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STATE OF HAWAII

KALI WATSON
CHAIRMAN
HAWAIIAN HOMES COMMISSION

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DEPUTY TO THE CHAIRMAN

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P.O. BOX 1879
HONOLULU, HAWAII 96805

April 24, 1996

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OFC. OF ENVIRON. QUALITY CONTROL

Mr. Gary Gill, Director
Office of Environmental
Quality Control
220 South King Street, 4th Floor
Honolulu, Hawaii 96813

Dear Mr. Gill:

SUBJECT: Kula Residence Lots, Unit 1
Kula, Island of Maui
TMK (2) 2-2-02:56 and por. of 14

Enclosed are four (4) copies of the Final Environmental Assessment (Negative Declaration) for the proposed Kula Residence Lots, Unit 1. Based on the analysis of the conditions and impacts presented in the Environmental Assessment, we have concluded that the proposed project will have no significant effect on the Environment. Therefore, we are filing a Negative Declaration for the proposed project.

We request that this Negative Declaration be published in the next OEQC Bulletin. A completed OEQC Bulletin Publication Form is enclosed as required.

Should you have any questions, please call me at 586-3815 or have your staff call Patrick Young of my staff at 586-3818.

Sincerely,

Mike Crozier, Administrator
Land Development Division

MC:PY: ATA.OEQ

cc: Austin Tsutsumi & Assoc.
Munekiyo & Arakawa, Inc.

1996-05-08-MA-FEA-Kula Residence Lots, Unit 1

Final Environmental Assessment

DHHL Kula Residential Lot, Unit 1

Prepared for

State of Hawaii, Dept. of Hawaiian Home Lands

April 1996

MUNEKIYO & ARAKAWA, INC.

Final Environmental Assessment

DHHL Kula Residential Lot, Unit 1

Prepared for

State of Hawaii, Dept. of Hawaiian Home Lands

April 1996

MUNEKIYO & ARAKAWA, INC.

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Chapter I

Project Overview

I. PROJECT OVERVIEW

A. PROJECT LOCATION, EXISTING USE, AND LAND OWNERSHIP

The applicant, the State of Hawaii, Department of Hawaiian Home Lands (DHHL), proposes to develop a residential subdivision on Hawaiian homestead lands in Kula, Maui, Hawaii. Identified by TMK's (2) 2-2-02:56 and por. 14, approximately 668 acres of DHHL homestead lands are in the process of being consolidated and resubdivided. Upon completion of the subdivision process, the proposed project will encompass approximately 460 acres of the total subdivided land area. The lands underlying the project site fall within the State Land Use "Agricultural" district.

It should be noted that five (5) privately owned kuleanas are located within the project site and are excluded from the proposed development. Existing access to these parcels from Kula Highway will continue to be maintained. See Figure 1.

Situated on the southwestern flank of Haleakala, the project site is located immediately west of Kula Highway and is surrounded by lands engaged in rural and agricultural activities. The town of Pukalani lies approximately eight (8) miles to the north of the project site, and the community of Kihei, although not directly accessible, is about four (4) miles to the west.

Currently, the project site is undeveloped and predominantly vegetated with kikuyu grass and black wattle trees at the upper elevations, and kiawe, lantana, and prickly pear cactus (a.k.a., panini) at the lower elevations.

The lands underlying the project site are owned by the DHHL.

