can intermittently exceed 90 dB when work is being performed at close distances in front of these structures. Along the major portion of the Collector Road "C" and North-South Collector Road alignments, distances between the construction sites and receptors are expected to be greater than 100 FT, and construction noise levels should generally be below 80 dB or inaudible. The State Department of Health currently regulates noise from construction activities on Oahu under a permit system (Reference 9). Under current permit procedures (see TABLE 8), noisy construction activities which exceed 95 dB at the project boundary lines are restricted to hours between 9:00 AM and 5:30 PM, from Monday through Friday, and exclude certain holidays. These restrictions minimize construction noise impacts on noise sensitive receptors near the project construction activities, and have generally been successfully applied. Consideration should be given to employing the curfew system of the State Department of Health regulations relating to excessive construction noise. In this way, construction noise impacts on noise sensitive receptors can be minimized.

In addition, the use of quieted portable engine generators and diesel equipment should be specified for use within 500 FT of noise sensitive properties. Heavy truck and equipment staging areas should also be located at areas which are at least 500 FT from noise sensitive properties whenever possible. Truck routes which avoid residential communities should be identified wherever possible. The use of 8 to 12 FT high construction noise barriers should also be used where close-in construction work to noise sen-

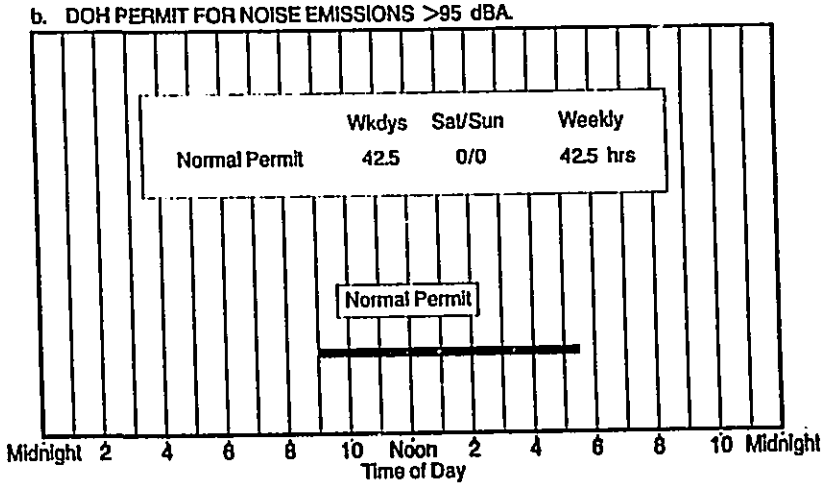
TABLE 8

AVAILABLE WORK HOURS UNDER DOH PERMIT PROCEDURES FOR CONSTRUCTION NOISE

a. DOH PERMIT FOR NOISE EMISSIONS ≤95 dBA.



b. DOH PERMIT FOR NOISE EMISSIONS >95 dBA.



sitive structures are unavoidable.

APPENDIX A. REFERENCES

(1) "Guidelines for Considering Noise in Land Use Planning and Control;" Federal Interagency Committee on Urban Noise; June 1980.

(2) "Environmental Criteria and Standards, Noise Abatement and Control, 24 CFR, Part 51, Subpart B;" U.S. Department of Housing and Urban Development; July 12, 1979.

(3) "Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety;" U.S. Environmental Protection Agency; EPA 550/9-74-004; March 1974.

(4) Federal Highway Administration; "Procedures for Abatement of Highway Traffic Noise and Construction Noise;" 23 CFR Chapter I, Subchapter J, Part 772; July 8, 1982.

(5) Correspondence from Ron Tsuzuki, Hawaii Department of Transportation, HWY-PA 2.4400; February 1, 1995.

(6) Barry, T. and J. Reagan, "FHWA Highway Traffic Noise Prediction Model"; FHWA-RD-77-108, Federal Highway Administration; Washington, D.C.; December 1978.

(7) Existing and Future Traffic Counts at Intersections in the Vicinity of the Collector Road "C" Project; Transmittals from Austin, Tsutsumi & Associates, Inc.; May 18, 1995 and May 31, 1995.

(8) 24-Hour Traffic Counts, Station 13-E, Piilani Highway at Lipoa Street; June 21-22, 1993; Hawaii State Department of Transportation.

(9) "Title 11, Administrative Rules, Chapter 43, Community Noise Control for Oahu"; Hawaii State Department of Health; November 6, 1981.

APPENDIX B

EXCERPTS FROM EPA'S ACOUSTIC TERMINOLOGY GUIDE

Descriptor Symbol Usage

The recommended symbols for the commonly used acoustic descriptors based on A-weighting are contained in Table I. As most acoustic criteria and standards used by EPA are derived from the A-weighted sound level, almost all descriptor symbol usage guidance is contained in Table I.

Since acoustic nomenclature includes weighting networks other than "A" and measurements other than pressure, an expansion of Table I was developed (Table II). The group adopted the ANSI descriptor-symbol scheme which is structured into three stages. The first stage indicates that the descriptor is a level (i.e., based upon the logarithm of a ratio), the second stage indicates the type of quantity (power, pressure, or sound exposure), and the third stage indicates the weighting network (A, B, C, D, E.....). If no weighting network is specified, "A" weighting is understood. Exceptions are the A-weighted sound level and the A-weighted peak sound level which require that the "A" be specified. For convenience in those situations in which an A-weighted descriptor is being compared to that of another weighting, the alternative column in Table II permits the inclusion of the "A". For example, a report on blast noise might wish to contrast the LCdn with the LAdn.

Although not included in the tables, it is also recommended that "Lpn" and "LepN" be used as symbols for perceived noise levels and effective perceived noise levels, respectively.

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:

The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured LA values were 85 and 75 dB respectively.

Descriptor Nomenclature

With regard to energy averaging over time, the term "average" should be discouraged in favor of the term "equivalent". Hence, Leq, is designated the "equivalent sound level". For Ld, Ln, and Ldn, "equivalent" need not be stated since the concept of day, night, or day-night averaging is by definition understood. Therefore, the designations are "day sound level", "night sound level", and "day-night sound level", respectively.

The peak sound level is the logarithmic ratio of peak sound pressure to a reference pressure and not the maximum root mean square pressure. While the latter is the maximum sound pressure level, it is often incorrectly labelled peak. In that sound level meters have "peak" settings, this distinction is most important.

"Background ambient" should be used in lieu of "background", "ambient", "residual", or "indigenous" to describe the level characteristics of the general background noise due to the contribution of many unidentifiable noise sources near and far.

With regard to units, it is recommended that the unit decibel (abbreviated dB) be used without modification. Hence, DBA, PNdB, and EPNdB are not to be used. Examples of this preferred usage are: the Perceived Noise Level (Lpn was found to be 75 dB. Lpn = 75 dB). This decision was based upon the recommendation of the National Bureau of Standards, and the policies of ANSI and the Acoustical Society of America, all of which disallow any modification of bel except for prefixes indicating its multiples or submultiples (e.g., decl).

Noise Impact

In discussing noise impact, it is recommended that "Level Weighted Population" (LUP) replace "Equivalent Noise Impact" (ENI). The term "Relative Change of Impact" (RCI) shall be used for comparing the relative differences in LUP between two alternatives.

Further, when appropriate, "Noise Impact Index" (NII) and "Population Weighed Loss of Hearing" (PHL) shall be used consistent with CHABA Working Group 69 Report Guidelines for Preparing Environmental Impact Statements (1977).

APPENDIX B (CONTINUED)

TABLE I

A-WEIGHTED RECOMMENDED DESCRIPTOR LIST

TERM	SYMBOL
1. A-Weighted Sound Level	L_A
2. A-Weighted Sound Power Level	L_{WA}
3. Maximum A-Weighted Sound Level	L_{max}
4. Peak A-Weighted Sound Level	L_{Apk}
5. Level Exceeded x% of the Time	L_x
6. Equivalent Sound Level	L_{eq}
7. Equivalent Sound Level over Time (T) (1)	$L_{eq(T)}$
8. Day Sound Level	L_d
9. Night Sound Level	L_n
10. Day-Night Sound Level	L_{dn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$
12. Sound Exposure Level	L_{SE}

(1) Unless otherwise specified, time is in hours (e.g. the hourly equivalent level is $L_{eq(1)}$). Time may be specified in non-quantitative terms (e.g., could be specified a $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine).

SOURCE: EPA ACOUSTIC TERMINOLOGY GUIDE, BNA 8-14-78, NOISE REGULATION REPORTER.

APPENDIX B (CONTINUED)

TABLE II

RECOMMENDED DESCRIPTOR LIST

TERM	A-WEIGHTING	ALTERNATIVE[1] A-WEIGHTING	OTHER[2] WEIGHTING	UNWEIGHTED
1. Sound (Pressure)[3] Level	L_A	L_{pA}	L_B, L_{pB}	L_p
2. Sound Power Level	L_{WA}		L_{WB}	L_W
3. Max. Sound Level	L_{max}	L_{Amax}	L_{Bmax}	L_{pmax}
4. Peak Sound (Pressure) Level	L_{Apk}		L_{Bpk}	L_{pk}
5. Level Exceeded x% of the time	L_x	L_{Ax}	L_{Bx}	L_{px}
6. Equivalent Sound Level	L_{eq}	L_{Aeq}	L_{Beq}	L_{peq}
7. Equivalent Sound Level[4] Over Time(T)	$L_{eq(T)}$	$L_{Aeq(T)}$	$L_{Beq(T)}$	$L_{peq(T)}$
8. Day Sound Level	L_d	L_{Ad}	L_{Bd}	L_{pd}
9. Night Sound Level	L_n	L_{An}	L_{Bn}	L_{pn}
10. Day-Night Sound Level	L_{dn}	L_{Adn}	L_{Bdn}	L_{pdn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$	$L_{Adn(Y)}$	$L_{Bdn(Y)}$	$L_{pdn(Y)}$
12. Sound Exposure Level	L_S	L_{SA}	L_{SB}	L_{Sp}
13. Energy Average value over (non-time domain) set of observations	$L_{eq(e)}$	$L_{Aeq(e)}$	$L_{Beq(e)}$	$L_{peq(e)}$
14. Level exceeded x% of the total set of (non-time domain) observations	$L_{x(e)}$	$L_{Ax(e)}$	$L_{Bx(e)}$	$L_{px(e)}$
15. Average L_x value	L_x	L_{Ax}	L_{Bx}	L_{px}

(1) "Alternative" symbols may be used to assure clarity or consistency.

(2) Only B-weighting shown. Applies also to C,D,E,.....weighting.

(3) The term "pressure" is used only for the unweighted level.

(4) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is Leq(1). Time may be specified in non-quantitative terms (e.g., could be specified as Leq(WASH) to mean the washing cycle noise for a washing machine.

Appendix C-1

Acoustic Evaluation of Straight Road "C" Alignment

Y. Ebisu & Associates
Acoustical and Electronic Engineers
1126 12th Avenue
Room 305
Honolulu, Hawaii 96816
(808) 733-1834

YEA Job #32.020
April 9, 1997

Munekiyo & Arakawa, Inc.
305 High Street, Suite 104
Wailuku, Maui, HI 96793

Attention: Mr. Milton Arakawa

Subject: Acoustical Evaluation of Straight Road "C" Alignment (Alternative 1)
Kihei Collector Road "C" Project; Kihei, Maui

Dear Mr. Arakawa:

In June 1995, an acoustic study of the subject project was completed by my firm. The original 1995 study examined the curvilinear alignment of Road "C", whose east end joined Piilani Highway at the existing Lipoa Street intersection. In addition, the original 1995 study utilized traffic forecasts for the Year 2005 which were typically higher than the most recent Kihei Master Plan traffic forecasts for the Year 2005. The most recent traffic forecasts for 2005 and applicable to the straight Road "C" alignment (Alternative 1) were obtained from Austin, Tsutsumi & Associates, Inc. on April 8, 1997.

This letter report describes the significant differences between the original 1995 study conclusions and our present evaluations of the straight Road "C" alignment using the most recent Year 2005 traffic forecasts. These differences are as follows:

1. Both the North–South Collector Road and Road "C" are not expected to carry (and divert) the large traffic volumes originally forecasted for Year 2005. Therefore, traffic noise levels along the North–South Collector and Road "C" are now predicted to be at least 5 dB less than were originally predicted in the 1995 study. This result further reduces the likelihood of adverse traffic noise impacts along both the North–South Collector and Road "C" alignments.

2. Traffic noise levels along Piilani Highway are predicted to be 1.3 dB lower than was originally forecasted for Year 2005 due to the lower traffic volume forecasts. Because Piilani Highway is, and will continue to be, a dominant noise source on the campus of Kihei Elementary School, the lower traffic noise levels forecasted along Piilani Highway will result in lower forecasted traffic noise levels at the school.

3. Along Lipoa Street between the North–South Collector and Kihei Road, Year 2005 traffic noise levels are expected to be 1.3 dB higher than were originally forecasted in the 1995 study. Nevertheless, they should still be less than Base Year (1994) traffic noise levels.

4. Along Lipoa Street between the North–South Collector and Piilani Highway, Year 2005 traffic noise levels are also expected to remain similar to Base Year levels. The higher noise levels originally forecasted from the curved section of Road "C" will not be present under Alternative 1, so Year 2005 traffic noise levels along this section of Lipoa Street should not result in adverse traffic noise impacts.

In summary, the straight Road "C" alignment coupled with the reduced traffic volume forecasts for Year 2005 should result in generally lower traffic noise levels at existing noise sensitive receptors, and should not cause adverse traffic noise impacts at these locations. Future traffic noise levels along the developed sections of Lipoa Street are now expected to be 1.3 dB higher than were originally predicted, but these changes are not expected to result in adverse noise impacts.

Sincerely,

Yoichi Ebisu, P.E.

Appendix D

Traffic Assessment

TRAFFIC ASSESSMENT REPORT

KIHEI ROAD "C"
KIHEI, MAUI, HAWAII

DRAFT
MARCH 1997

Prepared for

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
AND WASTE MANAGEMENT

Prepared by

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS • SURVEYORS

TRAFFIC ASSESSMENT REPORT
FOR
KIHEI ROAD "C"

DRAFT
MARCH 1997

PREPARED FOR

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT

Prepared By

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
Engineers • Surveyors
Honolulu • Wailuku • Hilo, Hawaii

Reference: 94-501

CONTENTS

CONTENTS
(Continued)

I. INTRODUCTION

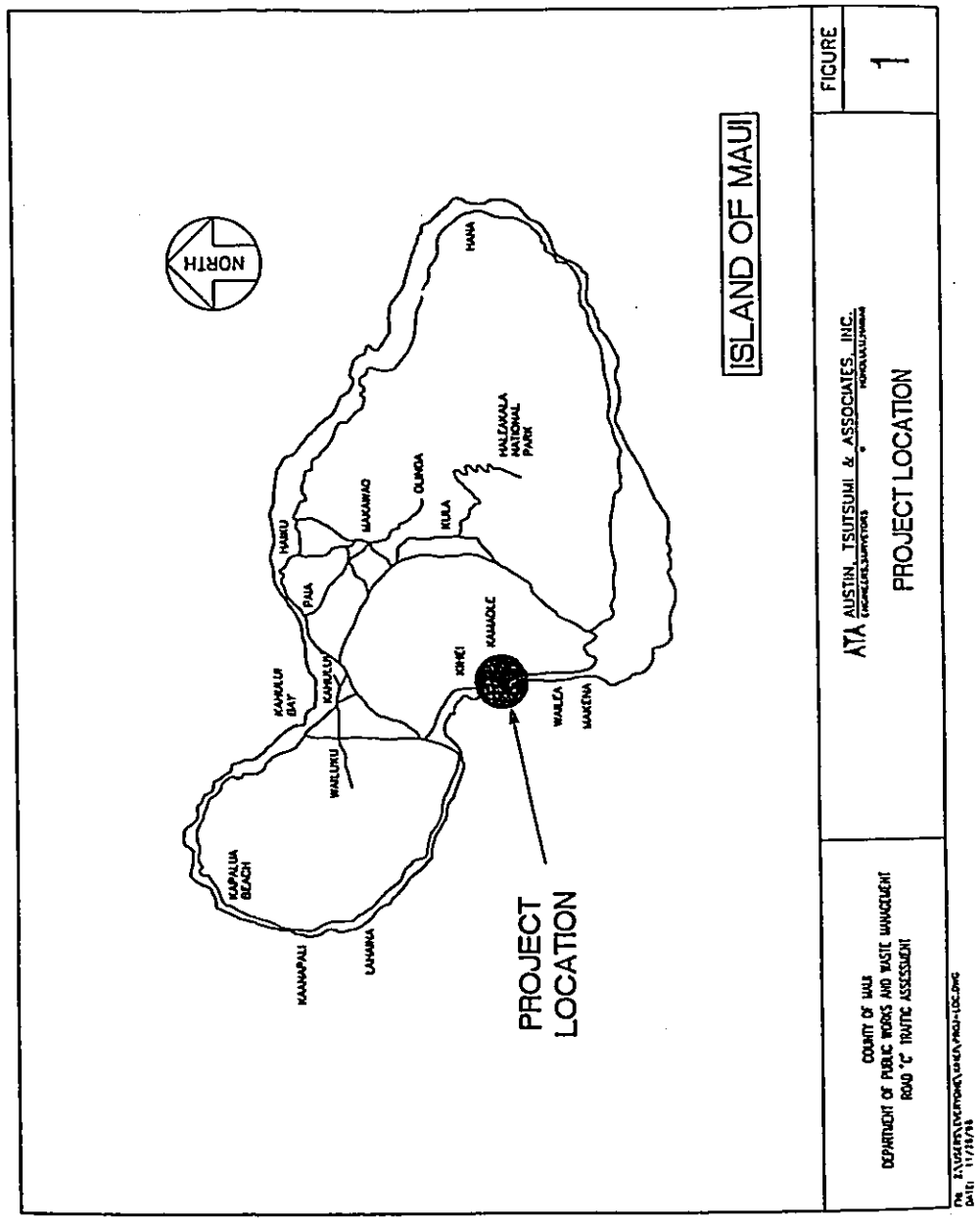
This report documents the traffic study to determine the merits of two alternatives to extend existing Road "C" eastward to Piilani Highway.

PROJECT DESCRIPTION

The proposed Road "C" Project is located in Kihei, Maui. Figure 1 shows the general location of the Project. The existing segment of Road "C" presently forms an intersection with South Kihei Road, approximately 900 feet north of Lipoa Street. The 60-foot right-of-way, 44-foot curb to curb roadway extends approximately 500 feet east from South Kihei Road. This traffic study is to analyze the alternatives to continue Road "C" eastward to intersect with Piilani Highway.

Road "C" is a County collector road. As such, its minimum right-of-way width is 60 feet, generally consisting of 44 feet of pavement between curbs and 8 feet of sidewalk provided on each side of the road. Separate turning lanes will be provided at cross-street intersections and major commercial driveway locations.

In addition, this project proposes to construct a portion of the North-South Collector Road between Road "C" and Lipoa Street. The North–South Collector Road is located approximately 2,000 feet east of South Kihei Road, on an alignment generally parallel to South Kihei Road and Piilani Highway. The North-South Collector Road will also have 60-foot wide right-of-way with 44-foot pavement between curbs.