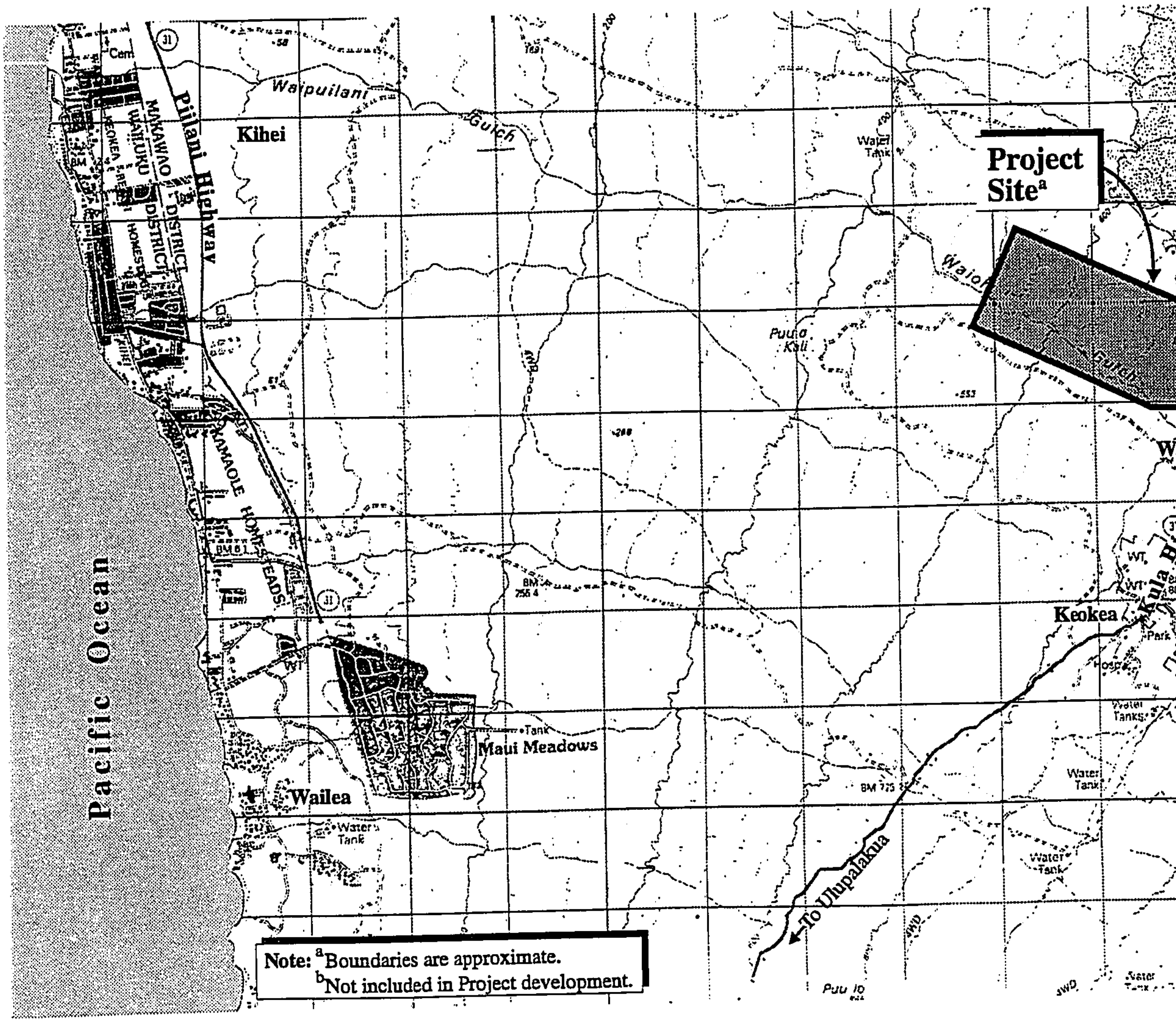
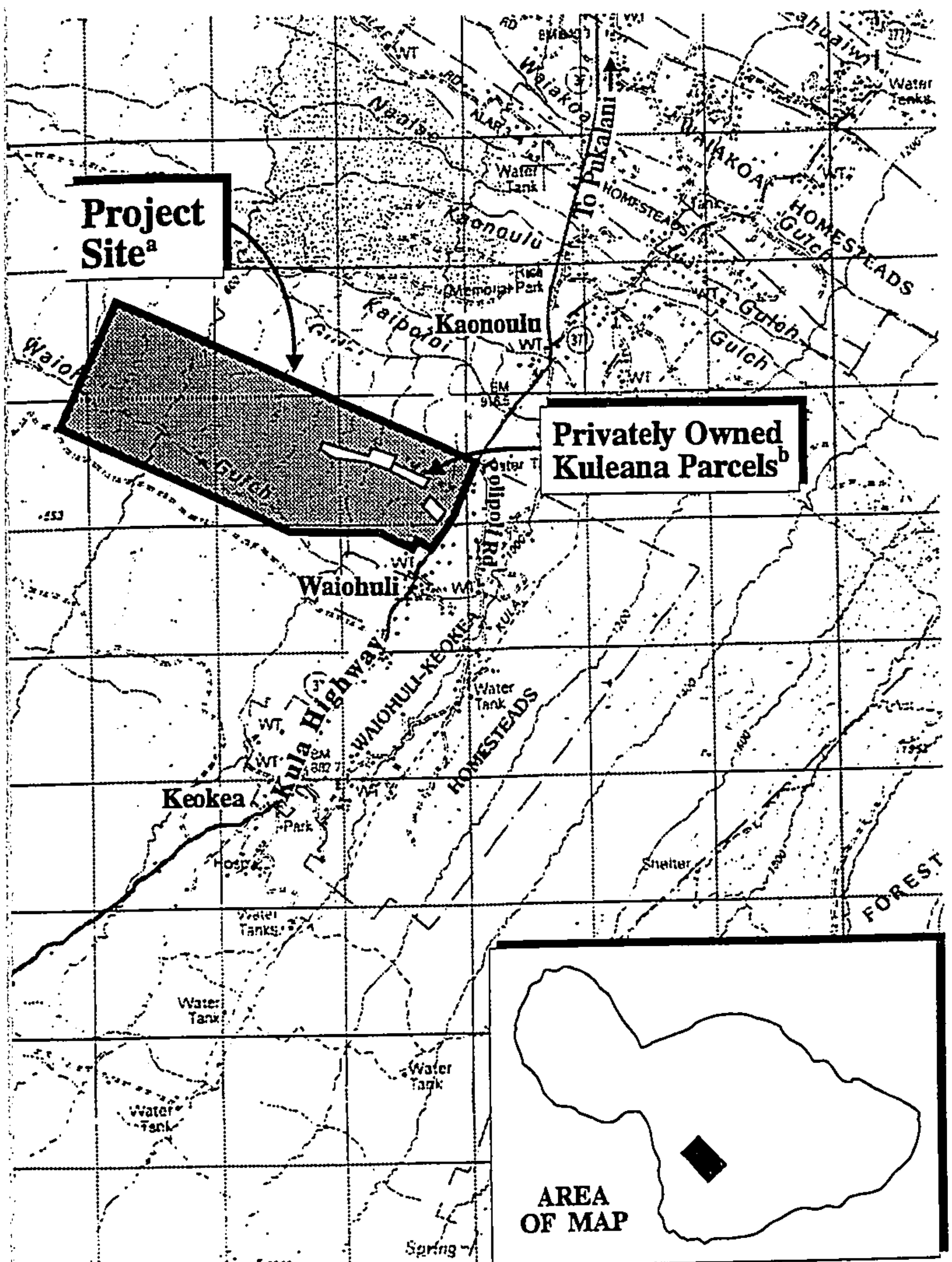


Figure 1

DHHL Kula Residential Lot, Unit

Regional Location Map

Prepared for: State of Hawaii, Dept. of Hawaiian Home Lands



ıtial Lot, Unit 1

tion Map

MUNEKIYO & ARAKAWA, INC.

0 25,000 50,000 100,000 Feet

B. *PROJECT NEED*

The Hawaiian Homes Commission Act (HHCA) set aside between 188,000 and 203,000 acres of ceded lands for homesteading by Native Hawaiians.

During the 73 years since the HHCA was signed into law, only 17.5 percent, or fewer than 3,800 families, actually reside, farm, or ranch on the lands which were originally set aside. In 1990, over 19,000 Native Hawaiians throughout the State were on the waiting list for homestead awards. As of June 30, 1994, there were a total of 4,991 Native Hawaiians on the waiting list for homestead lands on Maui. Of the total, 189 applicants were registered for pastoral awards, 2,388 had signed-up for agricultural lands, and 2,414 are waiting for residential lots (telephone conversation with DHHL employee, Joseph Chu, September 1994; Office of Hawaiian Affairs, 1991).

Of the 22,964 acres of homestead lands on Maui, there are twelve (12) acres in Waihee, 61 acres in Paukukalo, 6,111 acres in Kula, and 16,780 acres in Kahikinui. The Paukukalo site has been substantially developed and occupied. Subdivision improvements for the Waihee site have been completed and housing construction has commenced (telephone conversation with DHHL employee, Joseph Chu, September 1994; Office of Hawaiian Affairs, 1991).

The DHHL has plans to distribute approximately 1,700 acres of vacant land at Kahikinui for homesteading purposes. Situated along the southern slopes of Haleakala, the distribution would provide approximately 125 undeveloped lots ranging in size from ten (10) to twenty (20) acres. In this light, the project site remains as the only viable alternative for providing developed homestead lots (telephone conversation with Pat Young, DHHL employee, April 1996).

Pursuant to Section 204 of the HHCA, the proposed project addresses the demand for developed homestead lots for Native Hawaiians by providing them with residential homesteading opportunities.

C. PROPOSED IMPROVEMENTS

The proposed project will involve the development of a subdivision consisting of single-family homesites and related infrastructure improvements. See Figure 2. It should be noted that pursuant to Section 220 of the HHCA, Hawaiian homestead lands utilized for the purposes of the Act are exempt from County regulatory requirements.

1. Subdivision Lots

The proposed subdivision will consist of 386 residential lots and includes lots ranging in size from one-half to one (1) acre. The construction of single-family residential units will be the responsibility of the individual lot owners. In addition to Lot Q, a 16-acre parcel which will be utilized for future park development, additional parcels will also be set aside to serve as sites for water storage tanks and electrical substations, as well as for other community-related needs.

2. Roadways

The proposed roadway system will include cul-de-sacs, as well as collector and minor streets. Identified as project access roads, the collector streets will feature right-of-way and pavement widths of 50 feet and 24 feet, respectively. The minor streets will include right-of-way and pavement widths of 40 feet and 22 feet, respectively.