CORRECTION

THE PRECEDING DOCUMENT(S) HAS BEEN REPHOTOGRAPHED TO ASSURE LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

I. INTRODUCTION

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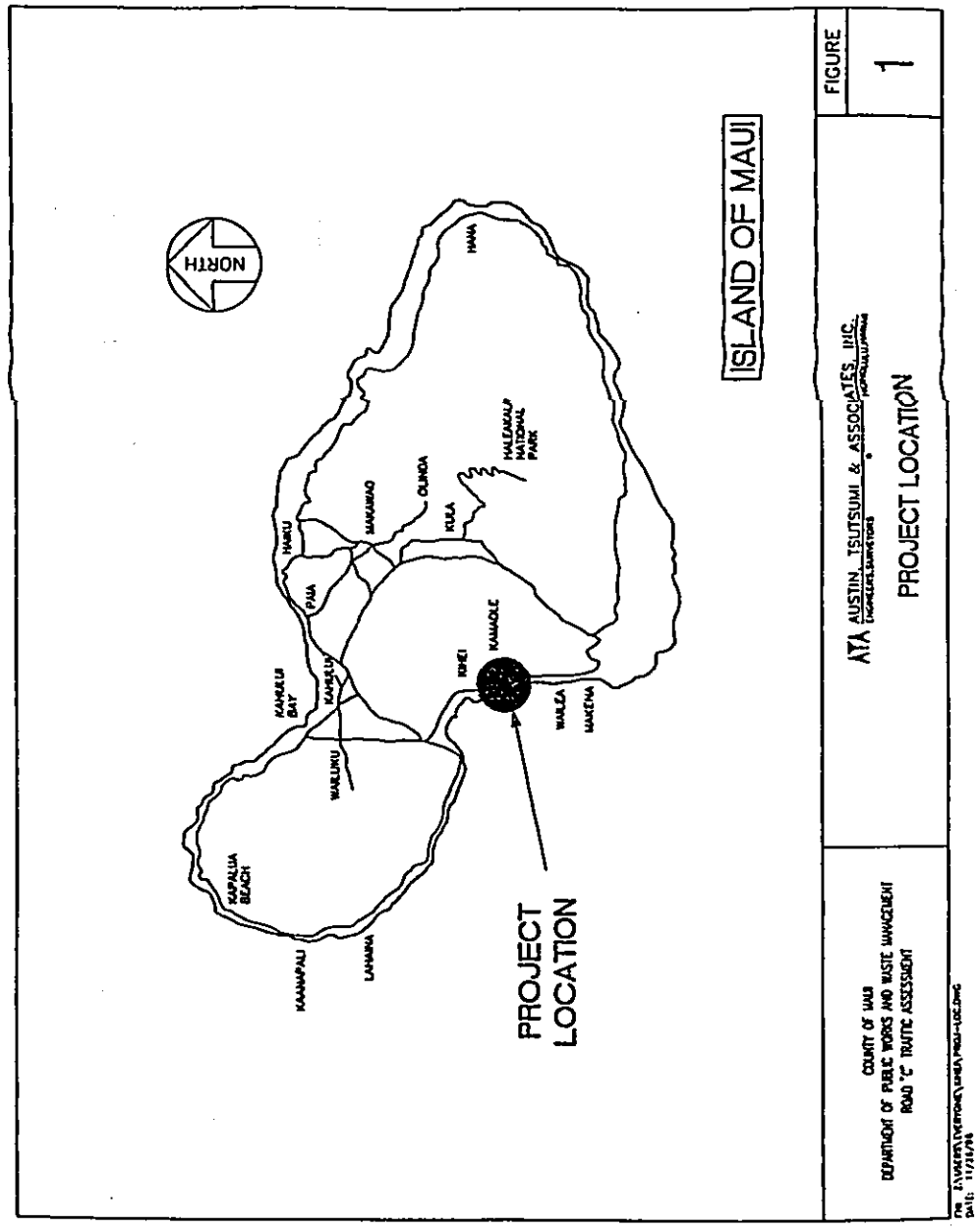


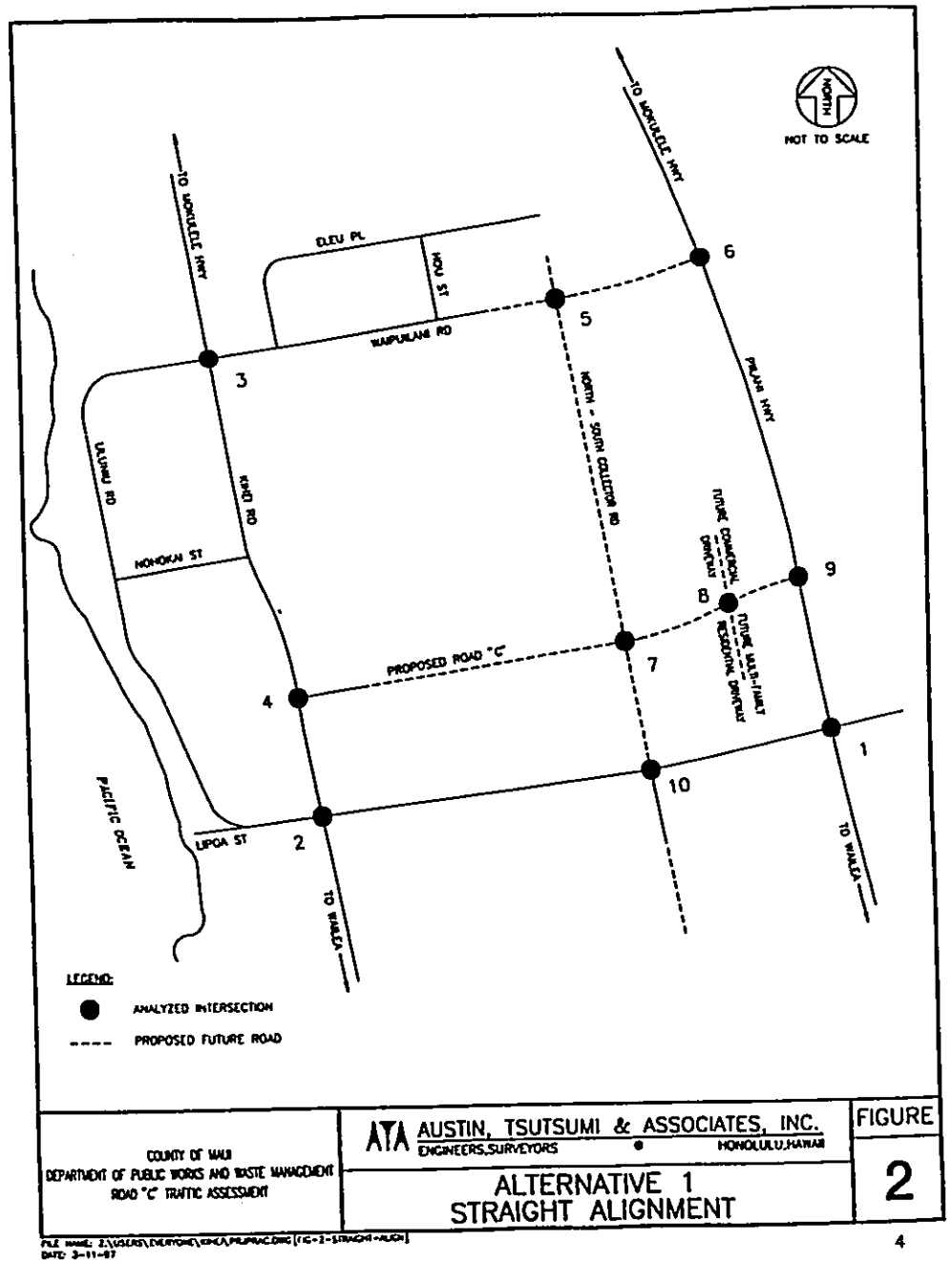
BACKGROUND

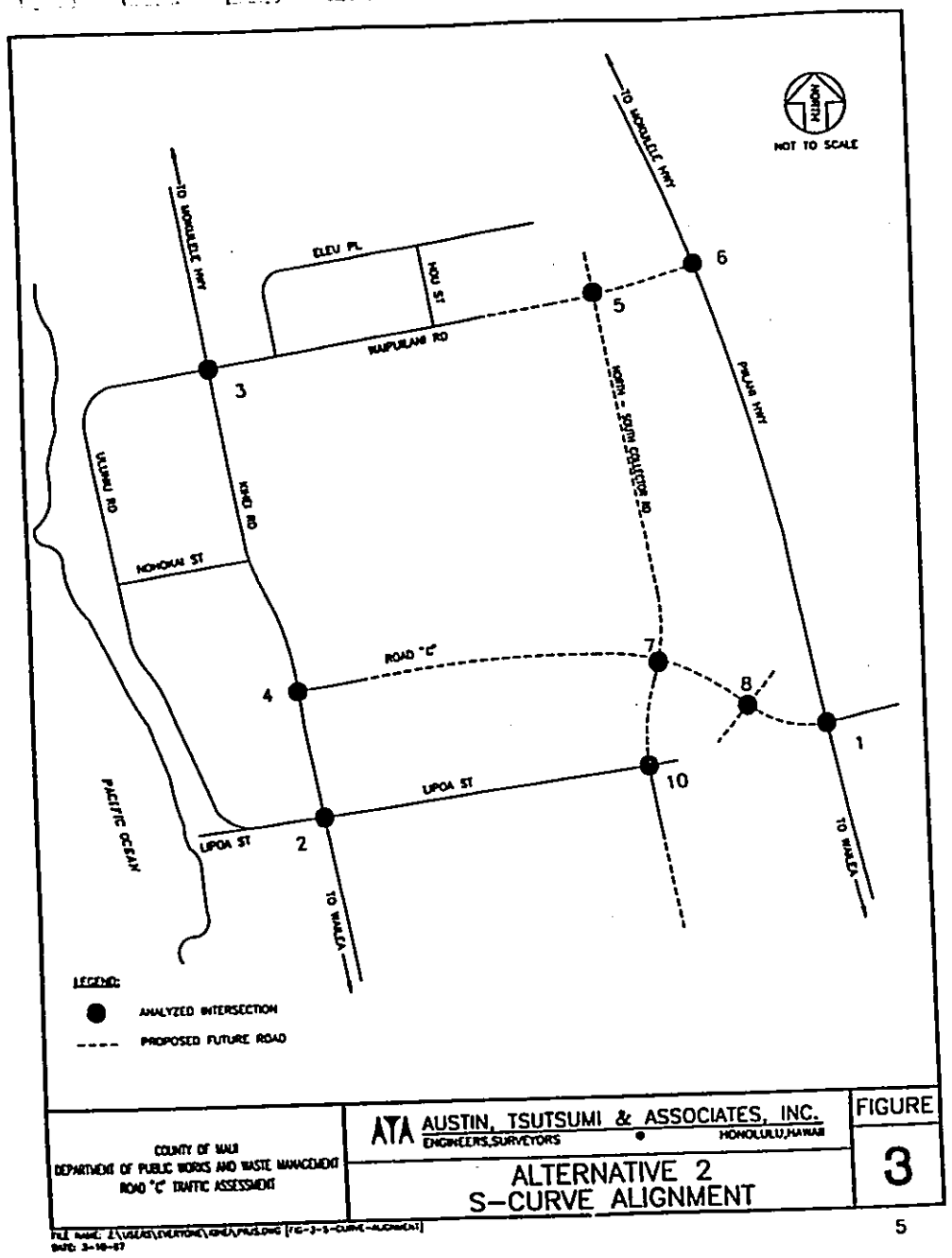
The County's 1988 Kihei Traffic Master Plan identified the future needs for Kihei. The Master Plan called for the construction of several east-west collector roads to connect Piilani Highway and South Kihei Road to provided for better circulation for the community. The Master Plan identified the Road "C" alignment to intersect Piilani Highway. The Master Plan also identified the North-South Collector Road, generally running the entire length of Kihei from Uwapo Road to Kilohana Drive in Wailea. The Road "C" Project is to implement part of the Kihei Traffic Master Plan. Recently Ke Alii Alanui (Road "F") was completed, which was also a roadway identified in the Kihei Traffic Master Plan.

ALTERNATIVES

Alternative 1 – Alternative 1 proposes to extend Road "C" from its present terminus east of South Kihei Road eastward on generally a straight alignment to intersect Piilani Highway as a T-intersection approximately 1,100 feet north of the Lipoa Street Intersection. This alignment will intersect the proposed North-South Collector Road at near right angles (90 degrees). The intersections along its alignment include 2 driveways serving the Piilani North commercial and multi-family development located north of Lipoa Street and east of the future North-South Collector Road. The intersection of Road "C" with Piilani Highway will be signalized to provide a 3-phased traffic signal system. Figure 2 shows the alignment of Alternative 1.

Alternative 2 -- Alternative 2 proposes to continue Road "C" eastward from its present terminus east of South Kihei Road. Alternative 2 proposes to mask Lipoa Street just west of the existing Piilani Highway intersection. In order to accomplish this, the Road "C" alignment follows a reversing curvilinear alignment (also commonly called an "S-curve). This curving alignment begins immediately east of the present completed Road "C". This causes the Road "C" intersection with the North-South Collector Road to be either skewed or to cause the North-South Collector Road to also form a reversing curve in order to intersect at a more acceptable skew angle. Figure 3 shows the alignment of Alternative 2.





COUNTY OF MAUI DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT ROAD "C" TRAFFIC ASSESSMENT	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, HAWAII ALTERNATIVE 2 S-CURVE ALIGNMENT	FIGURE 3

FILE NAME: Z:\USERS\EVERYONE\GIRE\FIG3.DWG [FIG-3-S-CURVE-ALIGNMENT]
DATE: 3-10-97

STUDY METHODOLOGY

The purpose of the study is to analyze potential benefits and adverse traffic impacts on the roadway system within the study area under both proposed alternatives. Based on the results of the analysis, an alternative is recommended for implementation.

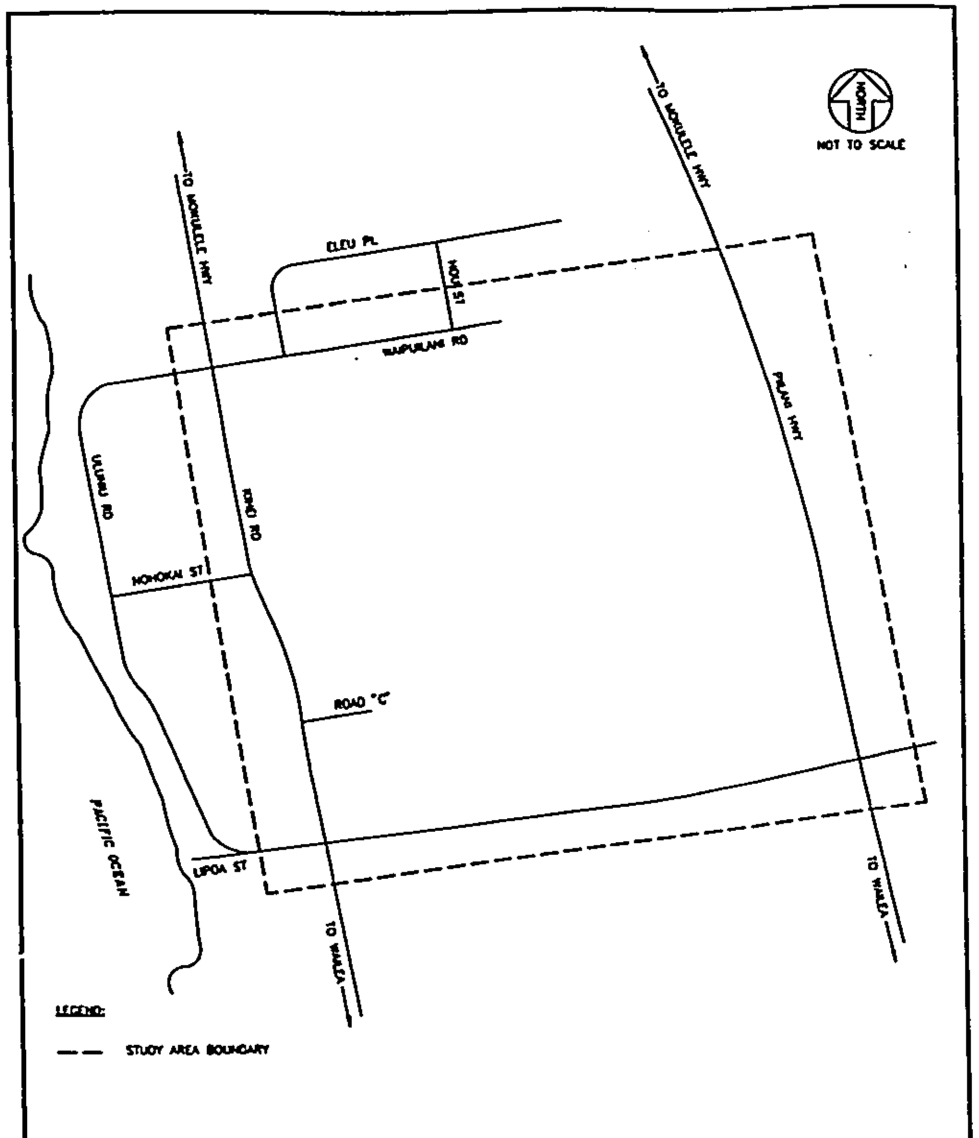
The study area, shown on Figure 4, is bordered by Piilani Highway on the east (mauka), South Kihei Road on the west (makai), Waipuilani Road to the north and Lipoa Street on the south. Potential roadway improvements, in addition to the Road "C" Project, within the study area will be identified. The following are the traffic scenarios which are analyzed in this study:

- Year 1996 Existing Conditions - The analysis of existing traffic conditions includes an inventory and description of major existing roadways and intersections, current traffic volumes and operating conditions within the study area.

- Year 2005 - Alternative 1 Conditions - The analysis provides future short-term traffic forecast and traffic operating conditions within the study area for the Year 2005 with the straight Road "C" alignment.

- Year 2005 - Alternative 2 Conditions - The analysis provides future short-term traffic forecast and traffic operating conditions within the study area for the Year 2005 with the S-curve Road "C" alignment.

Year 2005 is chosen to be the benchmark year for analysis based on the buildout of the future Piilani North development schedule and also to be consistent with the most recent Kihei Traffic Master Plan. Four existing and six future intersections have been identified within the study area to be analyzed during the AM and PM peak hours for each of the traffic scenarios described above. The ten intersections are:



COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT
ROAD "C" TRAFFIC ASSESSMENT

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, HAWAII

STUDY AREA

FIGURE 4

Existing Intersections

1. Lipoa Street and Piilani Highway (Road "C" under future Alternative 2)
2. Lipoa Street and South Kihei Road
3. Waipuilani Road and South Kihei Road
4. Future Road "C" and South Kihei Road

Future Intersections

5. Waipuilani Road and North-South Collector Road
6. Waipuilani Road and Piilani Highway
7. Road "C" and North-South Collector Road
8. Road "C" and Piilani Commercial Driveway
9. Road "C" and Piilani Highway (Alternative 1 only)
10. Lipoa Street and North-South Collector Road

Figures 2 and 3 also show the analyzed intersections within the study area for both Alternatives 1 and 2, respectively.

II. EXISTING CONDITIONS

A field investigation was undertaken to develop a description of existing conditions and infrastructure within the study area. Information relevant to the study includes land use, an inventory of streets, traffic volumes, and current operating conditions on the roadway system.

EXISTING ROADWAY SYSTEM

This section describes the existing circulation system serving the study area, including the number of travel lanes, street classifications, and traffic control devices. Brief descriptions of the facilities within the study area follow:

- Piilani Highway - Piilani Highway is a two-lane, State arterial highway which runs north-south through the study area. Piilani Highway intersects Mokulele Highway and North Kihei Road on the north and Wailea Ike Avenue in Wailea on the south. Within the study area, Piilani Highway fronts the Silversword Golf Course on the mauka side. Other land uses are primarily open space and residential. Within the study area, Piilani Highway is signalized at Lipoa Street.

- South Kihei Road – South Kihei Road is a County collector road which traverse the entire length of Kihei from Mokulele Highway in the north to Kilohana Drive in Wailea. The County is currently widening a segment of South Kihei Road to a four-lane road with left-turn lanes at major intersections. Within the study area, South Kihei Road fronts primarily commercial use. Traffic signals are located at Lipoa Street, Azeka Shopping Center Driveway and the Longs Drug Store/McDonald's driveways.

- Lipoa Street - Lipoa Street is a two-lane, County collector roadway which runs east-west between Piilani Highway and Uliniu Road. Lipoa Street fronts commercial users as well as residential use and the Kihei Elementary School. East of Piilani Highway, Lipoa Street becomes Lipoa Parkway serving the Silversword Golf Course and the Maui Research and Technology Center.

- Waipuilani Road - Waipuilani Road is a two-lane, east-west, local roadway which serves mostly residential use. Waipuilani Road begins makai of South Kihei Road (serving as beach access) and extends mauka into the residential area with no outlets.

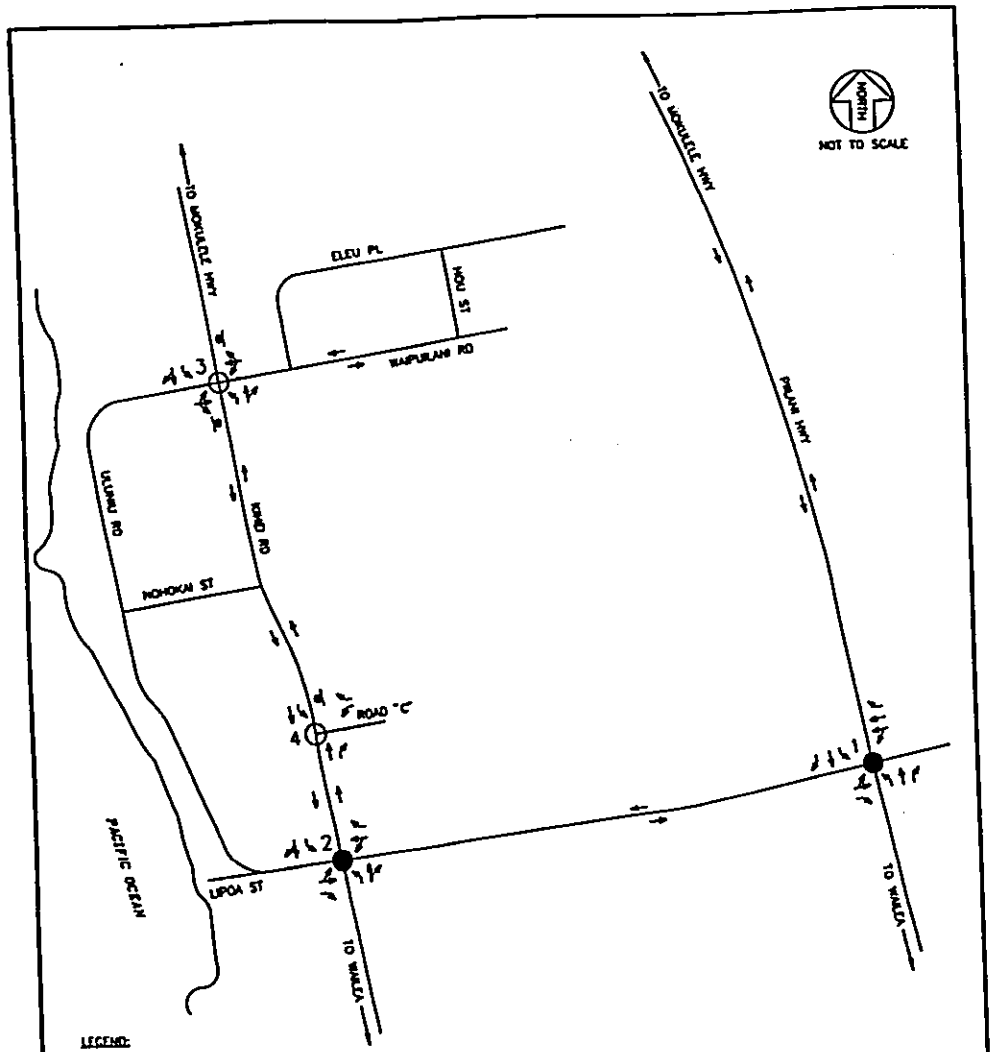
Figure 5 shows the existing intersection configurations of the four analyzed intersections.

EXISTING TRAFFIC VOLUMES

As part of this study, weekday AM and PM peak period traffic counts were conducted by ATA at the four existing analyzed intersections. The results of the traffic counts are provided in Appendix A. Manual turning movement counts were conducted during the morning and evening peak periods of traffic on September 10 and 11, 1996. Figure 6 summarizes the AM and PM peak hour traffic counts at the four existing analyzed intersections.

Based on the traffic counts, approximately 1,415 AM peak hour vehicles enter the study area from the south (Wailea) with approximately 915 vehicles on Piilani Highway and 500 vehicles on South Kihei Road. From the north (Mokulele Highway), approximately 1,485 AM peak hour vehicles enter the study area with 980 vehicles on Piilani Highway and 505 vehicles on South Kihei Road.

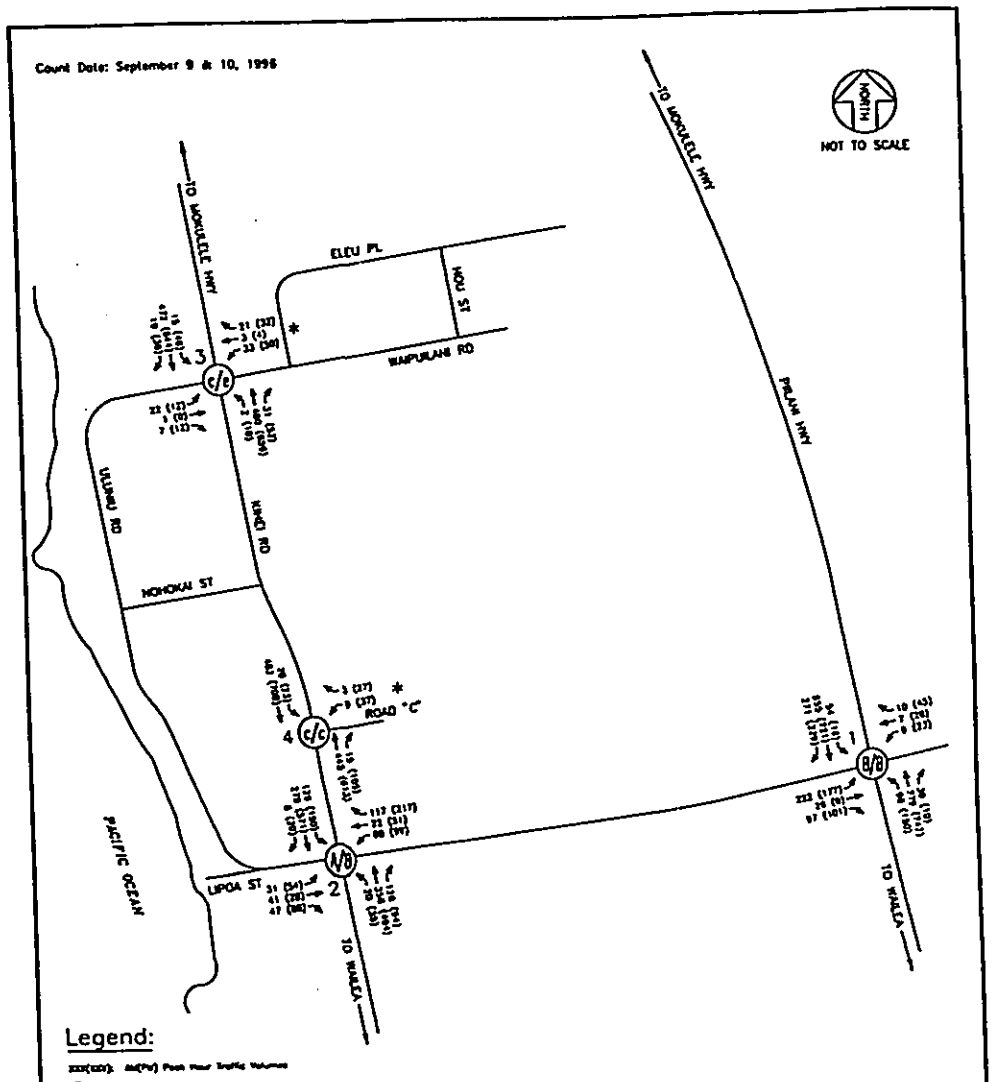
During the PM peak hour, traffic counts indicate that approximately 1,525 vehicles enter the study area from the south (Wailea), with 900 vehicles on Piilani Highway and 625 vehicles on South Kihei Road. From the north (Mokulele Highway), approximately 1,695 vehicles enter the study area with 965 vehicles on Piilani Highway and 730 vehicles on South Kihei Road.



COUNTY OF MAUI DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT ROAD 'C' TRAFFIC ASSESSMENT	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS,SURVEYORS • HONOLULU,HAWAII EXISTING ROADWAY/ INTERSECTION CONFIGURATIONS	FIGURE 5

FILE NAME: Z:\USERS\EVERYONE\GHEA\MLPRAC.DWG [FIG-5-1996-CONFIG]
DATE: 3-11-97

Count Date: September 9 & 10, 1996



COUNTY OF MAUI DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT ROAD 'C' TRAFFIC ASSESSMENT	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS,SURVEYORS • HONOLULU,HAWAII EXISTING YEAR 1996 AM AND PM PEAK HOUR TRAFFIC CONDITIONS	FIGURE 6

FILE NAME: Z:\USERS\EVERYONE\GHEA\MLPRAC.DWG [FIG-6-1996-LOS]
DATE: 3-11-97

Based on visual observations, traffic during the morning AM peak period generally flows well throughout the study area with no noticeable delays or congestion. This is due to the fact that most of the commercial shops within the study area are not opened for business during this time of the morning. However, during the afternoon PM peak period, traffic volumes are noticeably heavier than the morning peak period, with some slowdown, particularly on South Kihei Road fronting the commercial areas. The slowdowns are caused primarily by vehicles turning into and out of the commercial driveways along South Kihei Road and also due to the close proximity of the driveways. Although traffic is much heavier during the afternoon PM peak period, generally, all the intersections operate well with no significant backups or congestion.

EXISTING LEVEL OF SERVICE ANALYSIS

Level of service (LOS) is a qualitative measure used to describe the conditions of traffic flow, ranging from free-flow conditions at LOS A to congested conditions at LOS F. The 1994 Highway Capacity Manual - Special Report 209 methods for calculating volume to capacity ratios, delays and corresponding levels of service were utilized in this study. Level of service definitions for signalized and unsignalized intersections are provided in Tables 1 and 2, respectively. Figure 6 also shows the levels of service at the six existing intersections. Level of service calculations are provided in Appendix B.

Results show only the intersection of Waipuilani Road at South Kihei Road is operating at undesirable level of service of E during the PM peak hour. Poor operating conditions at the intersection are due mainly to the relatively high amount of traffic volumes on South Kihei Road (728 vehicles per hour in one lane), which offer little available gaps and essentially reduce the opportunities for vehicles on the minor street approaches to access the main roadway. Table 3 summarizes the existing AM and PM peak hour level of service results for the four analyzed intersections.

TABLE 1
LEVEL OF SERVICE DEFINITIONS FOR SIGNALIZED INTERSECTION

LEVEL OF SERVICE	DELAY (SECONDS/VEHICLE)	DESCRIPTION
A	0.0 - 5.0	Little or no delay
B	5.1 - 15.0	Short traffic delay
C	15.1 - 25.0	Moderate traffic delay
D	25.1 - 40.0	Long traffic delay
E	40.1 - 60.0	Very long traffic delay
F	> 60.0	Failure - extreme congestion

SOURCE: "Highway Capacity Manual", Transportation Research Board, 1994.

TABLE 2
LEVEL OF SERVICE DEFINITIONS FOR UNSIGNALIZED INTERSECTION

LEVEL OF SERVICE	DELAY (SECONDS/VEHICLE)	DESCRIPTION
A	0.0 - 5.0	Little or no delay
B	5.1 - 10.0	Short traffic delay
C	10.1 - 20.0	Moderate traffic delay
D	20.1 - 30.0	Long traffic delay
E	30.1 - 45.0	Very long traffic delay
F	> 45.0	Failure - extreme congestion

SOURCE: "Highway Capacity Manual", Transportation Research Board, 1994.

TABLE 3
SUMMARY OF EXISTING YEAR 1996 AM AND PM PEAK HOUR LEVEL OF SERVICE

INTERSECTION	EXISTING 1996					
	AM PEAK HOUR			PM PEAK HOUR		
	V/C	DELAY	LOS	V/C	DELAY	LOS
1. PIILANI HWY & LIPOA ST	0.62	8.2	B	0.62	8.4	B
2. KIHEI RD & LIPOA ST	0.33	5.0	A	0.57	9.5	B
3. KIHEI RD & WAIPUILANI RD [a]						
NB LEFT TURN	-	2.3	A	-	4.5	A
SB LEFT TURN	-	3.7	A	-	4.9	A
EB APPROACH	-	7.2	B	-	20.7	D
WB APPROACH	-	7.4	B	-	32.8	E
4. KIHEI RD & ROAD C [a]						
SB LEFT TURN	-	3.5	A	-	4.2	A
WB RIGHT TURN	-	4.4	A	-	5.6	B
WB LEFT TURN	-	12.7	C	-	27.4	D

NOTES:
[a] Existing stop-controlled intersection

III. YEAR 2005 WITH ROAD "C" CONDITIONS

This section describes the Year 2005 with Road "C" traffic conditions within the study area. The forecast for the Year 2005 traffic conditions is based on the June 1996 Draft Kihei Traffic Master Plan (KTMP) prepared by Kaku Associates, Inc. The Year 2005 forecast contained in the KTMP is consistent with the forecasts used in the development of the long range transportation plan for Maui, which is based on land use projections provided by the County of Maui Planning Department.

In this section, development projects and other planned roadway improvements, besides Road "C", are discussed.

TRAFFIC FORECAST

The KTMP Year 2005 traffic forecast for the Kihei area includes the development growth for the entire island, which results in an overall increase in traffic. Also included in the forecast is the growth in residential and non-residential uses, specifically within the Kihei area. In addition to the Year 2005 forecast, as described in the KTMP, the Piilani North development project-generated traffic is also included.

The Piilani North development project includes 230 single-family residential units, 145 multi-family residential units and an approximate 15-acre commercial site. The Piilani North development will be located north of Lipoa Street and east of the future North-South Collector Road. Table 4 summarizes the trip generation used in the study.

TABLE 4
SUMMARY OF PIILANI NORTH TRIP GENERATION

LAND USE	ITE CODE	UNIT	AM PEAK HOUR IN	AM PEAK HOUR OUT	AM PEAK HOUR TOTAL	PM PEAK HOUR IN	PM PEAK HOUR OUT	PM PEAK HOUR TOTAL
SINGLE FAMILY	210	DU	26%	74%	0.74	65%	35%	1.01
MULTI FAMILY	230	DU	17%	83%	0.44	66%	34%	0.55
COMMERCIAL (SHOPPING CENTER)	820	KSF	63%	37%	[a]	-	-	-
< 600 KSF			-	-	-	50%	50%	[b]
> 600 KSF			-	-	-	50%	50%	[c]

LAND USE	SIZE	UNIT	AM PEAK HOUR IN	AM PEAK HOUR OUT	AM PEAK HOUR TOTAL	PM PEAK HOUR IN	PM PEAK HOUR OUT	PM PEAK HOUR TOTAL
SINGLE FAMILY	115	DU	22	63	85	75	41	116
SINGLE FAMILY	115	DU	22	63	85	75	41	116
MULTI-FAMILY	145	DU	11	53	64	53	27	80
SHOPPING CENTER	90	KSF	96	57	153	308	307	615
TOTAL			151	236	387	511	416	927

Source: Institute of Transportation Engineers, "Trip Generation, 5th Edition", 1991.

[a] AM: LN(T)=0.589 LN(X)+2.378
[b] PM: LN(T)=0.837 LN(X)+3.553
[c] PM: LN(T)=0.725 LN(X)+2.987

WHERE:
LN = NATURAL LOGARITHM
T=TWO-WAY VOLUME OF TRAFFIC OF TOTAL TRIP ENDS
X=AREA IN 1,000 GROSS SQUARE FEET OF LEASABLE AREA.

PLANNED ROADWAY IMPROVEMENTS

Besides Road "C", other planned roadway improvements within the study area include the following:

- North-South Collector Road - The future North-South Collector Road will run parallel to and between Piilani Highway and South Kihei Road. Ultimately, the four-lane North-South Collector Road will run between Uwapo Road and Kanani Road and will serve as an alternative roadway to relieve local traffic demand on South Kihei Road. In addition, the future North-South Collector Road will provide a bicycle route, school bus route and pedestrian facilities. For the purpose of this study, it is assumed that only the portion of the two-lane North-South Collector Road from Waipuilani Road to Halekuai Street (serving Kihei Elementary and Lokelani Intermediate School) is constructed. The North-South Collector Road's connection with Halekuai Street provides a secondary linkage to South Kihei Road.

- Waipuilani Road Extension - The extension of Waipuilani Road from its existing eastern terminus to Piilani Highway is included in this study. The extension will take the current two-lane local roadway to Piilani Highway and form the stem of the "T" intersection.

- South Kihei Road - South Kihei Road will be widened to five lanes between Lipoa Street and the Longs Drug Store/McDonald's driveways. The center lane will function as a continuous left-turn lane serving turning vehicles into various commercial driveways.

- Other Roadway Improvements - Other roadway improvements include bicycle facilities and pedestrian facilities mainly along South Kihei Road and selected connecting roadways between Piilani Highway and South Kihei Road.

Six new intersections that will be created within the study area as a result of new roadways include the following:

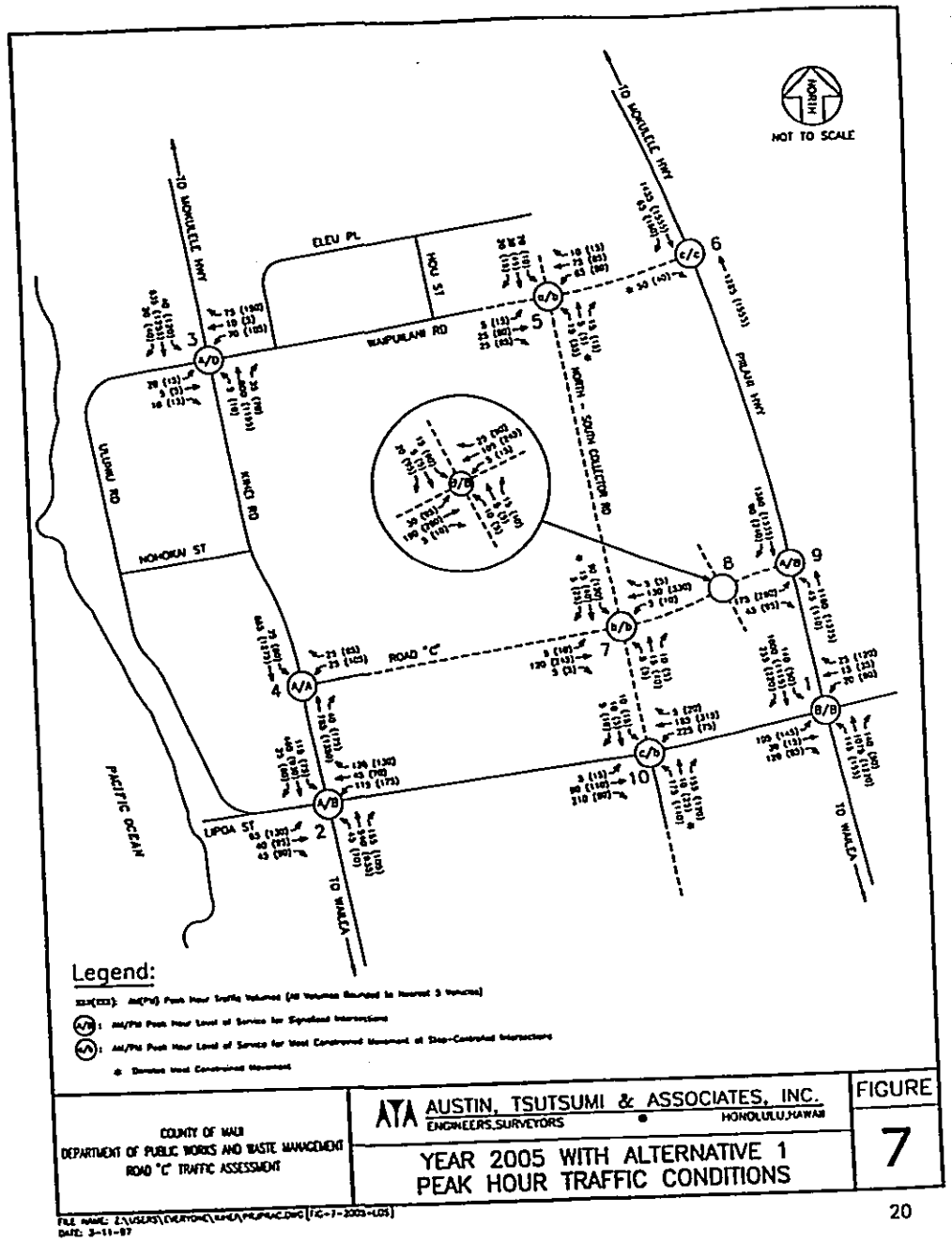
- Waipuilani Road and North-South Collector Road
- Waipuilani Road and Piilani Highway
- Road "C" and North-South Collector Road
- Road "C" and Piilani Commercial Driveway
- Road "C" and Piilani Highway (Alternative 1 only)
- Lipoa Street and North-South Collector Road

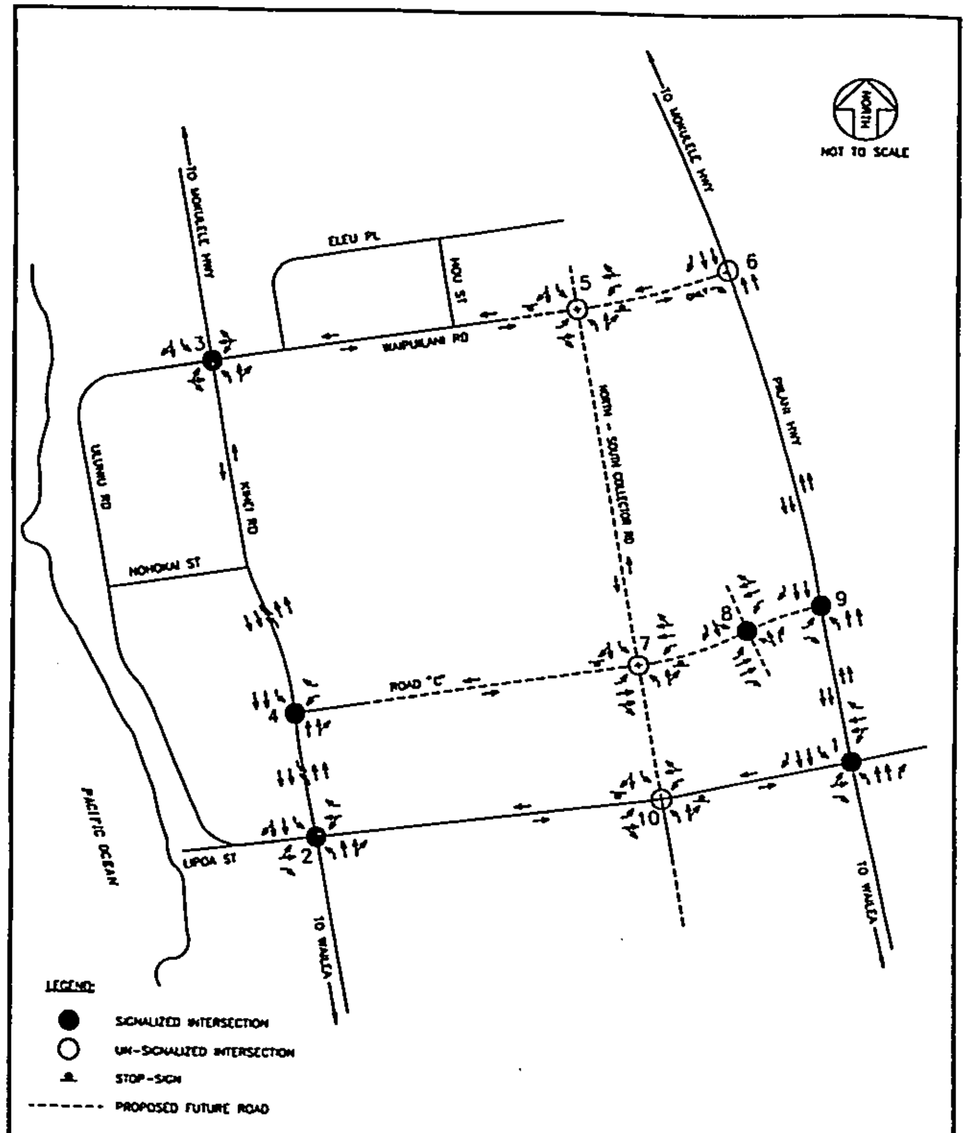
Figures 2 and 3 also show the intersection locations for the two respective alternatives.