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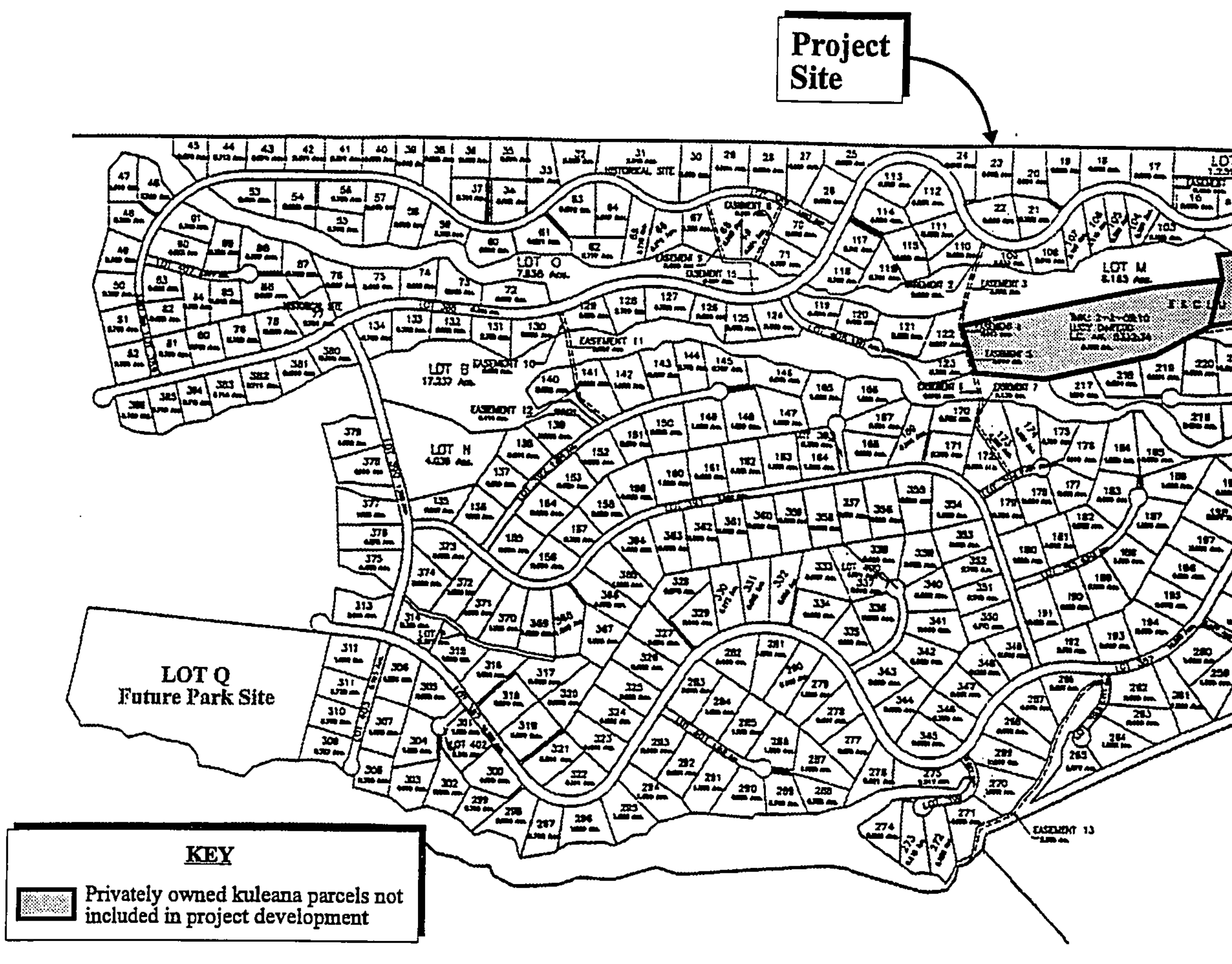

Source: Austin, Tsutsumi & Associates, Inc.

Figure 2

DHHL Kula Residential Lot, Unit

Site Map

Prepared for: State of Hawaii, Dept. of Hawaiian Home Lands

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tial Lot, Unit 1

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NOT TO SCALE

With a right-of-way width of 40 feet, the proposed cul-de-sacs will consist of a pavement width of 22 feet.

Materials utilized in the construction of the proposed roadway improvements will include 2-inch asphaltic concrete pavement, 6-inch crushed rock base course, and 6-inch subbase course where required. Concrete (i.e., Portland cement) pavement will be utilized for road slopes that exceed the paving limits of asphaltic concrete.

3. ***Wastewater***

The proposed project will utilize cesspools as individual wastewater systems for each lot. Since the proposed project will exceed the 50-lot limit established by the State Department of Health (DOH), a variance from this standard will be sought in order to allow the project to be developed by utilizing cesspools as individual wastewater systems.

4. ***Water***

The proposed water system will consist of four (4) service zones, and with the exception of zone 1, which will connect to the existing Upper Kula System, will consist of reservoir tanks ranging in capacity from approximately 0.1 to 1.5 million gallons (MG), as well as related waterline improvements. Water from the Lower Kula System will flow into the approximately 0.2 MG tank proposed in zone 3 via a new transmission line from Naalae Road and will then be pumped to the approximately 1.5 MG tank proposed in zone 2. Water system improvements will be constructed in accordance with the standards of the County Department of Water Supply (DWS).

It should be noted that a separate Environmental Assessment was prepared for the new offsite water transmission line. (Final Environmental Assessment for the Kula Water Transmission Main, Phase I, R.T. Tanaka Engineering, Inc., September 1995). Consisting of approximately 9,000 linear feet of 18-inch ductile iron pipe, the transmission line will connect to the existing 18-inch lower Kula waterline at Naalae Road and proceed in a southwesterly direction toward the project site. The transmission line is intended to meet the needs of the proposed subdivision and is not anticipated to result in any adverse short- or long-term environmental impacts. It should be noted that the transmission line will also serve the kuleana parcels within the subdivision, as well as the privately owned parcels along its alignment.