ALTERNATIVE 1 (STRAIGHT ALIGNMENT) ANALYSIS AND RESULTS

The KTMP's Year 2005 AM and PM peak hour traffic forecasts (with the addition of Piilani North development traffic) are adjusted to reflect the shift of traffic patterns due to the construction of the new roadways within the study area. The traffic assignment of Piilani North's generated traffic to specific streets and intersections was based on the available access into and out of the site and the availability of local routes to access the regional highway system. Figure 7 shows the Year 2005 AM and PM peak hour traffic volumes with adjustments.

Based on the estimated AM and PM peak hour traffic volumes, roadway and intersection configurations are determined. Figure 8 shows the recommended roadway and intersection configurations under Alternative 1. The recommended intersection configurations are based on volume to capacity (V/C) ratios, calculated delays and corresponding levels of service. Table 5 summarizes the level of service results.





COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT
ROAD "C" TRAFFIC ASSESSMENT

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, HAWAII

YEAR 2005 WITH ALTERNATIVE 1
ROADWAY/INTERSECTION CONFIGURATIONS

FIGURE 8

FILE NAME: Z:\USERS\EVERYONE\KIHEI\PILIPIAC.DWG [FIG-8-2005-CONFIG]
DATE: 3-11-97

TABLE 5
SUMMARY OF YEAR 2005 AM AND PM PEAK HOUR LEVEL OF SERVICE
ALTERNATIVE 1 - STRAIGHT ALIGNMENT

INTERSECTION	EXISTING 1996						YEAR 2005 WITH ROAD "C"					
	AM PEAK HOUR			PM PEAK HOUR			AM PEAK HOUR			PM PEAK HOUR		
	V/C	DELAY	LOS	V/C	DELAY	LOS	V/C	DELAY	LOS	V/C	DELAY	LOS
1. PIILANI HWY & LIPOA ST	0.62	8.2	B	0.62	8.4	B	0.53	7.9	B	0.56	7.3	B
2. S. KIHEI RD & LIPOA ST	0.33	5	A	0.57	9.5	B	0.30	4.8	A	0.60	8.4	B
3. S. KIHEI RD & WAIPUILANI RD [a]							0.58	4.6	A	0.97	25.4	D
NB LEFT TURN	-	2.3	A	-	4.5	A						
SB LEFT TURN	-	3.7	A	-	4.9	A						
EB APPROACH	-	7.2	B	-	20.7	D						
WB APPROACH	-	7.4	B	-	32.8	E						
4. S. KIHEI RD & ROAD C [a]							0.34	3.4	A	0.55	3.1	A
SB LEFT TURN	-	3.5	A	-	4.2	A						
WB RIGHT TURN	-	4.4	A	-	5.6	B						
WB LEFT TURN	-	12.7	C	-	27.4	D						
5. WAIPUILANI RD & NS COLLECTOR [b]	FUTURE INTERSECTION											
EB LEFT TURN							-	2.3	A	-	2.4	A
WB LEFT TURN							-	2.3	A	-	2.6	A
NB APPROACH							-	4.1	A	-	6.0	B
SB APPROACH							-	1.5	A	-	1.1	A
6. PIILANI HWY & WAIPUILANI RD	FUTURE INTERSECTION											
EB RIGHT TURN							-	17.7	C	-	20.0	C
7. ROAD C & N-S COLLECTOR RD [b]	FUTURE INTERSECTION											
EB LEFT TURN							-	2.5	A	-	3.2	A
WB LEFT TURN							-	2.4	A	-	2.9	A
NB APPROACH							-	4.4	A	-	8.1	B
SB APPROACH							-	5.2	B	-	9.4	B
8. ROAD C & PIILANI NORTH DRIVEWAYS	FUTURE INTERSECTION						0.08	5.7	B	0.15	5.4	B
9. PIILANI HWY & ROAD C	FUTURE INTERSECTION						0.55	4.0	A	0.69	7.7	B
10. LIPOA ST & N-S COLLECTOR RD [b]	FUTURE INTERSECTION											
EB LEFT TURN							-	2.6	A	-	3.1	A
WB LEFT TURN							-	3.7	A	-	2.7	A
NB APPROACH							-	12.8	C	-	8.2	B
SB APPROACH							-	4.6	A	-	5.2	B

NOTES:
[a] Existing stop-controlled intersection. Signalized under future conditions.
[b] Future stop-controlled intersection.

The following summarizes the recommended improvements under Alternative 1:

- Based on the projected Year 2005 traffic forecast, regional traffic demand on Piilani Highway will warrant widening from its current two lanes to four lanes. This improvement is consistent with the recommendations in the KTMP which call for the widening of Piilani Highway between Mokulele Highway and Kilohana Drive.

- It is recommended that Road "C" be a four-lane roadway between Piilani Highway and the future North-South Collector Road. West of the North-South Collector Road, Road "C" can be maintained as a two-lane roadway until demand warrants its widening to its ultimate four lanes.

- New traffic signal systems will be warranted at the following intersections by the Year 2005 (please note that traffic signal systems may be warranted prior to the Year 2005 and installation should be considered based on the vehicular demand at each of the respective intersections) :

    - Road "C" and Piilani Highway
    - Road "C" and South Kihei Road
    - Waipuilani Road and South Kihei Road

- It is recommended that the future intersection of Waipuilani Road and Piilani Highway be a stop-controlled intersection with turn restrictions to allow right-turn in and right-turn out movements only.

- For the purpose of this study, only the portion of the future North-South Collector Road between Waipuilani Road and Halekuai Street is assumed to be constructed. Intersections along this portion of the North-South Collector Road could be maintained as stop-controlled intersections until the increase in traffic demand warrants signalization.

ALTERNATIVE 2 (S-CURVE) ANALYSIS AND RESULTS

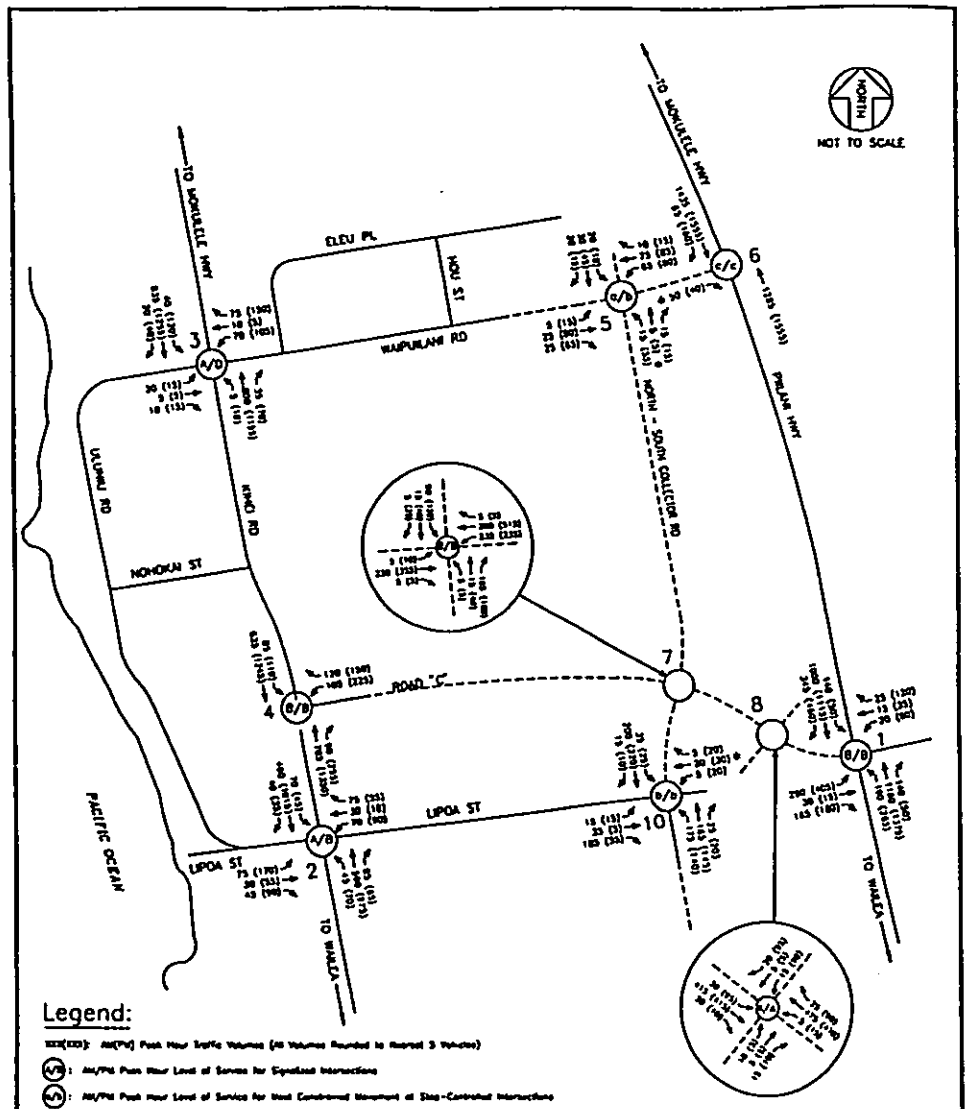
The KTMP's Year 2005 AM and PM peak hour traffic forecasts (with the addition of Piilani North development traffic) are adjusted to reflect the shift of traffic patterns due to the construction of the new roadways within the study area under the Alternative 2 scenario. The traffic assignment of Piilani North's generated traffic to specific streets and intersections was based on the available access into and out of the site and the availability of local routes to access the regional highway system. Figure 9 shows the Year 2005 AM and PM peak hour traffic volumes with adjustments.

Based on the estimated AM and PM peak hour traffic volumes, roadway and intersection configurations are determined. Figure 10 shows the recommended roadway and intersection configurations under Alternative 2. The recommended intersection configurations are based on volume to capacity (V/C) ratios, calculated delays and corresponding levels of service. Table 6 summarizes the level of service results.

The following summarizes the recommended improvements under Alternative 2:

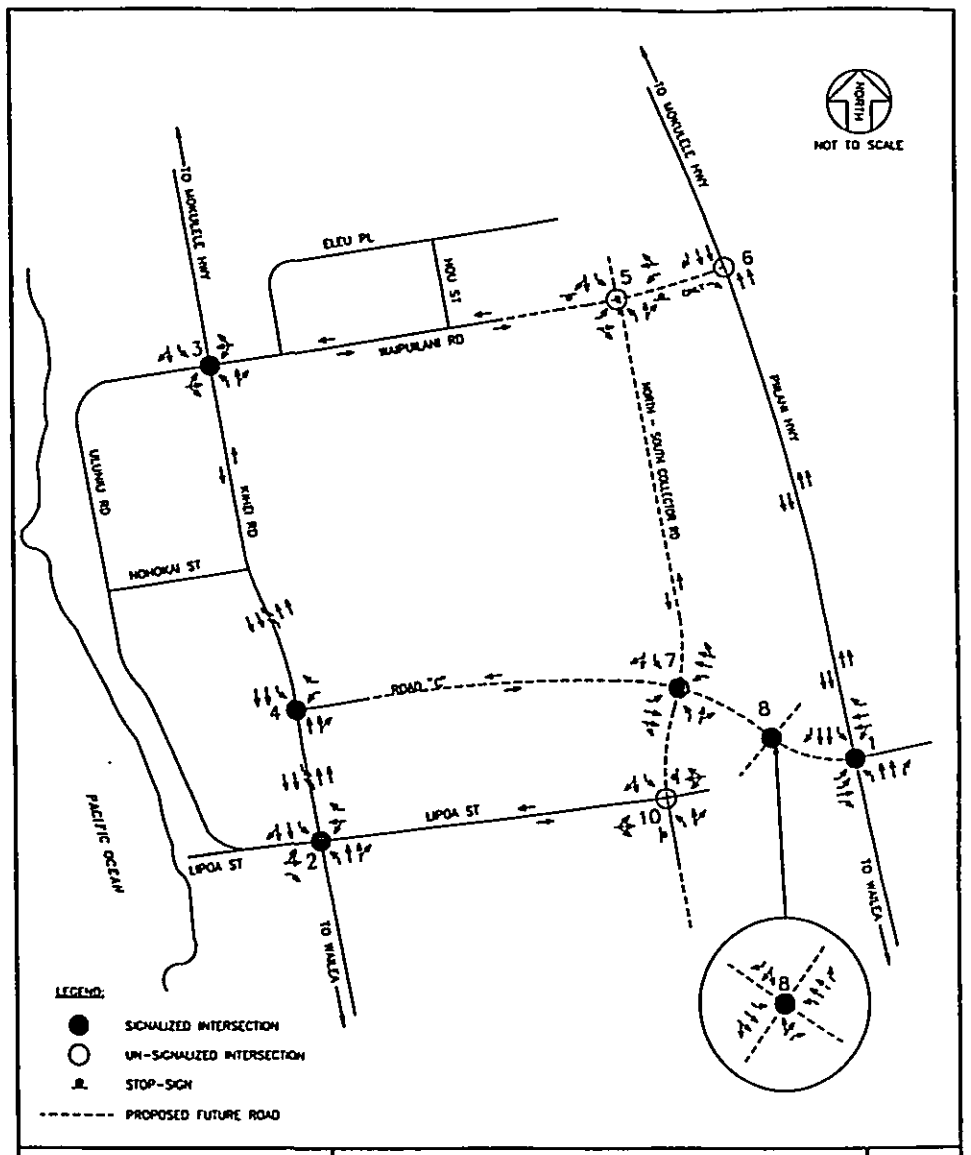
- Based on the projected Year 2005 traffic forecast, regional traffic demand on Piilani Highway will warrant widening from its current two lanes to four lanes. This improvement is consistent with the recommendations in the KTMP which call for the widening of Piilani Highway between Mokulele Highway and Kilohana Drive.

- The eastbound approach at the future Road "C" and Piilani Highway intersection needed to be widened to provide for double exclusive left-turn lanes. The double exclusive left-turn lanes are warranted to accommodate the increase in left-turn vehicular demand. Currently, the approach provides one shared left-turn and through lane and one exclusive right-turn lane. With the recommended improvement, the approach will provide two exclusive left-turn lanes, one through lane and one exclusive right-turn lane.



COUNTY OF MAUI DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT ROAD "C" TRAFFIC ASSESSMENT	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, HAWAII YEAR 2005 WITH ALTERNATIVE 2 PEAK HOUR TRAFFIC CONDITIONS	FIGURE 9

FILE NAME: Z:\USERS\EVERYONE\KIHEA\MXLSDWG [FIG-9-2005-LOS]
DATE: 3-10-97



COUNTY OF MAUI DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT ROAD "C" TRAFFIC ASSESSMENT	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, HAWAII YEAR 2005 WITH ALTERNATIVE 2 ROADWAY/INTERSECTION CONFIGURATIONS	FIGURE 10

FILE NAME: Z:\USERS\EVERYONE\KIHEA\MXLSDWG [FIG-10-2005-CONFIG]
DATE: 3-10-97

TABLE 6
SUMMARY OF YEAR 2005 AM AND PM PEAK HOUR LEVEL OF SERVICE
ALTERNATIVE 2 - S-CURVE ALIGNMENT

INTERSECTION	EXISTING 1996						YEAR 2005 WITH ROAD "C"					
	AM PEAK HOUR			PM PEAK HOUR			AM PEAK HOUR			PM PEAK HOUR		
	V/C	DELAY	LOS	V/C	DELAY	LOS	V/C	DELAY	LOS	V/C	DELAY	LOS
1. PIILANI HWY & LIPOA ST [c]	0.62	8.2	B	0.62	8.4	B	0.67	12.2	B	0.71	12.4	B
2. S. KIHEI RD & LIPOA ST	0.33	5	A	0.57	9.5	B	0.27	4.6	A	0.53	6.4	B
3. S. KIHEI RD & WAIPUILANI RD [a]							0.58	4.6	A	0.97	26.4	D
NB LEFT TURN	-	2.3	A	-	4.5	A						
SB LEFT TURN	-	3.7	A	-	4.9	A						
EB APPROACH	-	7.2	B	-	20.7	D						
WB APPROACH	-	7.4	B	-	32.8	E						
4. S. KIHEI RD & ROAD C [a]							0.51	8.1	B	0.68	8.0	B
SB LEFT TURN	-	3.5	A	-	4.2	A						
WB RIGHT TURN	-	4.4	A	-	5.6	B						
WB LEFT TURN	-	12.7	C	-	27.4	D						
5. WAIPUILANI RD & NS COLLECTOR [b]	FUTURE INTERSECTION											
EB LEFT TURN							-	2.3	A	-	2.4	A
WB LEFT TURN							-	2.3	A	-	2.6	A
NB APPROACH							-	4.1	A	-	6.0	B
SB APPROACH							-	1.5	A	-	1.1	A
6. PIILANI HWY & WAIPUILANI RD	FUTURE INTERSECTION											
EB RIGHT TURN							-	17.7	C	-	20.0	C
7. ROAD C & N-S COLLECTOR RD [b]	FUTURE INTERSECTION						0.36	8.7	B	0.24	5.3	B
EB LEFT TURN												
8. ROAD C & PIILANI NORTH DRIVEWAYS	FUTURE INTERSECTION						0.22	4.8	A	0.21	4.5	A
10. LIPOA ST & N-S COLLECTOR RD [b]	FUTURE INTERSECTION											
NB LEFT TURN							-	3.1	A	-	3.1	A
SB LEFT TURN							-	2.7	A	-	2.6	A
EB APPROACH							-	6.5	B	-	5.4	B
WB APPROACH							-	8.9	B	-	7.6	B

NOTES:
[a] Existing stop-controlled intersection. Signalized under future conditions.
[b] Future stop-controlled intersection.

- It is recommended that Road "C" be a four-lane roadway between Piilani Highway and the future North-South Collector Road. West of the North-South Collector Road, Road "C" can be maintained as a two-lane roadway until demand warrants its widening to its ultimate four lanes.

- New traffic signal systems will be warranted at the following intersections by the Year 2005 (please note that traffic signal systems may be warranted prior to the Year 2005 and installation should be considered based on the vehicular demand at each of the respective intersections) :
  - Road "C" and South Kihei Road
  - Waipuilani Road and South Kihei Road

- In addition to the two intersections listed above, a traffic signal system is also recommended at the intersection of North-South Collector Road and Road "C".

- It is recommended that the future intersection of Waipuilani Road and Piilani Highway be a stop-controlled intersection with turn restrictions to allow right-turn in and right-turn out movements only.

For the purpose of this study, only the portion of the future North-South Collector Road between Waipuilani Road and Halekual Street is assumed to be constructed. Intersections along this portion of the North-South Collector Road could be maintained as stop-controlled intersections until the increase in traffic demand warrants signalization.

RECOMENDED ALTERNATIVE

After review of the two proposed Road "C" alternatives, ATA recommends the straight alignment (Alternative 1). The results of the level of service analysis of both Alternatives 1 and 2 show that in the Year 2005, with the intersection configurations proposed for each of the

respective alternatives, key intersections will operate at acceptable levels of service (i.e. LOS A, B, C or D). However, from a safety and operational standpoint, the straight alignment (Alternative 1) is preferred over the S-curve alignment. Typically, in the design of roadways, a straight alignment of the roadway is usually preferred unless dictated by physical or environmental constraints.

In addition, Alternative 2 (S-curve) would create a less desirable skewed intersection with the North-South Collector Road. This alternative would also cause the North-South Collector Road (in the vicinity of Road "C") to also be curvilinear. Also, under Alternative 2, the increase in and concentration of traffic volumes eastbound Road "C" approach to Piilani Highway will require double exclusive left-turn lanes. This improvement would require the widening of Piilani Highway to four lanes before it can be implemented.

General design guidelines as contained in AASHTO's 1994, A Policy on Geometric Design of Highways and Streets - General Controls for Horizontal Alinement states, *"In general, the number of short curves should be kept to a minimum. Winding alinement composed of short curves should be avoided because it usually is a cause of erratic operation."* Also stated, *"Any abrupt reversal in alinement should be avoided. Such a change makes it difficult for a driver to keep within his own lane. it is also difficult to superelevate both curves adequately, and hazardous and erratic operation may result.*

REFERENCES

- Institute of Transportation Engineers, Trip Generation, 5th Edition, 1991.
- Transportation Research Board, Access Management Guidelines for Activity Centers - NCHRP Report 348, 1992.
- American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets, 1990.
- Kaku Associates, Inc., Draft Kihei Traffic Master Plan, June 1996.

Appendix E

Preliminary Grading and Drainage Report

PRELIMINARY GRADING AND DRAINAGE REPORT

FOR

ROAD "C" AND KIHEI/LOKELANI SCHOOLS ACCESS ROAD

KIHEI, MAUI, HAWAII

TMK: 3-9-02:30 AND 76; 2-2-2:42, 43, 66 & 67

January 27, 1997
Revised: February 14, 1997

I. INTRODUCTION

The purpose of this report is to evaluate the existing drainage conditions and to develop a preliminary grading and drainage plan for the proposed project.

II. PROPOSED PROJECT

A. LOCATION

The project site is located in Kihei, Maui, Hawaii, in the vicinity of Tax Map Key (2) 3-9-2:30. Refer to Exhibit 1.

B. PROJECT DESCRIPTION

The proposed project is the planning, designing and construction of a new collector road along the general alignment described in the Kihei Traffic Master Plan as Road "C". This road extends from the intersection of South Kihei Road and the existing portion of Road "C" along Longs Drugs Store to Piilani Highway at its intersection with Lipoa Street.

A new roadway, designated as the Kihei/ Lokelani Schools Access (KLSA) Road, will be constructed from approximately 800 feet north of Road "C" to Lipoa Street, and running along the makai boundary of Kihei Elementary and Lokelani Intermediate Schools and connecting to the terminus of Halekuai Street. Refer to Exhibit 1.

Piilani Highway will be widened to accommodate a right turn deceleration lane and left turn lane into Road "C".

The typical right-of-way width of Road "C" will range from 60 feet to 92 feet. The portion of Road "C" between South Kihei Road and KLSA Road will have two 12-foot lanes and 6-foot paved shoulders. The portion between KLSA Road and Piilani Highway will have four 12-foot travel lanes with turning pockets and concrete curbs, gutters and sidewalk. Future road widening between South Kihei Road and KLSA Road will ultimately increase the roadway to 44 feet (curb to curb). The right-of-way width at intersections along Road "C" will vary between 70 to 92 feet, depending on the required number of turning lanes.

III. EXISTING CONDITIONS

A. ADJACENT LAND USES

The eastern end of Road "C" connects to the State's Piilani Highway right-of-way. The western end of Road "C" connects to an existing section of roadway along Longs Drugs Store and the intersection with South Kihei Road. The northern and southern boundaries of Road "C" are adjacent to privately owned lands that are currently undeveloped, with the exception of the shopping complexes at South Kihei Road.

Two man-made wetland mitigation ponds, Longs/Fern and Azeka, are situated on either side of Road "C", just mauka (east) of the shopping complexes.

B. TOPOGRAPHY AND SOIL CONDITIONS

The site slopes in the westerly direction towards South Kihei Road. The upper half of the site has an average slope of 2 percent (exclusive of the existing

Piilani Highway fill) and the lower half of the site is relatively flat. Onsite elevations range from 72 feet to 5 feet (mean sea level).

The three major soil classifications of the site are described as "Jaucas sand, saline (JcC)", "Pulehu clay loam (PsA)" and "Waiakoa extremely stony silty clay loam (WID2)" by the U.S. Natural Resources Conservation Service's "Soil Survey of the Islands of Kauai, Oahu, Molokai, Maui and Lanai." For the JcC soil, it is poorly drained in depression areas and the water table is normally within a depth of 30 inches. For the PsA soil, permeability is moderate, runoff is slow and the erosion hazard is no more than slight. For the WID2 soil, runoff is medium and the erosion hazard is severe.

The upper, undeveloped portion of the site is covered with buffelgrass and a scattering of kiawe trees. The lower, undeveloped portion of the site is covered with thick stands of kiawe and salt-tolerant plants, except for the Road "C" corridor, which is clear of vegetation.

C. CLIMATE

The area is generally warm and sunny throughout the year. The mean annual temperature is 75 degrees Fahrenheit and the annual rainfall amounts to 10 to 30 inches, most of which occurs during the few winter cyclonic "Kona" storms. Northeasterly trades prevail during the dry season, extending from May through September. During the rainy season, October through April, the wind condition varies with strong southerly winds accompanying the "Kona" storms.

D. DRAINAGE

Runoff generally sheet flows in the westerly direction, towards a low point in the Road "C" alignment near the Longs/Fern wetland. Stormwater then ponds in low-lying areas until it sheet flows over South Kihei Road, ponds in low-lying areas until it sheet flows over Uluniu Road and eventually flows into the ocean.

Runoff from an existing 54" culvert across Piilani Highway, located just to the north of Road "C", sheet flows to an existing drainageway northwest of the proposed terminus of KLSA Road. The drainageway conveys runoff from the lands mauka of Piilani Highway. Runoff in the drainageway flows to the existing wetland area just mauka of South Kihei Road.

An existing gully runs parallel to and south of the Road "C" alignment, near the intersection of Piilani Highway and Lipoa Street. This gully conveys runoff from lands mauka of Piilani Highway, and terminates about 1000 feet makai of Piilani Highway. The runoff then flows down Lipoa Street to Kupalaki Street and flows overland to the south into an existing wetland just mauka of South Kihei Road.

There is an existing drainageway through the schools that conveys runoff from lands mauka of Piilani Highway. The drainageway crosses the proposed KLSA Road and flows overland to the west into the existing wetland just mauka of South Kihei Road. This drainageway is known as the Kihei School Offsite Drainage System.

E. FLOOD ZONE

A portion of Road "C" extending 1000 feet mauka from South Kihei Road, is in an area classified as "Zone AH (elevation 6 feet) according to the Flood Insurance Rate Map, dated 9/6/89 and prepared by the Federal Emergency Management Agency. This zone is an area of 100-year shallow flooding; the base flood elevation is +6 (NGVD).

The remaining sections of Road "C" and KLSA Road are in an area classified as "Zone C", which is an area of minimal flooding.

IV. GRADING AND DRAINAGE PLAN

A. GRADING PLAN

The proposed grading will require excavation and embankment for the construction of the roadway improvements. The entire right-of-way width may not be graded for future widening; the grading operations will accommodate the aforementioned roadway improvements being installed as part of this project. The use of retaining walls is not anticipated at this time. In addition, a borrow site is being made available at an existing mound just to the west (makai) of Piilani Highway, between Road "C" and Lipoa Street that will serve as a local source of embankment for roadway construction.

Erosion control measures will be incorporated during the construction period to minimize soil loss and erosion hazards. Construction plans, erosion control plan and a NPDES permit application (if required) will be submitted to the Department of Public Works and Waste Management, County of Maui, for approval.

B. DRAINAGE PLAN

Stormwater from the Road "C" right-of-way, the portion of KLSA Road north of Lipoa Street, and approximately 21 acres of undeveloped land east of KLSA Road, will be intercepted by a new drainage system constructed within the Road "C" and KLSA Road right-of-ways and conveyed to a temporary detention basin located at the northeasterly end of KLSA Road. The stormwater from approximately 12 acres of undeveloped land will sheet flow directly into the temporary detention basin. Runoff out of the detention basin will flow into an existing drainageway north of KLSA Road. Due to the construction of the detention basin, post-development runoff in the existing drainageway will not exceed the pre-development flow. Runoff in the existing drainageway will flow overland to the wetland just mauka of South Kihei Road per the existing condition. The runoff flowing into the temporary detention basin will ultimately be discharged into a permanent detention basin located directly north of the temporary detention basin. The permanent detention basin will be constructed at the proposed Piilani Village park site (to be constructed at the time Piilani Village, Phase III is fully developed). Stormwater generated makai (west) of the portion of KLSA Road north of Lipoa Street will flow into the low-lying area mauka (east) of the Longs/Fern wetland mitigation pond, per the existing condition. Drainage improvements as described in the County of Maui's Kihei Drainage Master Plan will be implemented in the future (by others). Improvements include a box culvert crossing and open channels at South Kihei Road and a drainage outlet at Uluniu Road.

Stormwater from the portion of KLSA Road south of Lipoa Street will drain

off the roadway and enter the Kihei School offsite drainageway, per the existing condition. An existing culvert will be extended under KLSA Road to convey runoff from Kihei/ Lokelani Schools. Runoff will then flow to the existing wetland mauka (east) of South Kihei Road, per the existing condition.

Runoff from the existing gully near the Piilani Highway/Lipoa Street intersection will enter a temporary detention basin, to be constructed in Lot A-4 of the Piilani North-II Subdivision (by others). Any runoff out of the detention basin will flow onto Lipoa Street, per the existing condition. Future improvements (by others) will intercept this runoff at the KLSA Road / Lipoa Street intersection with an underground drainage system, which will convey runoff in the KLSA Road to the proposed Kihei School Offsite Drainage System. Runoff will then flow to the wetland just mauka of South Kihei Road and south of Lipoa Street.

Runoff from an existing 54" culvert across Piilani Highway located just to the north of Road "C" will be conveyed approximately 400 feet ± further downstream by a drainage system. Runoff will be conveyed to the existing drainageway northwest of the terminus of KLSA Road, per the existing condition.

A swale will be constructed along the southerly side of Road "C" (between Piilani Highway and KLSA Road) to preclude localized ponding along Road "C" in low areas created during the roadway construction at locations where the roadway embankment may intersect local ridges.

The existing portion of Road "C" at the intersection of South Kihei Road will continue to drain per the existing condition.

Construction plans, drainage report and a NPDES permit application (if

required) will be submitted to the Department of Public Works and Waste Management, County of Maui, for approval.

C. HYDROLOGY

The Rational Method, as described in the "Rules for the Design of Storm Drainage Facilities in the County of Maui", November 12, 1995, by the County of Maui, was used in calculating the onsite roadway storm runoff. These calculations are based on a 50-year storm recurrence interval.

A runoff rate of approximately 9.0 cfs is calculated for the pre-development condition. A runoff rate of approximately 18.3 cfs is calculated for the post development condition. See Appendix for calculations.

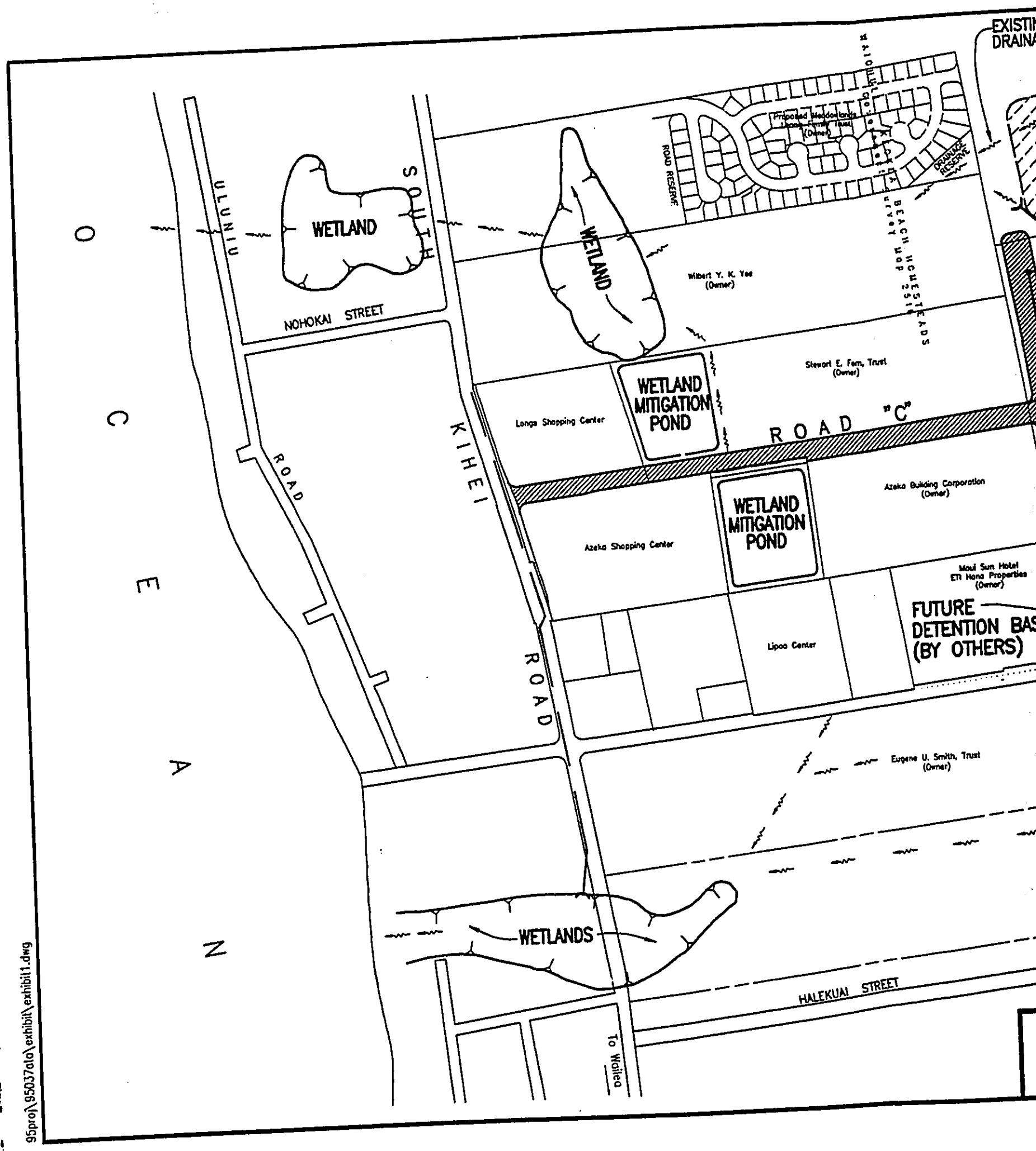
The Natural Resources Conservation Service (NRCS) method, as described in the "Rules for the Design of Storm Drainage Facilities in the County of Maui", November 12, 1995, by the County of Maui was used in calculating the pre and post development storm runoff through the existing drainageway located at the northerly end of KLSA Road. These calculations are based on a 100-year storm recurrence interval based on a 24 hour storm.

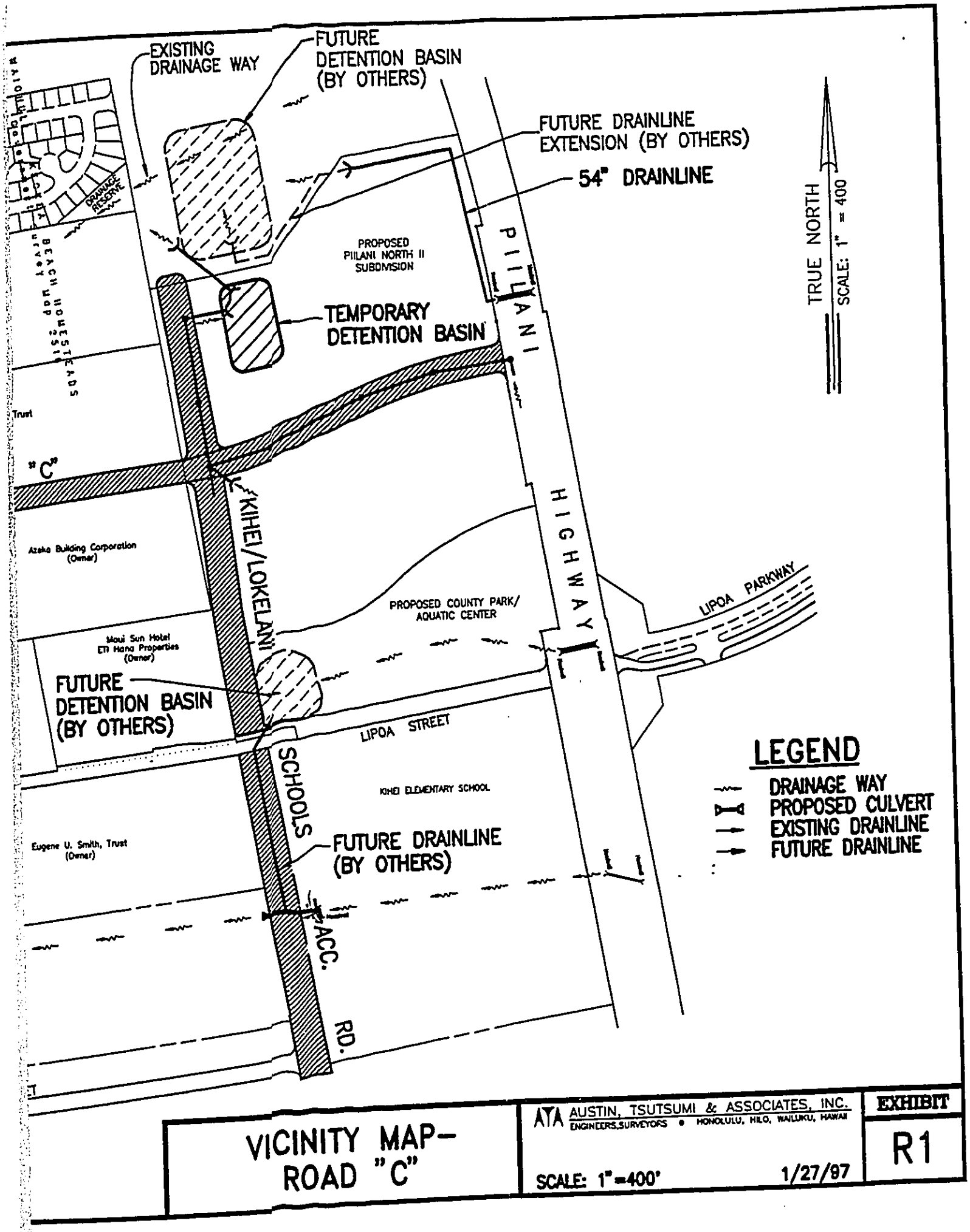
A runoff rate of approximately 908 cfs is calculated for the pre-development condition of the existing drainageway. A runoff rate of approximately 905 cfs is calculated for the post-development condition of the existing drainageway due to attenuation from the temporary detention basin. See Appendix for calculations.

V. CONCLUSION

The proposed grading and drainage improvements will be designed to produce no adverse effects by storm runoff to adjacent properties. All drainage improvements will conform to County Standards.