5. ***Drainage***

Drain lines, manholes, and catch basins will be provided within the proposed roadway right-of-way. Drainage culverts, with inlet and outlet structures, will be provided under sections of the roadway to convey drainage flows through the project site.

D. *PROJECT COSTS AND IMPLEMENTATION*

Preliminary project infrastructure costs are estimated to be approximately $20 million. Upon the receipt of all applicable permits, construction of the project is anticipated to commence in January 1997, with completion targeted for October 1997.

Since the proposed project involves State lands and funds, an Environmental Assessment has been prepared pursuant to the requirements established by Chapter 343, Hawaii Revised Statutes, and

Title 11, Chapter 200, Administrative Rules of the State Department of Health.

It should noted that pursuant to Section 220 of the HHCA, Hawaiian homestead lands utilized for the purposes of the Act are exempt from County regulatory requirements. In this regard, the proposed project will be developed in accordance with County design standards with the exception of the following exemptions:

1. Grass and paved swales will be utilized instead of curbs and gutters;
2. Sidewalks will not be installed;
3. Cul-de-sacs may be more than 550 feet in length or serve more than twenty (20) lots;
4. Flag lots will be allowed to be situated back-to-back;
5. Street trees will not be planted. Trees will be planted in the front of each parcel and will be maintained by the individual lot owners; and
6. Power, telephone and cable T.V. lines will be allowed to be installed overhead.

It should be noted that the preceding exemptions are in the interest of the public, will not substantially endanger human health or safety, and that conformance with the applicable standards would produce serious hardship without equal or greater benefit to the awardee and public.

Chapter II

Description of the Existing Environment

II. DESCRIPTION OF THE EXISTING ENVIRONMENT

A. PHYSICAL SETTING

1. Surrounding Land Uses

The Kula region is located on the western slopes of Haleakala, with the population focused on two (2) principal settlement areas. The towns of Makawao and Pukalani reflect a mixture of suburban and rural land uses, while the Kula area is characterized by a combination of rural and agricultural uses. Kula is renown for its produce and flowers which are exported to domestic, mainland, and international markets.

The Makawao-Pukalani-Kula region is popularly referred to as Upcountry, reflecting first its location and elevation on Haleakala and secondly, the social qualities of its small rural, agricultural towns and villages.

Land uses in the vicinity of the project site are reflected by low-density rural residential properties, small farms, and lands engaged in agricultural cultivation and ranching activities.

2. Climate

Kula's climate is typical of most mountainous areas in Hawaii, with climatic conditions varying according to altitude and wind direction. Lowland areas are generally typified by arid to semi-tropical climates, while higher elevations are characterized by more temperate conditions.

The Kula region is relatively dry with rainfall measuring from 20 to 30 inches annually. Generally, temperatures range from the low 50's during the winter, to the mid-80's during the summer. Maui is cooled by the northeast tradewinds throughout most of the year. These winds are constant during the spring and summer months. Kona weather conditions, ranging from strong southerly winds with heavy rains, to calm, humid, or rainy weather, are in evidence during the winter months.

3. *Topography and Soil Characteristics*

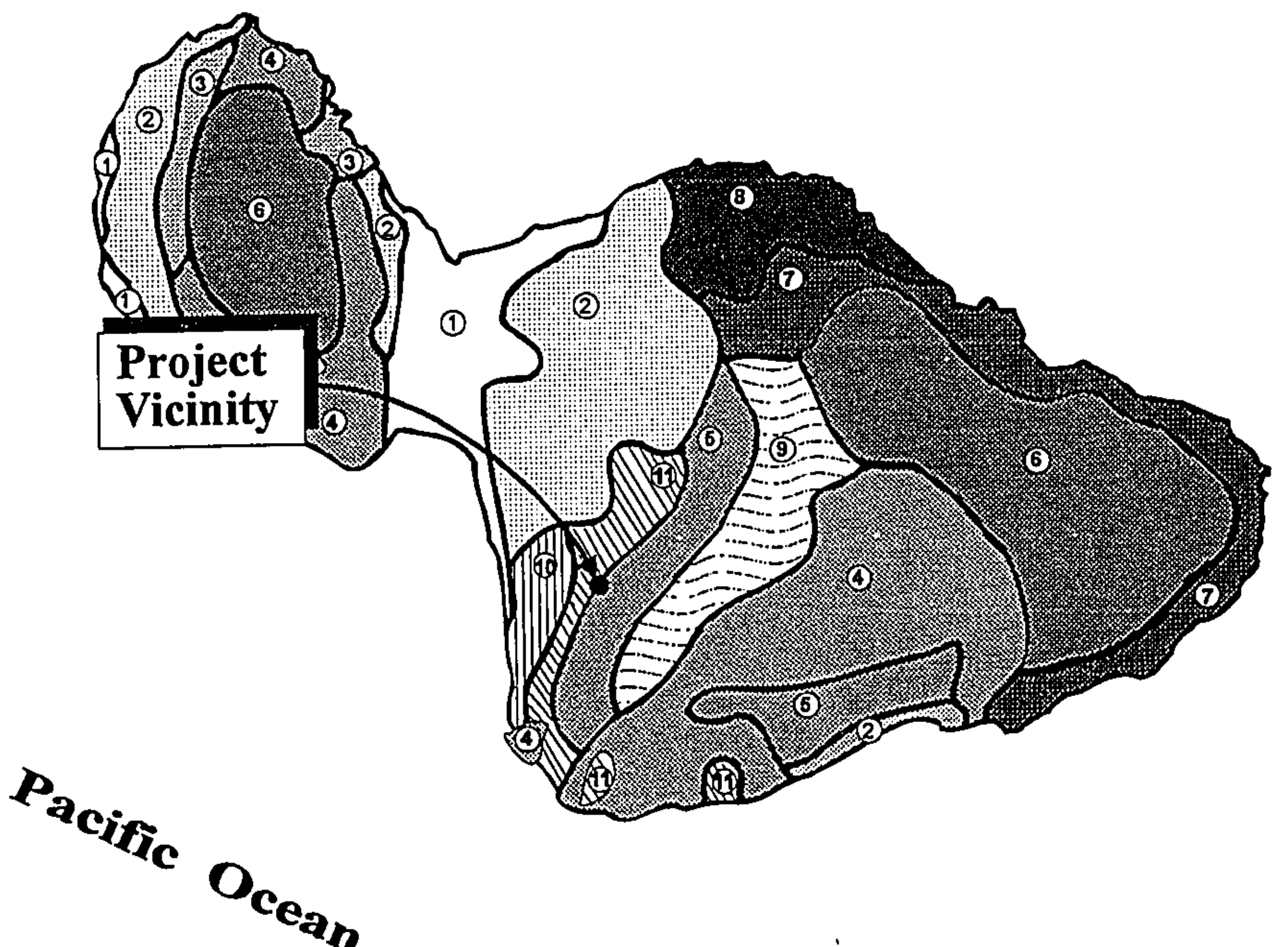
Located on the southwestern flank of Haleakala, the project site slopes away from Kula Highway in a northwesterly direction at an average of 10 to 15 percent. Elevations at the project site range from 3,000 feet above mean sea level (AMSL) at Kula Highway to 1,800 feet AMSL along the western extent of the site. As the lands ascend, the terrain becomes steeper and gulches and intermittent stream beds caused by erosion are evidenced.

Underlying the site and surrounding lands are soils belonging to the Puu Pa-Kula-Pane and Kamaole-Oanapuka associations. See Figure 3. The Puu Pa-Kula-Pane soil association is found on the intermediate and high uplands, and consists of deep, gently sloping to steep, well-drained soils that have a medium or moderately textured subsoil. This association is used for orchards, pastures, truck crops, and wildlife habitat. The Kamaole-Oanapuka association is found on the low and intermediate highlands, and is characterized by gently sloping to moderately steep, well-drained, very stony to extremely stony soils that have a fine or medium-textured subsoil. This association is utilized for pasture and wildlife.

The soil types specific to the site are the Kula cobbly loam, 12 to 20 percent slopes (KxaD), and Kamaole very stony silt loam, 3 to 15 percent slopes (KGKC). See Figure 4. Kula cobbly loam and