APPENDIX


WETLAND
ULUNIU
SOUTH
NOHOKAI STREET
ROAD
KIHEI
WETLAND
ROAD RESERVE
Proposed Meadowlands
(Owner)
DRAINAGE RESERVE
Wilbert Y. K. Yee
(Owner)
BEACH HOMESTEADS
Longs Shopping Center
WETLAND MITIGATION POND
Stewart E. Fern, Trust
(Owner)
ROAD "C"
Azeka Shopping Center
WETLAND MITIGATION POND
Azeka Building Corporation
(Owner)
Maui Sun Hotel
ETI Hana Properties
(Owner)
Lipoa Center
FUTURE
DETENTION BAS
(BY OTHERS)
Eugene U. Smith, Trust
(Owner)
WETLANDS
HALEKUAI STREET
To Wailea
O C E A N
95proj\95037a1a\exhibit\exhibit1.dwg

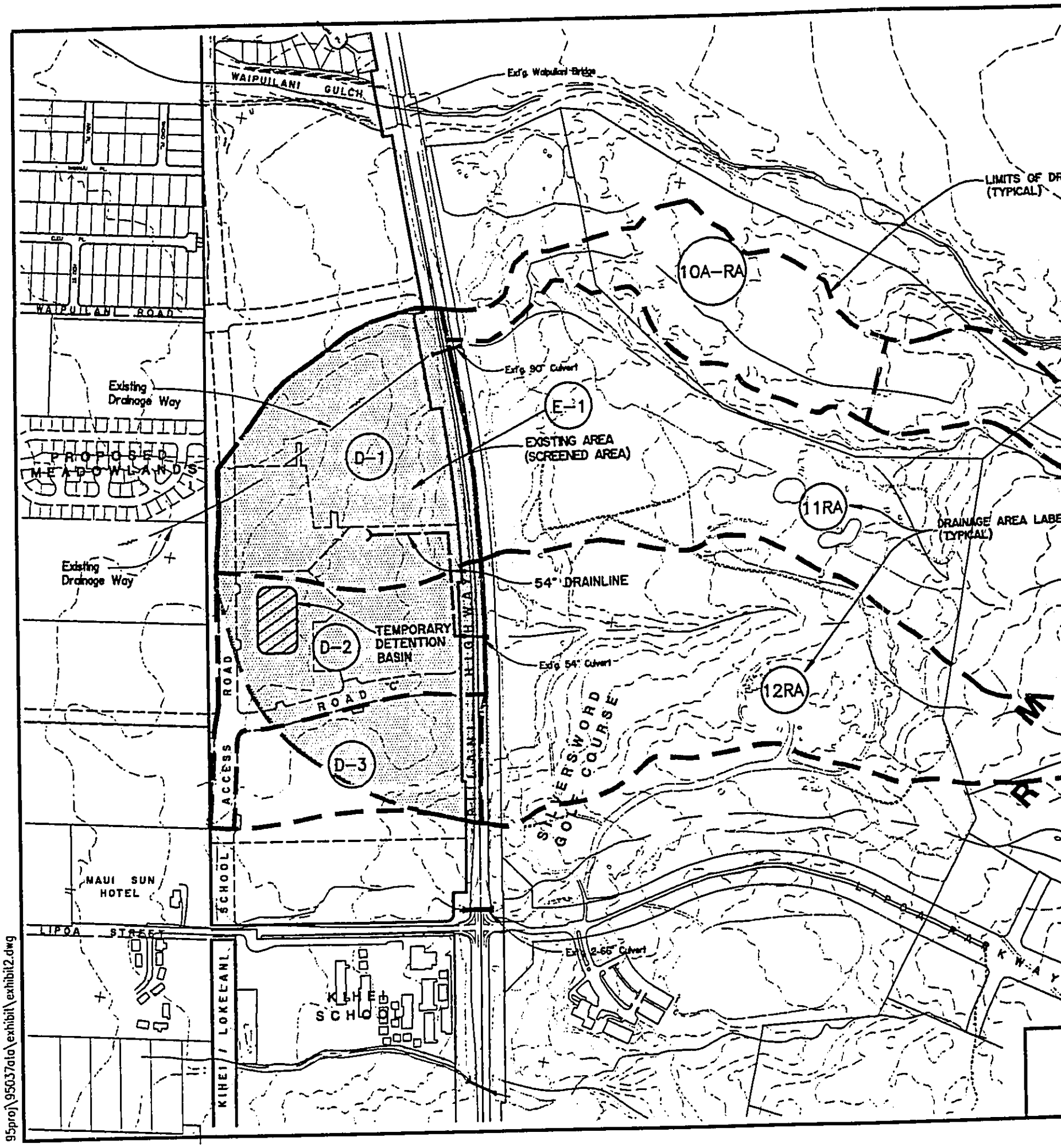


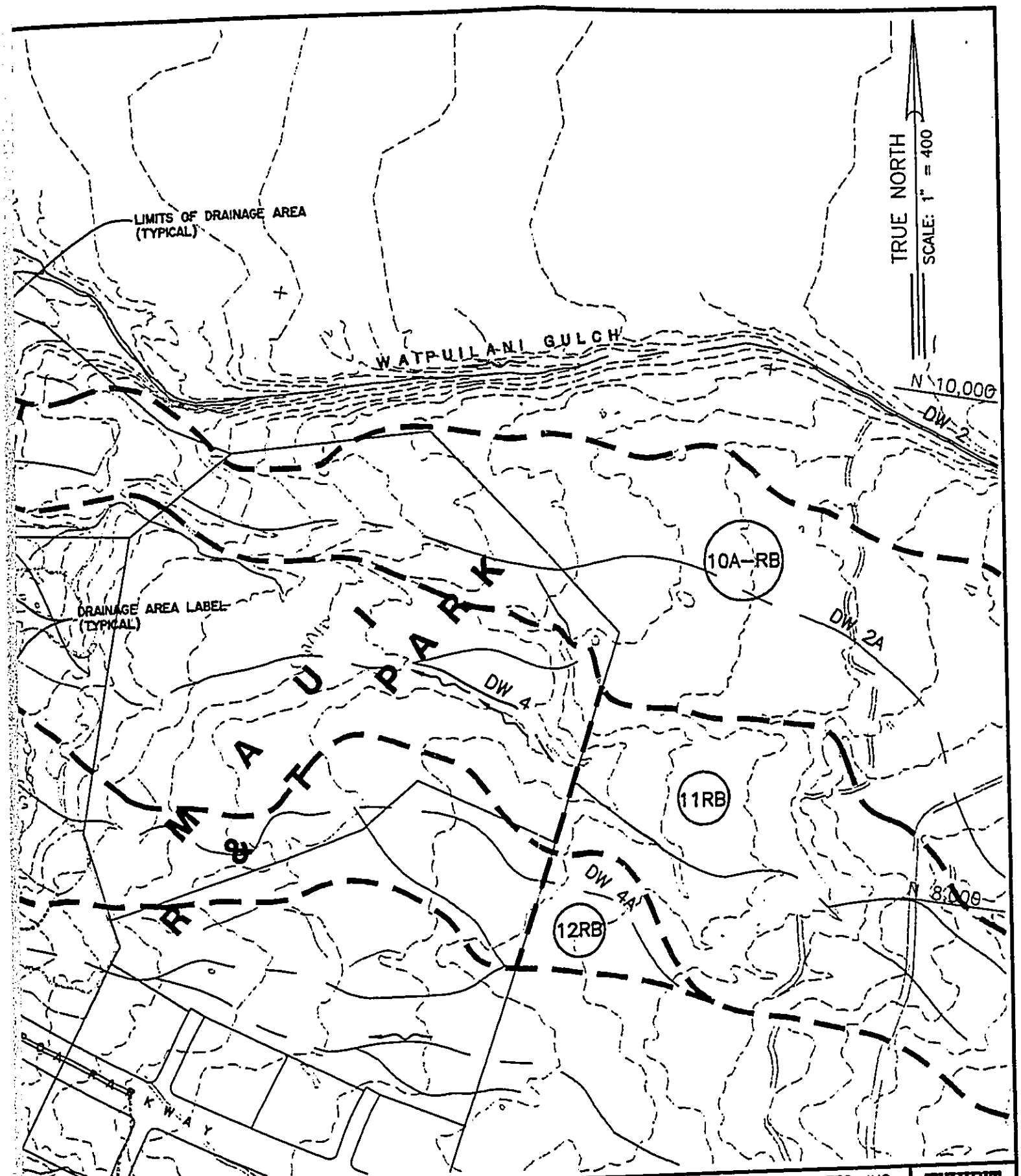
VICINITY MAP– ROAD "C"

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS,SURVEYORS • HONOLULU, HILO, WAILUKU, HAWAII

SCALE: 1"=400' 1/27/97

EXHIBIT R1


WAIPUILANI GULCH
Exi'g. Waipuilani Bridge
LIMITS OF DR
(TYPICAL)
WAIPUILANI ROAD
10A-RA
Existing
Drainage Way
Exi'g. 90" Culvert
E-1
EXISTING AREA
(SCREENED AREA)
PROPOSED
MEADOWLANDS
SUBDIVISION
D-1
11RA
DRAINAGE AREA LABE
(TYPICAL)
Existing
Drainage Way
54" DRAINLINE
TEMPORARY
DETENTION
BASIN
D-2
Exi'g. 54" Culvert
12RA
ROAD "C"
D-3
ACCESS ROAD
SILVERSWORD
GOLF COURSE
MAUI SUN
HOTEL
SCHOOL
LIPOA STREET
Exi'g. 2-66" Culvert
KIHEI / LOKELANI
KIHEI
SCHOOL
95proj\95037ala\exhibit\exhibit2.dwg



DRAINAGE AREA MAP

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, HILO, WAILUKU, HAWAII

SCALE: 1"=500'

1\27\97

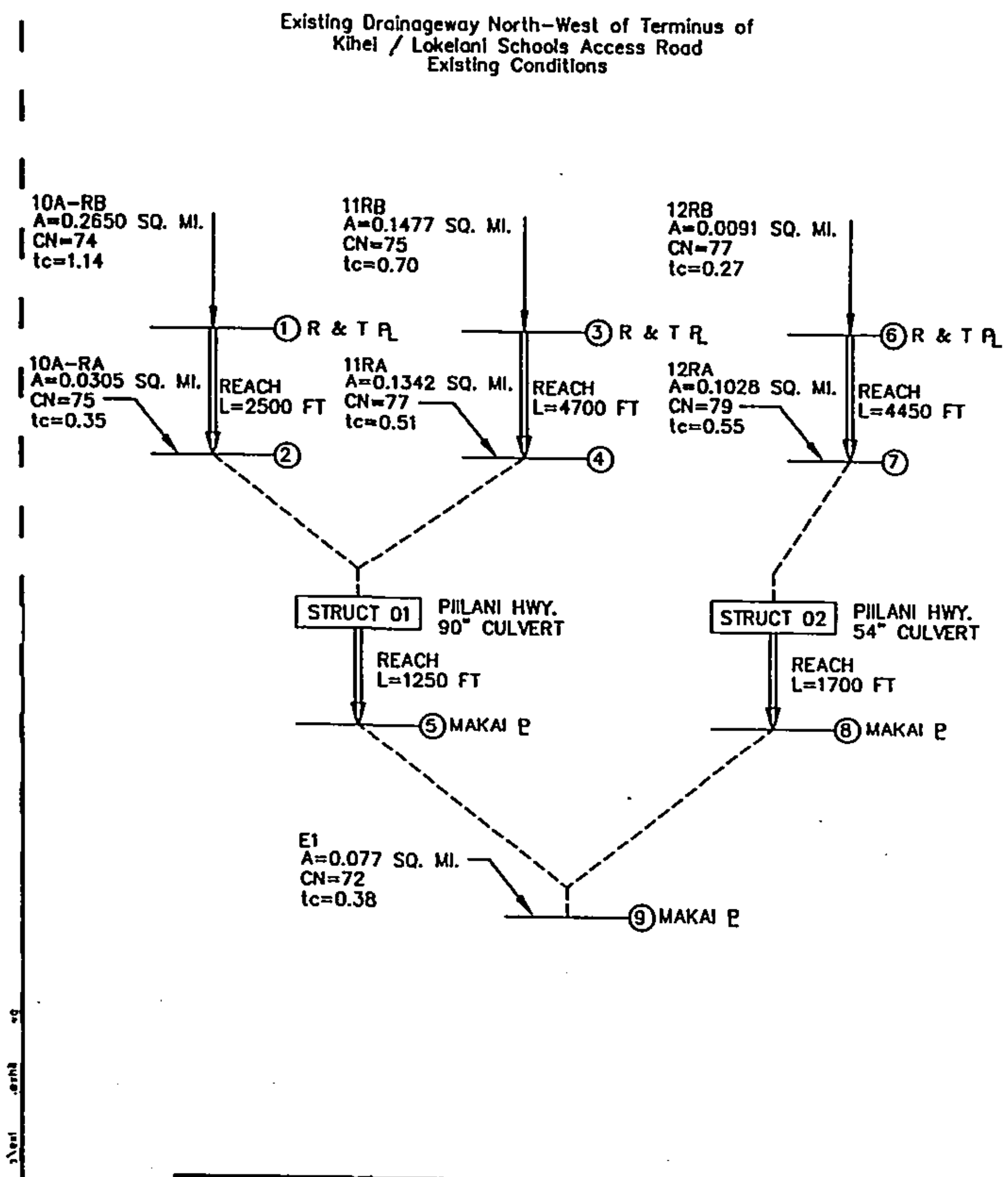
EXHIBIT

R2

HYDROLOGY COMPUTATION

Drainage Area	Area, A, (Acre)	Runoff Coefficient, C	Rainfall Intensity, I, (In./Hr.)	Length of Reach, L, (Ft.)	Slope, S, (Ft./Ft.)	Time of Concentration, T_c (Min.)	Correction Factor	Runoff Discharge Q = CIA, (CFS)	Accumulated Q, (CFS)
Pre-Development									
Road "C"	3.2	0.5	2	2400	0.01	35	1.3	4.7	
KLSA Road (North)	1.7	0.5	2	1600	0.02	25	1.5	2.6	
KLSA Road (South)	1.1	0.5	2	550	0.01	25	1.5	1.7	9.0
Post-Development									
Road "C"	3.2	0.8	2	2400	0.02	15	1.8	9.2	
KLSA Road (North)	1.7	0.8	2	1600	0.01	14	2.0	5.4	
KLSA Road (South)	1.1	0.8	2	550	0.01	10	2.1	3.7	18.3

x:\data\...\HYDRCOMP.XLS



TR-20 SCHEMATIC	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.	EXHIBIT
	NOT TO SCALE 1/27-97	R3

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$$$$$$$$$$$$$$$$$$$$80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY$$$$$$$$$$$$$$$$$$$$

JOB TR-20                    FULLPRINT          SUMMARY
TITLE 001 FN:RCP4E.DAT - PEILANI DRAINAGE STUDY
TITLE 002 EXIST., WATERSHED 10R+11R+12R+E4 (2, 10 AND 100-YR FLOW)
 2 ISECTN  002          1.0         126.0
 8                    122.0         0.0          0.0
 8                    124.0         100.0        40.0
 8                    126.0         1265.0       200.0
 9 ENDTBL
 2 ISECTN  004          1.0         114.0
 8                    110.0         0.0          0.0
 8                    112.0         100.0        40.0
 8                    114.0         1162.0       160.0
 9 ENDTBL
 2 ISECTN  005          1.0         26.0
 8                     22.0         0.0          0.0
 8                     24.0         671.0        140.0
 8                     26.0         3195.0       420.0
 9 ENDTBL
 2 ISECTN  007          1.0         202.0
 8                    198.0         0.0          0.0
 8                    200.0         459.0        95.0
 8                    202.0         2839.0       345.0
 9 ENDTBL
 2 ISECTN  009          1.0         48.0
 8                     46.0         0.0          0.0
 8                     47.0         588.0        100.0
 8                     48.0         1225.0       275.0
 9 ENDTBL
 3 STRUCT     01
 8                     41.5         0.3          0.0
 8                     42.0         35.0         0.01
 8                     44.0         60.0         0.07
 8                     46.0         150.0        0.36
 8                     48.0         300.0        1.10
 8                     50.0         480.0        2.19
 8                     52.0         530.0        3.26
 9 ENDTBL
 3 STRUCT     02
 8                     50.4         0.0          0.0
 8                     52.0         25.0         0.51
 8                     54.0         70.0         1.94
 8                     56.0         120.0        3.78
 8                     58.0         170.0        5.42
 8                     60.0         200.0        6.73
 8                     62.0         230.0        8.15
 9 ENDTBL
```

```
$$$$$$$$$$$$$$$$$$$$80-80 LIST OF INPUT DATA (CONTINUED)$$$$$$$$$$$$$$$$$$$$

 6 RUNOFF 1 001          1 0.2650     74.0      1.14      1   1   1
 6 REACH  3 002   1      2 2500.0                         1   1   1
 6 RUNOFF 1 002          3 0.0305     75.0      0.35      1   1   1
 6 ADDHYD 4 002   2 3 1                                   1   1   1
 6 RUNOFF 1 003          3 0.1477     75.0      0.78      1   1   1
 6 REACH  3 004   3      4 4700.0                         1   1   1
 6 RUNOFF 1 004          5 0.1342     77.0      0.51      1   1   1
 6 ADDHYD 4 004   4 5 2                                   1   1   1
 6 ADDHYD 4    01 1 2 3                                   1   1   1
 6 RESVOR 2    01 3   6 41.5                             1   1   1
 6 REACH  3 005   6      5 1250.0                         1   1   1
 6 RUNOFF 1 006          1 0.0691     77.0      0.27      1   1   1
 6 REACH  3 007   1      2 4450.0                         1   1   1
 6 RUNOFF 1 007          3 0.1028     79.0      0.55      1   1   1
 6 ADDHYD 4 007   2 3 1                                   1   1   1
 6 RESVOR 2    02 1   7 50.4                             1   1   1
 6 REACH  3 008   7      2 1700.0                         1   1   1
 6 ADDHYD 4 009   5 2 3                                   1   1   1
 6 RUNOFF 1 009          1 0.077      72.0      0.38      1   1   1
 6 ADDHYD 4 009   1 3 2                                   1   1 1 1
   ENDATA
 7 INCSEN 6                    0.100
 7 COMPUT 7 001   009   0.0          4.0       1.0       1 2  01  01
   ENDCMP 1
 7 COMPUT 7 001   009   0.0          6.5       1.0       1 2  01  02
   ENDCMP 1
 7 COMPUT 7 001   009   0.0          10.5      1.0       1 2  01  03
   ENDCMP 1
 7 COMPUT 7 001   009   0.0          6.0       6.0       6 2  01  04
   ENDCMP 1
   ENDJOB 2

$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$END OF 80-80 LIST$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
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SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE N	ANTEC MOIST COND	RAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 1													
ISECTION 1	RUNOFF	.26	1	2	.10	.0	4.00	24.00	1.60	---	10.66	63.93	241.2
ISECTION 2	REACH	.26	1	2	.10	.0	4.00	24.00	1.60	122.69	10.87	61.91	233.6
ISECTION 2	RUNOFF	.03	1	2	.10	.0	4.00	24.00	1.67	---	10.00	13.07	429.1
ISECTION 2	ADDHYD	.30	1	2	.10	.0	4.00	24.00	1.60	122.74	10.84	66.10	224.0
ISECTION 3	RUNOFF	.15	1	2	.10	.0	4.00	24.00	1.66	---	10.29	48.14	325.9
ISECTION 4	REACH	.15	1	2	.10	.0	4.00	24.00	1.66	100.44	10.62	39.95	270.5
ISECTION 4	RUNOFF	.13	1	2	.10	.0	4.00	24.00	1.01	---	10.17	56.72	422.6
ISECTION 4	ADDHYD	.28	1	2	.10	.0	4.00	24.00	1.73	110.91	10.26	82.14	291.4
STRUCTURE 1	ADDHYD	.58	1	2	.10	.0	4.00	24.00	1.67	45.65	10.63	136.20	232.6
STRUCTURE 1	RESVOR	.58	1	2	.10	.0	4.00	24.00	1.67	45.65	10.68	134.06	232.2
ISECTION 5	REACH	.53	1	2	.10	.0	4.00	24.00	1.67	22.40	10.80	133.53	231.3
ISECTION 6	RUNOFF	.01	1	2	.10	.0	4.00	24.00	1.01	---	10.04	4.57	502.2
ISECTION 7	REACH	.01	1	2	.10	.0	4.00	24.00	1.00	190.01	10.77	2.35	250.0
ISECTION 7	RUNOFF	.10	1	2	.10	.0	4.00	24.00	1.96	---	10.10	46.61	453.4
ISECTION 7	ADDHYD	.11	1	2	.10	.0	4.00	24.00	1.95	190.21	10.19	47.26	422.3
STRUCTURE 2	RESVOR	.11	1	2	.10	.0	4.00	24.00	1.95	52.52	10.46	36.60	327.0
ISECTION 8	REACH	.11	1	2	.10	.0	4.00	24.00	1.95	46.07	10.50	36.55	326.7
ISECTION 9	ADDHYD	.69	1	2	.10	.0	4.00	24.00	1.71	---	10.75	160.39	240.3
ISECTION 9	RUNOFF	.00	1	2	.10	.0	4.00	24.00	1.45	---	10.10	26.05	340.7
ISECTION 9	ADDHYD	.77	1	2	.10	.0	4.00	24.00	1.69	---	10.69	179.99	234.9
ALTERNATE 1 STORM 2													
ISECTION 1	RUNOFF	.26	1	2	.10	.0	6.50	24.00	3.61	---	10.60	160.93	607.3
ISECTION 2	REACH	.26	1	2	.10	.0	6.50	24.00	3.61	123.75	10.79	157.15	593.0
ISECTION 2	RUNOFF	.03	1	2	.10	.0	6.50	24.00	3.71	---	10.06	31.54	1034.0
ISECTION 2	ADDHYD	.30	1	2	.10	.0	6.50	24.00	3.62	123.36	10.75	167.25	565.0
ISECTION 3	RUNOFF	.15	1	2	.10	.0	6.50	24.00	3.71	---	10.26	110.09	799.4
ISECTION 4	REACH	.15	1	2	.10	.0	6.50	24.00	3.71	101.15	10.53	103.15	670.4
ISECTION 4	RUNOFF	.13	1	2	.10	.0	6.50	24.00	3.92	---	10.15	131.52	900.0
ISECTION 4	ADDHYD	.20	1	2	.10	.0	6.50	24.00	3.01	112.05	10.25	206.29	731.0
STRUCTURE 1	ADDHYD	.50	1	2	.10	.0	6.50	24.00	3.71	40.71	10.55	335.36	500.0
STRUCTURE 1	RESVOR	.50	1	2	.10	.0	6.50	24.00	3.71	43.64	10.65	331.77	574.6
ISECTION 5	REACH	.50	1	2	.10	.0	6.50	24.00	3.71	22.99	10.76	331.60	574.3