LEGEND

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



Map Source: USDA Soil Conservation Service

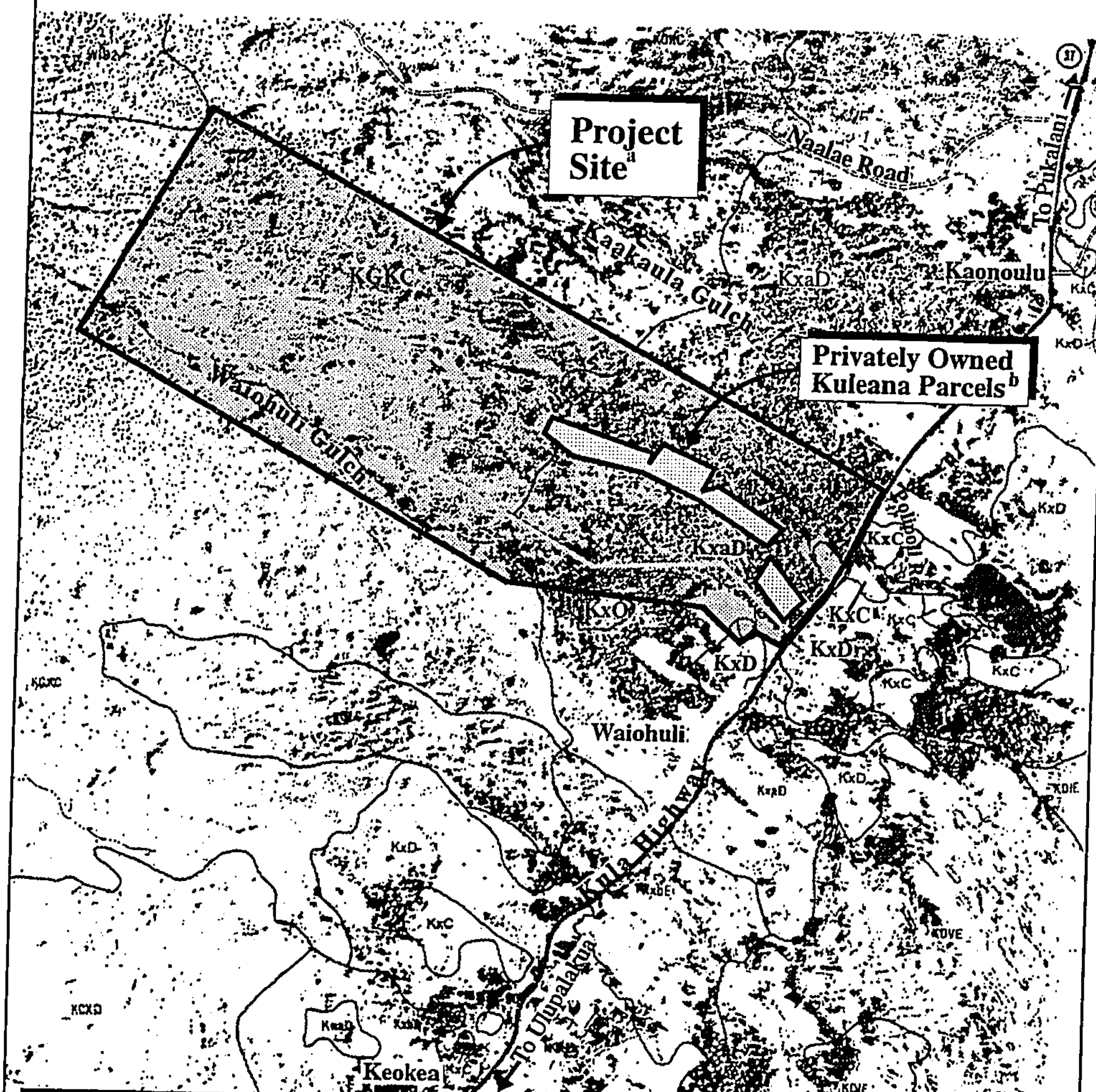
Figure 3

DHHL Kula Residential Lot, Unit 1
Soil Association Map

MUNEKIYO & ARAKAWA, INC.

Prepared for: State of Hawaii, Dept. of Hawaiian Home Lands

NOT TO SCALE



Note: [a]Boundaries are approximate.
[b]Not included in Project development.

Figure 4

DHHL Kula Residential Lot, Unit 1
Soil Classification Map

Prepared for: State of Hawaii, Dept. of Hawaiian Home Lands

0 1000 2000 4000 Feet

MUNEKIYO & ARAKAWA, INC.

Kamaole very stony silt loam soils are well-drained soils developed in volcanic ash. For Kula cobbly loam soils, permeability is moderately rapid, runoff is medium, and erosion hazard is moderate. For Kamaole very stony silt loam, permeability is moderate, runoff is slow to medium, and the erosion hazard is slight to moderate.

Lands underlying the project site are designated "C" and "E" by the University of Hawaii Land Study Bureau. According to the classification system, land productivity characteristics are rated on a scale from "A" through "E", with the designations "A" and "E" representing the highest and lowest ratings, respectively.

The State Department of Agriculture has established three (3) categories of Agricultural Lands of Importance to the State of Hawaii (ALISH). "Prime" agricultural lands have the soil quality, growing season, and moisture supply needed to produce sustained high crop yields economically when treated and managed according to modern farming methods. "Unique" agricultural lands possess a combination of soil quality, location, growing season, and moisture supply currently used to produce sustained high yields of a specific crop when treated and managed according to modern farming methods. "Other" important agricultural lands include those which have not been rated "prime" or "unique".

As indicated by the ALISH map, the lands in the project area fall within the "other" important agricultural lands category. See Figure 5.