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

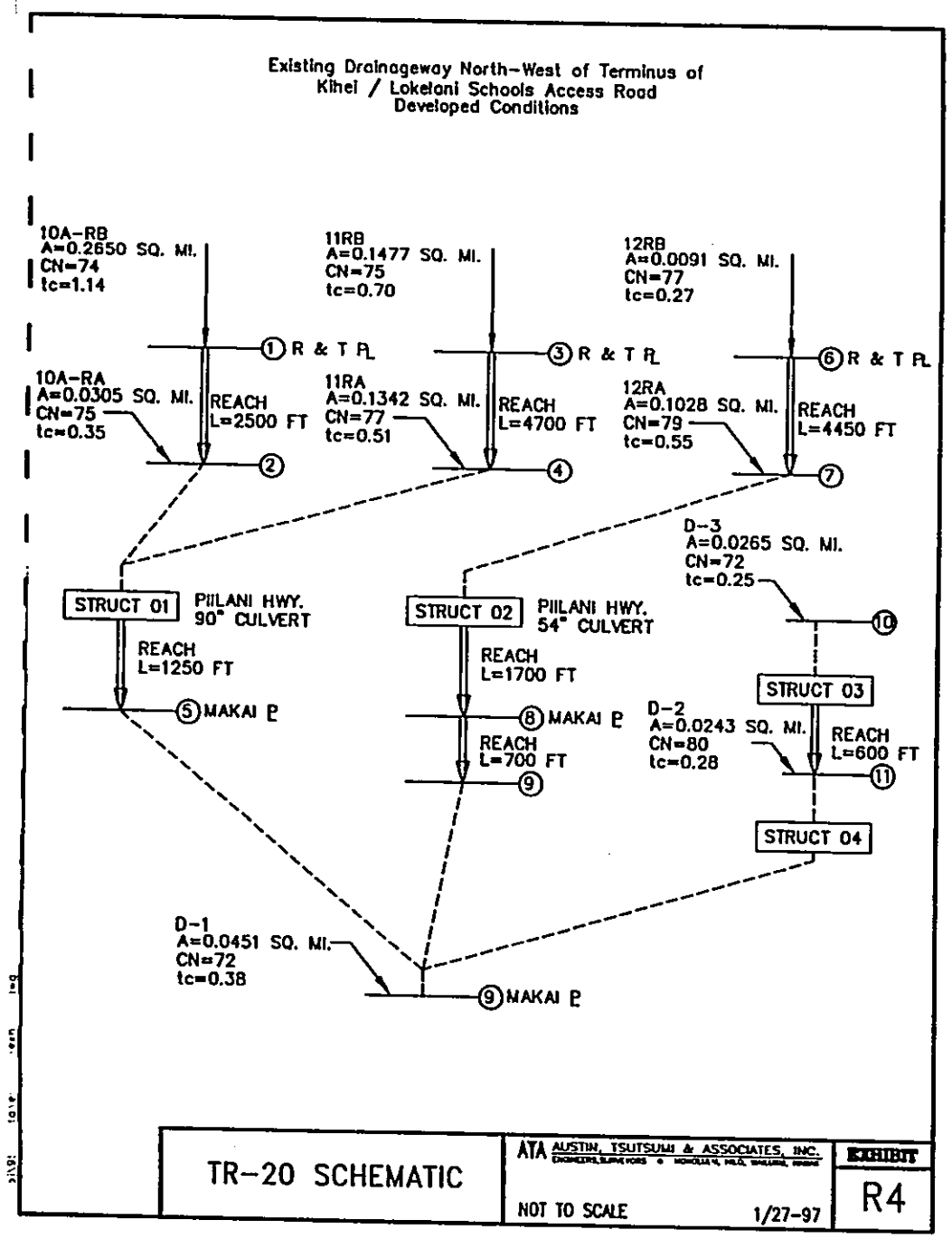
SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE N	ANTEC MOIST COND	RAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 2													
ISECTION 6	RUNOFF	.01	1	2	.10	.0	6.50	24.00	3.92	---	10.01	10.47	1150.6
ISECTION 7	REACH	.01	1	2	.10	.0	6.50	24.00	3.90	190.05	10.60	6.32	694.0
ISECTION 7	RUNOFF	.10	1	2	.10	.0	6.50	24.00	4.03	---	10.16	103.01	1003.0
ISECTION 7	ADDHYD	.11	1	2	.10	.0	6.50	24.00	4.01	190.47	10.17	106.77	954.1
STRUCTURE 2	RESVOR	.11	1	2	.10	.0	6.50	24.00	4.01	54.40	10.45	79.97	714.7
ISECTION 8	REACH	.11	1	2	.10	.0	6.50	24.00	4.01	46.16	10.60	79.56	711.0
ISECTION 9	ADDHYD	.69	1	2	.10	.0	6.50	24.00	3.77	---	10.71	400.90	593.2
ISECTION 9	RUNOFF	.00	1	2	.10	.0	6.50	24.00	3.40	---	10.00	70.10	911.5
ISECTION 9	ADDHYD	.77	1	2	.10	.0	6.50	24.00	3.74	---	10.64	437.45	570.9
ALTERNATE 1 STORM 3													
ISECTION 1	RUNOFF	.26	1	2	.10	.0	10.50	24.00	7.21	---	10.50	334.53	1262.4
ISECTION 2	REACH	.26	1	2	.10	.0	10.50	24.00	7.21	124.27	10.74	329.75	1249.6
ISECTION 2	RUNOFF	.03	1	2	.10	.0	10.50	24.00	7.34	---	10.05	63.05	2093.7
ISECTION 2	ADDHYD	.30	1	2	.10	.0	10.50	24.00	7.22	124.21	10.71	349.40	1102.7
ISECTION 3	RUNOFF	.15	1	2	.10	.0	10.50	24.00	7.33	---	10.24	242.43	1501.7
ISECTION 4	REACH	.15	1	2	.10	.0	10.50	24.00	7.33	112.99	10.48	210.12	1476.0
ISECTION 4	RUNOFF	.13	1	2	.10	.0	10.50	24.00	7.50	---	10.13	200.04	1543.7
ISECTION 4	ADDHYD	.20	1	2	.10	.0	10.50	24.00	7.46	112.51	10.24	420.32	1519.4
STRUCTURE 1	ADDHYD	.50	1	2	.10	.0	10.50	24.00	7.34	54.50	10.46	690.94	1210.5
STRUCTURE 1	RESVOR	.50	1	2	.10	.0	10.50	24.00	7.34	54.52	10.56	693.63	1201.3
ISECTION 5	REACH	.59	1	2	.10	.0	10.50	24.00	7.34	24.02	10.66	693.60	1201.3
ISECTION 6	RUNOFF	.01	1	2	.10	.0	10.50	24.00	7.60	---	10.00	20.61	2264.4
ISECTION 7	REACH	.01	1	2	.10	.0	10.50	24.00	7.59	199.05	10.46	13.79	1515.0
ISECTION 7	RUNOFF	.10	1	2	.10	.0	10.50	24.00	7.06	---	10.15	209.67	1952.3
ISECTION 7	ADDHYD	.11	1	2	.10	.0	10.50	24.00	7.04	190.91	10.16	207.99	1075.6
STRUCTURE 2	RESVOR	.11	1	2	.10	.0	10.50	24.00	7.04	57.41	10.45	155.25	1307.5
ISECTION 8	REACH	.11	1	2	.10	.0	10.50	24.00	7.04	46.31	10.59	154.07	1376.9
ISECTION 9	ADDHYD	.69	1	2	.10	.0	10.50	24.00	7.42	---	10.64	046.70	1220.5
ISECTION 9	RUNOFF	.00	1	2	.10	.0	10.50	24.00	6.94	---	10.07	140.70	1931.2
ISECTION 9	ADDHYD	.77	1	2	.10	.0	10.50	24.00	7.37	---	10.60	907.60	1104.6
ALTERNATE 1 STORM 4													
ISECTION 1	RUNOFF	.26	6	2	.10	.0	6.00	6.00	3.10	---	3.14	237.60	676.6
ISECTION 2	REACH	.26	6	2	.10	.0	6.00	6.00	3.10	124.10	3.33	232.39	076.9
ISECTION 2	RUNOFF	.03	6	2	.10	.0	6.00	6.00	3.20	---	2.57	49.02	1697.4
ISECTION 2	ADDHYD	.30	6	2	.10	.0	6.00	6.00	3.19	124.12	3.31	247.70	050.2
ISECTION 3	RUNOFF	.15	6	2	.10	.0	6.00	6.00	3.20	---	2.79	100.06	1224.5

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	RAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 4													
ISECTION 4	REACH	.15	6	2	.10	.0	6.00	6.00	3.28	111.77	3.04	158.05	1075.5
ISECTION 4	RUNOFF	.13	6	2	.10	.0	6.00	6.00	3.48	---	2.66	202.01	1585.3
ISECTION 4	ADDHYD	.28	6	2	.10	.0	6.00	6.00	3.37	112.27	2.88	312.61	1188.9
STRUCTURE 1	ADDHYD	.58	6	2	.10	.0	6.00	6.00	3.28	51.52	3.06	498.53	863.4
STRUCTURE 1	RESVOR	.58	6	2	.10	.0	6.00	6.00	3.28	51.44	3.16	493.62	854.9
ISECTION 5	REACH	.58	6	2	.10	.0	6.00	6.00	3.28	23.47	3.26	493.32	854.4
ISECTION 6	RUNOFF	.01	6	2	.10	.0	6.00	6.00	3.48	---	2.52	16.58	1812.7
ISECTION 7	REACH	.01	6	2	.10	.0	6.00	6.00	3.47	198.04	3.01	9.99	1098.8
ISECTION 7	RUNOFF	.10	6	2	.10	.0	6.00	6.00	3.69	---	2.68	160.01	1556.5
ISECTION 7	ADDHYD	.11	6	2	.10	.0	6.00	6.00	3.66	198.72	2.78	165.95	1483.0
STRUCTURE 2	RESVOR	.11	6	2	.10	.0	6.00	6.00	3.65	56.00	3.00	120.09	1073.2
ISECTION 8	REACH	.11	6	2	.10	.0	6.00	6.00	3.66	46.24	3.13	119.25	1065.7
ISECTION 9	ADDHYD	.69	6	2	.10	.0	6.00	6.00	3.30	---	3.23	610.32	855.4
ISECTION 9	RUNOFF	.08	6	2	.10	.0	6.00	6.00	2.99	---	2.68	109.98	1403.7
ISECTION 9	ADDHYD	.77	6	2	.10	.0	6.00	6.00	3.31	---	3.19	651.38	849.9

SUMMARY TABLE 3 - DISCHARGE (CFS) AT ISECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

SECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS..... 1	2	3	4
STRUCTURE 2	.11				
ALTERNATE 1		56.63	79.77	155.24	120.09
STRUCTURE 1	.58				
ALTERNATE 1		134.06	331.77	695.63	493.62
ISECTION 1	.26				
ALTERNATE 1		63.93	168.75	334.53	237.68
ISECTION 2	.30				
ALTERNATE 1		69.18	167.25	347.43	247.70
ISECTION 3	.15				
ALTERNATE 1		48.14	118.88	242.43	160.86
ISECTION 4	.28				
ALTERNATE 1		82.14	205.29	428.32	312.61
ISECTION 5	.58				
ALTERNATE 1		133.53	331.68	677.50	493.32
ISECTION 6	.01				
ALTERNATE 1		4.57	10.47	20.61	16.58
ISECTION 7	.11				
ALTERNATE 1		47.24	105.77	207.33	165.95
ISECTION 8	.11				
ALTERNATE 1		56.55	79.55	154.07	119.25
ISECTION 9	.77				
ALTERNATE 1		179.99	437.46	907.80	651.38

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1**********HEC-HB LIST OF INPUT DATA FOR IR-20 HYDROLOGY**********

JOB IR-20              * FULLPRINT        SUMMARY
TITLE 001 FN:MS-RDC1.DAT - NORTH SOUTH - ROAD C
TITLE 002 DEV., CP4 W/ ROADS AND TEMP BASINS(2, 10 AND 100-YR FLOW)
 2 ISECTN   002        1.0       126.0
 8                    122.0       0.0       0.0
 8                    124.0     100.0      40.0
 8                    126.0    1765.0     700.0
 9 ENDTBL
 2 ISECTN   004        1.0       114.0
 8                    110.0       0.0       0.0
 8                    112.0     100.0      40.0
 8                    114.0    1162.0     350.0
 9 ENDTBL
 2 ISECTN   005        1.0        26.0
 8                     22.0       0.0       0.0
 8                     24.0     671.0     140.0
 8                     26.0    3195.0     420.0
 9 ENDTBL
 2 ISECTN   007        1.0       202.0
 8                    199.0       0.0       0.0
 8                    200.0     459.0      95.0
 8                    202.0    2839.0     345.0
 9 ENDTBL
 2 ISECTN   008        1.0        34.0
 8                     30.0       0.0       0.0
 8                     31.0      37.0      2.63
 8                     32.0     140.0      6.93
 8                     33.0     270.0     11.26
 8                     34.0     365.0     14.94
 9 ENDTBL
 2 ISECTN   009        1.0        28.0
 8                     24.0       0.0       0.0
 8                     25.0      52.0      18.0
 8                     26.0     182.0      24.0
 8                     27.0     395.0      42.0
 8                     28.0     702.0      64.0
 9 ENDTBL
 2 ISECTN   011        1.0        24.0
 8                     20.0       0.0       0.0
 8                     21.0     16.44      2.46
 8                     22.0     60.82      6.28
 8                     23.0    109.46     10.11
 8                     24.0    170.94     12.57
 9 ENDTBL
 3 STRUCT   01
 8                     41.5       0.0       0.0
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8                  42.0      38.0      0.01
8                  44.0      68.0      0.07
8                  46.0     150.0      0.26
8                  48.0     308.0      1.18
8                  50.0     488.0      2.19
8                  52.0     538.0      3.26
9 ENDTBL
3 STRUCT     82
8                  50.4       0.0      0.0
8                  52.0      25.0      0.51
8                  54.0      70.0      1.96
8                  56.0     120.0      3.70
8                  58.0     170.0      5.42
8                  60.0     200.0      6.73
8                  62.0     230.0      8.15
9 ENDTBL
3 STRUCT     83
8                  24.0       0.0      0.0
8                  26.0      19.5      0.022
8                  28.0      50.7      0.189
8                  30.0      72.1      0.328
9 ENDTBL
3 STRUCT     84
8                  15.0       0.0      0.0
8                  16.0       3.6      0.031
8                  18.0      12.8      0.137
8                  20.0      18.1      0.657
8                  22.0      22.2      1.896
8                  24.0      25.6      3.932
8                  26.0      28.7      6.735
9 ENDTBL
6 RUNOFF 1 881       1 0.2650    74.0      1.14      1  1  1
6 REACH  3 882   1   2 2580.0                       1  1  1
6 RUNOFF 1 882       3 0.0305    75.0      0.75      1  1  1
6 ADDHYD 4 882   2 3 1                              1  1  1
6 RUNOFF 1 883       3 0.1477    75.0      0.78      1  1  1
6 REACH  3 884   3   4 4780.0                       1  1  1
6 RUNOFF 1 884       5 0.1342    77.0      0.51      1  1  1
6 ADDHYD 4 884   4 5 2                              1  1  1
6 ADDHYD 4    81 1 2 3                              1  1  1
6 RESVOR 2    81 3   6 41.5                         1  1  1
6 REACH  3 885   6   5 1250.0                       1  1  1
6 RUNOFF 1 885       1 0.0891    77.0      0.27      1  1  1
6 REACH  3 887   1   2 4450.0                       1  1  1
6 RUNOFF 1 887       3 0.1020    79.0      0.55      1  1  1
6 ADDHYD 4 887   2 3 1                              1  1  1
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6 RESVOR 2    82 1   7 50.4                         1  1  1
6 REACH  3 888   7   2 1880.0                       1  1  1
6 REACH  3 889   2   7  780.0                       1  1  1
6 RUNOFF 1 889       2 0.0243    80.0      0.28      1  1  1
6 ADDHYD 4 889   7 5 3                              1  1  1
6 RUNOFF 1 810       4 0.0265    72.0      0.25      1  1  1
6 RESVOR 2    83 4   7 24.0                         1  1  1
6 REACH  3 811   7   1  680.0                       1  1  1
6 ADDHYD 4    84 1 2 4                              1  1  1
6 RESVOR 2    84 4   7 15.0                         1  1  1
6 RUNOFF 1 812       6 0.0450    72.0      0.38      1  1  1
6 ADDHYD 4 812   7 6 1                              1  1  1
6 ADDHYD 4 812   1 3 7                              1  1  1
  ENDATA
7 BRCHEM 6                 0.100
7 COMPUT 7 881  812  0.0       4.0       1.0       1 2  81  81
  ENDCMP 1
7 COMPUT 7 891  812  0.0       6.5       1.0       1 2  81  82
  ENDCMP 1
7 COMPUT 7 901  812  0.0      10.5       1.0       1 2  81  83
  ENDCMP 1
7 COMPUT 7 881  812  0.0       6.0       6.0       6 2  81  84
  ENDCMP 1
  ENDJOB 2
```

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 1													
ISECTION 1	RUNOFF	.24	1	2	.10	.0	4.00	24.00	1.60	---	10.66	63.93	241.2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ISECTION 2	RUNOFF	.03	1	2	.10	.0	8.00	24.00	1.67	---	10.00	13.09	429.1
ISECTION 2	ADDHYD	.30	1	2	.10	.0	4.00	24.00	1.60	122.74	10.04	66.10	224.0
ISECTION 3	RUNOFF	.15	1	2	.10	.0	4.00	24.00	1.66	---	10.29	48.14	325.9
ISECTION 4	REACH	.15	1	2	.10	.0	4.00	24.00	1.66	110.44	10.62	39.95	270.5
ISECTION 4	RUNOFF	.13	1	2	.10	.0	4.00	24.00	1.01	---	10.17	55.72	422.6
ISECTION 4	ADDHYD	.28	1	2	.10	.0	4.00	24.00	1.73	110.91	10.26	82.14	291.4
STRUCTURE 1	ADDHYD	.58	1	2	.10	.0	4.00	24.00	1.67	45.65	10.63	134.20	232.6
STRUCTURE 1	RESVOR	.53	1	2	.10	.0	4.00	24.00	1.67	45.65	10.69	134.06	232.2
ISECTION 5	REACH	.58	1	2	.10	.0	4.00	24.00	1.67	22.40	10.00	133.53	231.3
ISECTION 6	RUNOFF	.01	1	2	.10	.0	4.00	24.00	1.01	---	10.04	4.57	502.2
ISECTION 7	REACH	.01	1	2	.10	.0	4.00	24.00	1.00	190.01	10.77	2.35	258.0
ISECTION 7	RUNOFF	.10	1	2	.10	.0	4.00	24.00	1.96	---	10.10	46.61	453.4
ISECTION 7	ADDHYD	.11	1	2	.10	.0	4.00	24.00	1.95	190.21	10.19	47.26	422.3
STRUCTURE 2	RESVOR	.11	1	2	.10	.0	4.00	24.00	1.95	52.52	10.46	36.60	327.0
ISECTION 8	REACH	.11	1	2	.10	.0	4.00	24.00	1.95	30.99	10.46	36.60	327.0
ISECTION 9	REACH	.11	1	2	.10	.0	4.00	24.00	1.95	24.71	10.46	36.60	327.0
ISECTION 9	RUNOFF	.02	1	2	.10	.0	4.00	24.00	2.04	---	10.03	14.06	570.5
ISECTION 9	ADDHYD	.69	1	2	.10	.0	4.00	24.00	1.71	25.03	10.73	166.54	241.6
ISECTION 10	RUNOFF	.03	1	2	.10	.0	4.00	24.00	1.46	---	10.04	10.22	385.0
STRUCTURE 3	RESVOR	.03	1	2	.10	.0	4.00	24.00	1.46	25.05	10.06	10.33	389.7
ISECTION 11	REACH	.03	1	2	.10	.0	4.00	24.00	1.46	20.63	10.06	10.33	389.7
STRUCTURE 4	ADDHYD	.05	1	2	.10	.0	4.00	24.00	1.74	23.10	10.05	24.20	476.4
STRUCTURE 4	RESVOR	.05	1	2	.10	.0	4.00	24.00	1.74	18.87	10.26	15.11	297.5
ISECTION 12	RUNOFF	.05	1	2	.10	.0	4.00	24.00	1.46	---	10.10	15.69	348.7
ISECTION 12	ADDHYD	.10	1	2	.10	.0	4.00	24.00	1.61	---	10.13	30.34	316.7
ISECTION 12	ADDHYD	.79	1	2	.10	.0	4.00	24.00	1.70	---	10.67	197.27	238.5
ALTERNATE 1 STORM 2													
ISECTION 1	RUNOFF	.26	1	2	.10	.0	6.50	24.00	3.61	---	10.60	160.93	607.3
ISECTION 2	REACH	.26	1	2	.10	.0	6.50	24.00	3.61	123.75	10.79	157.15	593.0
ISECTION 2	RUNOFF	.03	1	2	.10	.0	6.50	24.00	3.71	---	10.05	31.54	1034.0

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	MAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 2													
ISECTION 2	ADDHYD	.30	1	2	.10	.0	6.50	24.00	3.62	123.86	10.75	167.25	566.0
ISECTION 3	RUNOFF	.15	1	2	.10	.0	6.50	24.00	3.71	---	10.26	110.00	799.4
ISECTION 4	REACH	.15	1	2	.10	.0	6.50	24.00	3.71	111.15	10.53	103.15	690.4
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ISECTION 8	ADDHYD	.28	1	2	.10	.0	6.50	24.00	3.81	112.05	10.25	286.29	731.0
STRUCTURE 1	ADDHYD	.58	1	2	.10	.0	6.50	24.00	3.71	49.71	10.55	335.36	580.0
STRUCTURE 1	RESVOR	.58	1	2	.10	.0	6.50	24.00	3.71	48.64	10.65	331.77	574.6
ISECTION 5	REACH	.58	1	2	.10	.0	6.50	24.00	3.71	22.99	10.76	331.68	574.3
ISECTION 6	RUNOFF	.01	1	2	.10	.0	6.50	24.00	3.92	---	10.01	10.47	1150.6
ISECTION 7	REACH	.01	1	2	.10	.0	6.50	24.00	3.90	190.03	10.60	6.32	694.0
ISECTION 7	RUNOFF	.10	1	2	.10	.0	6.50	24.00	4.13	---	10.16	103.01	1009.0
ISECTION 7	ADDHYD	.11	1	2	.10	.0	6.50	24.00	4.11	193.47	10.17	106.77	954.1
STRUCTURE 2	RESVOR	.11	1	2	.10	.0	6.50	24.00	4.11	50.40	10.46	79.97	714.7
ISECTION 8	REACH	.11	1	2	.10	.0	6.50	24.00	4.11	31.42	10.46	79.97	714.7
ISECTION 9	REACH	.11	1	2	.10	.0	6.50	24.00	4.11	25.22	10.46	79.97	714.7
ISECTION 9	RUNOFF	.02	1	2	.10	.0	6.50	24.00	4.23	---	10.01	30.30	1246.9
ISECTION 9	ADDHYD	.69	1	2	.10	.0	6.50	24.00	3.77	27.03	10.60	405.45	588.2
ISECTION 10	RUNOFF	.03	1	2	.10	.0	6.50	24.00	3.41	---	10.01	26.32	993.2
STRUCTURE 3	RESVOR	.03	1	2	.10	.0	6.50	24.00	3.40	26.43	10.05	26.24	990.3
ISECTION 11	REACH	.03	1	2	.10	.0	6.50	24.00	3.40	21.22	10.05	26.24	990.3
STRUCTURE 4	ADDHYD	.05	1	2	.10	.0	6.50	24.00	3.80	43.69	10.03	56.12	1184.7
STRUCTURE 4	RESVOR	.05	1	2	.10	.0	6.50	24.00	3.80	21.55	10.55	21.27	448.7
ISECTION 12	RUNOFF	.05	1	2	.10	.0	6.50	24.00	3.40	---	10.00	41.02	911.5
ISECTION 12	ADDHYD	.10	1	2	.10	.0	6.50	24.00	3.61	---	10.10	60.05	635.1
ISECTION 12	ADDHYD	.79	1	2	.10	.0	6.50	24.00	3.76	---	10.04	443.72	585.2
ALTERNATE 1 STORM 3													
ISECTION 1	RUNOFF	.26	1	2	.10	.0	10.50	24.00	7.21	---	10.50	334.53	1262.4
ISECTION 2	REACH	.26	1	2	.10	.0	10.50	24.00	7.21	124.27	10.74	328.75	1240.6
ISECTION 2	RUNOFF	.03	1	2	.10	.0	10.50	24.00	7.34	---	10.05	63.86	2893.7
ISECTION 2	ADDHYD	.30	1	2	.10	.0	10.50	24.00	7.22	124.31	10.71	349.48	1182.7
ISECTION 3	RUNOFF	.15	1	2	.10	.0	10.50	24.00	7.33	---	10.24	242.48	1641.7
ISECTION 4	REACH	.15	1	2	.10	.0	10.50	24.00	7.33	112.00	10.49	210.12	1476.6
ISECTION 4	RUNOFF	.13	1	2	.10	.0	10.50	24.00	7.69	---	10.13	288.84	1943.7
ISECTION 4	ADDHYD	.28	1	2	.10	.0	10.50	24.00	7.46	112.51	10.24	428.32	1519.4
STRUCTURE 1	ADDHYD	.58	1	2	.10	.0	10.50	24.00	7.34	54.60	10.46	690.94	1210.5
STRUCTURE 1	RESVOR	.58	1	2	.10	.0	10.50	24.00	7.34	54.52	10.56	693.63	1201.3

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	RAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 3													
ISECTION 5	REACH	.50	1	2	.10	.0	10.50	24.00	7.34	24.02	10.66	693.60	1201.3
ISECTION 6	RUNOFF	.01	1	2	.10	.0	10.50	24.00	7.60	---	10.00	20.61	2264.4
ISECTION 7	REACH	.01	1	2	.10	.0	10.50	24.00	7.59	198.86	10.46	13.79	1515.0
ISECTION 7	RUNOFF	.10	1	2	.10	.0	10.50	24.00	7.84	---	10.15	208.69	1952.3
ISECTION 7	ADDHYD	.11	1	2	.10	.0	10.50	24.00	7.84	198.91	10.16	209.00	1875.6
STRUCTURE 2	RESVOR	.11	1	2	.10	.0	10.50	24.00	7.84	57.41	10.45	155.26	1387.5
ISECTION 8	REACH	.11	1	2	.10	.0	10.50	24.00	7.84	32.12	10.45	155.26	1387.5
ISECTION 9	REACH	.11	1	2	.10	.0	10.50	24.00	7.84	25.79	10.45	155.26	1387.5
ISECTION 9	RUNOFF	.02	1	2	.10	.0	10.50	24.00	8.00	---	10.00	57.45	2364.3
ISECTION 9	ADDHYD	.69	1	2	.10	.0	10.50	24.00	7.42	28.46	10.61	841.71	1221.1
ISECTION 10	RUNOFF	.03	1	2	.10	.0	10.50	24.00	6.94	---	10.00	55.39	2898.2
STRUCTURE 3	RESVOR	.03	1	2	.10	.0	10.50	24.00	6.93	28.38	10.66	53.98	2833.8
ISECTION 11	REACH	.03	1	2	.10	.0	10.50	24.00	6.93	21.84	10.86	53.98	2833.8
STRUCTURE 4	ADDHYD	.85	1	2	.10	.0	10.50	24.00	7.44	78.46	10.02	110.01	2165.5
STRUCTURE 4	RESVOR	.85	1	2	.10	.0	10.50	24.00	7.44	24.56	10.86	26.47	521.0
ISECTION 12	RUNOFF	.05	1	2	.10	.0	10.50	24.00	6.94	---	10.07	86.90	1931.2
ISECTION 12	ADDHYD	.10	1	2	.10	.0	10.50	24.00	7.21	---	10.00	110.97	1150.4
ISECTION 12	ADDHYD	.79	1	2	.10	.0	10.50	24.00	7.39	---	10.50	984.74	1152.4
ALTERNATE 1 STORM 4													
ISECTION 1	RUNOFF	.26	6	2	.10	.0	6.00	6.00	3.10	---	3.14	237.60	876.6
ISECTION 2	REACH	.26	6	2	.10	.0	6.00	6.00	3.10	124.10	3.33	232.39	876.9
ISECTION 2	RUNOFF	.03	6	2	.10	.0	6.00	6.00	3.20	---	2.57	49.02	1607.4
ISECTION 2	ADDHYD	.30	6	2	.10	.0	6.00	6.00	3.19	124.12	3.31	247.70	838.2
ISECTION 3	RUNOFF	.15	6	2	.10	.0	6.00	6.00	3.20	---	2.79	100.06	1224.5
ISECTION 4	REACH	.15	6	2	.10	.0	6.00	6.00	3.20	111.77	3.04	158.05	1075.5
ISECTION 4	RUNOFF	.13	6	2	.10	.0	6.00	6.00	3.40	---	2.66	202.01	1585.3
ISECTION 6	ADDHYD	.28	6	2	.10	.0	6.00	6.00	3.37	112.27	2.80	312.61	1108.9
STRUCTURE 1	ADDHYD	.58	6	2	.10	.0	6.00	6.00	3.20	51.52	3.06	498.53	853.4
STRUCTURE 1	RESVOR	.58	6	2	.10	.0	6.00	6.00	3.20	51.44	3.16	493.62	854.9
ISECTION 5	REACH	.58	6	2	.10	.0	6.00	6.00	3.20	23.47	3.26	493.32	854.4
ISECTION 6	RUNOFF	.01	6	2	.10	.0	6.00	6.00	3.40	---	2.52	16.50	1812.7
ISECTION 7	REACH	.01	6	2	.10	.0	6.00	6.00	3.47	198.84	3.01	9.99	1098.0
ISECTION 7	RUNOFF	.10	6	2	.10	.0	6.00	6.00	3.60	---	2.68	160.01	1556.5
ISECTION 7	ADDHYD	.11	6	2	.10	.0	6.00	6.00	3.66	199.72	2.70	165.95	1493.0
STRUCTURE 2	RESVOR	.11	6	2	.10	.0	6.00	6.00	3.66	56.00	3.00	120.09	1073.2
ISECTION 8	REACH	.11	6	2	.10	.0	6.00	6.00	3.66	31.01	3.00	120.09	1073.2

SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS IN THE ORDER PERFORMED
(A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES INDICATES A FLAT TOP HYDROGRAPH
A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST POINT.)

SECTION/ STRUCTURE ID	STANDARD CONTROL OPERATION	DRAINAGE AREA (SQ MI)	RAIN TABLE #	ANTEC MOIST COND	RAIN TIME INCREM (HR)	PRECIPITATION BEGIN (HR)	PRECIPITATION AMOUNT (IN)	PRECIPITATION DURATION (HR)	RUNOFF AMOUNT (IN)	PEAK DISCHARGE ELEVATION (FT)	PEAK DISCHARGE TIME (HR)	PEAK DISCHARGE RATE (CFS)	PEAK DISCHARGE RATE (CSM)
ALTERNATE 1 STORM 4													
ISECTION 9	REACH	.11	6	2	.10	.0	6.00	6.00	3.66	25.52	3.00	120.09	1073.2
ISECTION 9	RUNOFF	.02	6	2	.10	.0	6.00	6.00	3.78	---	2.52	47.93	1972.5
ISECTION 9	ADDHYD	.69	6	2	.10	.0	6.00	6.00	3.34	27.60	3.21	684.86	877.5
ISECTION 10	RUNOFF	.03	6	2	.10	.0	6.00	6.00	2.99	---	2.52	41.30	1559.4
STRUCTURE 3	RESVOR	.03	6	2	.10	.0	6.00	6.00	2.99	27.37	2.56	40.88	1542.6
ISECTION 11	REACH	.03	6	2	.10	.0	6.00	6.00	2.99	21.56	2.56	40.88	1542.6
STRUCTURE 4	ADDHYD	.85	6	2	.10	.0	6.00	6.00	3.37	60.45	2.53	88.38	1738.2
STRUCTURE 4	RESVOR	.85	6	2	.10	.0	6.00	6.00	3.37	23.14	3.34	24.14	475.2
ISECTION 12	RUNOFF	.05	6	2	.10	.0	6.00	6.00	2.99	---	2.60	63.17	1403.7
ISECTION 12	ADDHYD	.10	6	2	.10	.0	6.00	6.00	3.19	---	2.61	85.53	892.8
ISECTION 12	ADDHYD	.79	6	2	.10	.0	6.00	6.00	3.32	---	3.10	653.40	832.2

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID		DRAINAGE AREA (SQ MI)	STORM NUMBERS.......... 1	2	3	4
STRUCTURE 4		.25				
ALTERNATE	1		15.11	21.27	26.47	24.14
STRUCTURE 3		.02				
ALTERNATE	1		19.[illegible]	[illegible]	53.72	40.05
STRUCTURE 2		.11				
ALTERNATE	1		35.53	77.97	155.26	120.07
STRUCTURE 1		.59				
ALTERNATE	1		134.05	371.77	673.63	473.62
XSECTION 1		.25				
ALTERNATE	1		62.[illegible]	162.[illegible]	334.53	237.60
XSECTION 2		.30				
ALTERNATE	1		55.19	157.25	347.48	247.70
XSECTION 3		.15				
ALTERNATE	1		49.14	110.09	242.43	190.85
XSECTION 4		.29				
ALTERNATE	1		82.14	235.29	428.22	312.61
XSECTION 5		.56				
ALTERNATE	1		137.5[illegible]	371.60	693.60	493.32
XSECTION 6		.01				
ALTERNATE	1		4.57	10.47	20.61	16.59
XSECTION 7		.11				
ALTERNATE	1		47.25	105.77	209.89	165.95
XSECTION 8		.11				
ALTERNATE	1		35.53	77.97	155.26	120.07
XSECTION 9		.69				
ALTERNATE	1		156.54	405.45	811.71	484.85
XSECTION 10		.02				
ALTERNATE	1		18.22	26.32	55.79	41.30

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID		DRAINAGE AREA (SQ MI)	STORM NUMBERS.......... 1	2	3	4
XSECTION 11		.03				
ALTERNATE	1		12.[illegible]	26.24	53.72	40.69
XSECTION 12		.79				
ALTERNATE	1		197.27	443.72	904.74	653.40

Appendix F

Letter from Department of the Army to Munekiyo & Arakawa dated October 6, 1995

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

REPLY TO ATTENTION OF
Operations Branch

October 6, 1995

Mr. Milton Arakawa
Munekiyo and Arakawa, Inc.
1823 Wells Street, Suite 3
Wailuku, Hawaii 96793

Dear Mr. Arakawa:

Thank you for your letter of September 19,1995, requesting, on the behalf of the County of Maui, Department of Public Works (DPW) an initial corrective measure order for the unauthorized fill in Road "C" in Kihei, Maui.

The unauthorized fill, which consisted of approximately 23 cubic yards, was "inadvertently" placed by the current landowner, Jonathan Fern and the Stewart Fern Trust. The affected wetland is the remaining batis flat mauka of the Long's wetland mitigation pond in Kihei, Maui. For quite some time now, Maui DPW has planned to widen the existing gravel road for a roadway that connects South Kihei Road with Piilani Highway (Road "C"). As so stated in your September 19, 1995 request, the Maui DPW plans to retain the fill for use as the future roadway base.

The Corps followed 33 CFR, Part 326.3 (d), Federal Register of November 13, 1986 in making the following decision. Although the extent of the fill was minor, we consulted with the U.S. Fish and Wildlife Service (USFWS) to determine the effect the fill had on the wetland mitigation ponds. As you have proposed, the Maui DPW shall resolve this matter by planting a buffer of Scaevola sericea (Naupaka kahakai) along the sides of the mitigation ponds (Long's and Azeka's). The USFWS concurred with the planting of the Naupaka buffer in an August 8, 1995 letter to Maui DPW.

Implementation of the following corrective measures order will substantially eliminate all current and future detrimental impacts resulting from the unauthorized work. It will not be necessary to issue a Corps permit in connection with these initial corrective measures. However, compliance with this order does not foreclose the Government's options to initiate appropriate legal action or to later require the submission of a permit application.

Maui DPW will comply with the following order:

a. Maui DPW will plant Naupaka as shown in the plan (attachments 1 and 2).

b. Planting will take place within four months of the date of this letter, not after completion of the Phase I of the roadway work (post 1998).

c. Maui DPW will immediately replace any dead plants.

d. Maui DPW will maintain this buffer in perpetuity.

If you have any questions concerning this matter, please contact Ms. Terrell Kelley at 438-9258, extension 13.

Sincerely,

James L. Bersson, P.E.
Chief, Operations Branch

Attachments

Copies Furnished (with attachments):

Department of Public Works, County of Maui, Maui, HI
Clean Water Branch, Environmental Management Division, State Department of Health, Honolulu, HI
Office of State Planning, Coastal Zone Management Program Office, Honolulu, HI
U.S. Fish and Wildlife Service, Honolulu, HI
U.S. Environmental Protection Agency, San Francisco, CA

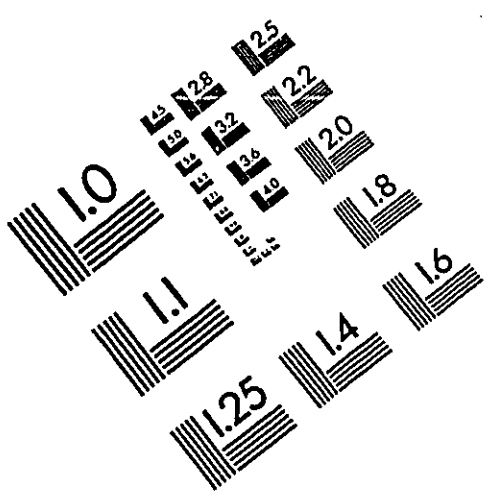
END

CERTIFICATION

I HEREBY CERTIFY THAT THE MICROPHOTOGRAPH APPEARING IN THIS REEL OF FILM ARE TRUE COPIES OF THE ORIGINAL DOCUMENTS.

2004
DATE

Erin A Nakamura
SIGNATURE OF OPERATOR

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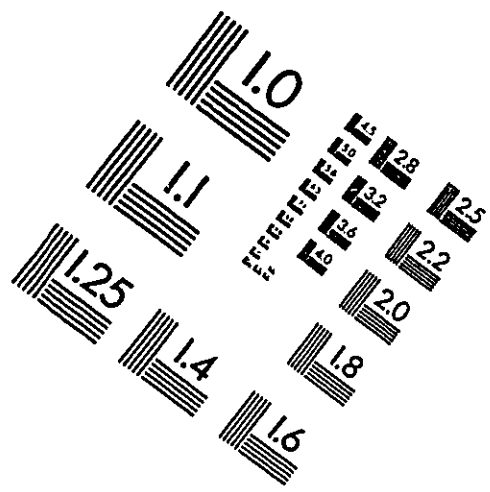
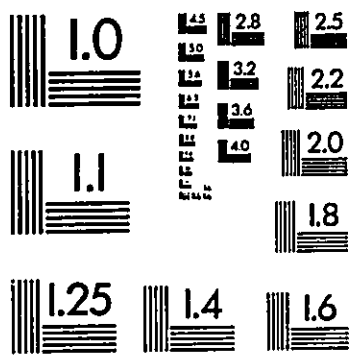
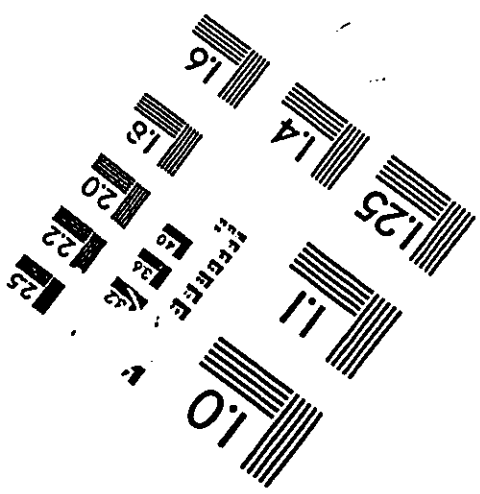
Silver Spring, Maryland 20910
301/587-8202

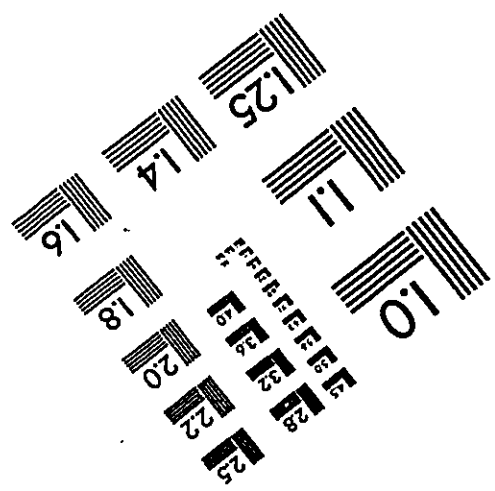


Centimeter

Inches







DENSITY TARGET