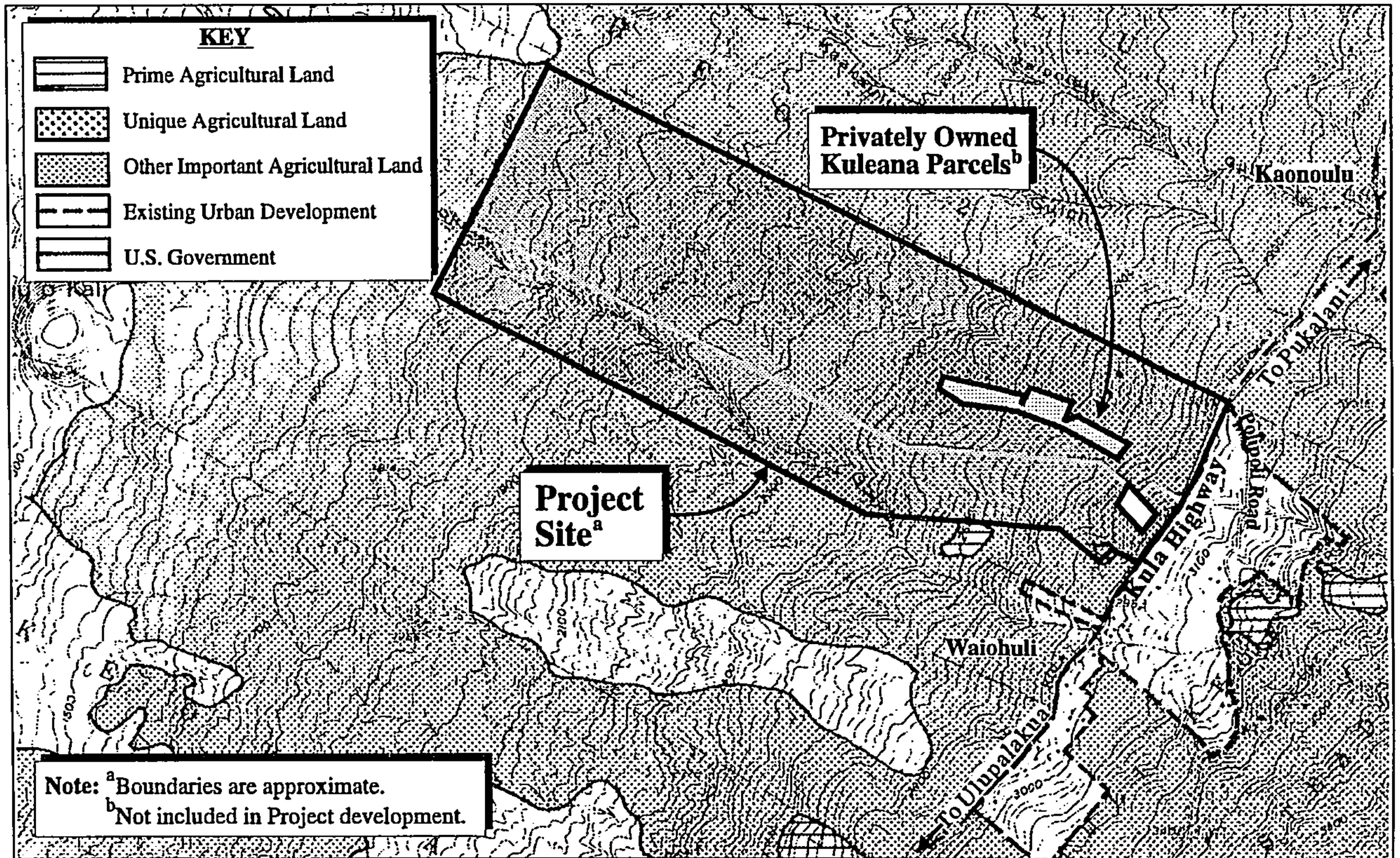


Figure 5

DHHL Kula Residential Lot, Unit 1

ALISH Map

Prepared for: State of Hawaii, Dept. of Hawaiian Home Lands

4. *Flood Hazard*

As indicated by the Flood Insurance Rate Map, the proposed project site is situated in Zone C, an area of minimal flooding.

5. *Flora*

A botanical survey encompassing the project site was undertaken by Char & Associates in September 1994. See Appendix A. The primary objectives of the survey were to identify and inventory major vegetation types, search for rare, threatened, and endangered plant species, and identify potential environmental impacts and propose appropriate mitigation measures.

Three (3) major vegetation types were identified during the survey. Ranging from the Kula Highway to an elevation of approximately 2,350 feet, a dense forest of black wattle trees characterizes the vegetation type occurring on the upper section of the project site. Extending from the 2,350 foot elevation downslope to the project's boundary and beyond, dense patches of lantana and clumps of prickly pear cactus (a.k.a., panini) characterize the second vegetation type. Gulch vegetation comprises the third vegetation type and typically consists of dense clumps of Guinea grass with scattered stands of Chinaberry trees.

The vegetation within the project site is dominated primarily by introduced or alien species. Of a total of 112 plant species inventoried, 95 are introduced or alien species, two (2) are originally of Polynesian introduction, and fifteen (15) are native. Of the native species, twelve (12) are indigenous, that is native to the Hawaiian Islands and elsewhere, and three (3) are endemic, that is native only to the Hawaiian Islands.

6. *Fauna*

A survey of avifauna and feral mammals within the project site was undertaken by Environmental Consultant Faunal Surveys in November 1994. See Appendix B. The objectives of the survey were to document bird and mammal species, provide data on the abundance of each species, note the presence or likely occurrence of any native fauna, particularly those listed as threatened or endangered, and determine any significant impacts to the native fauna in the region.

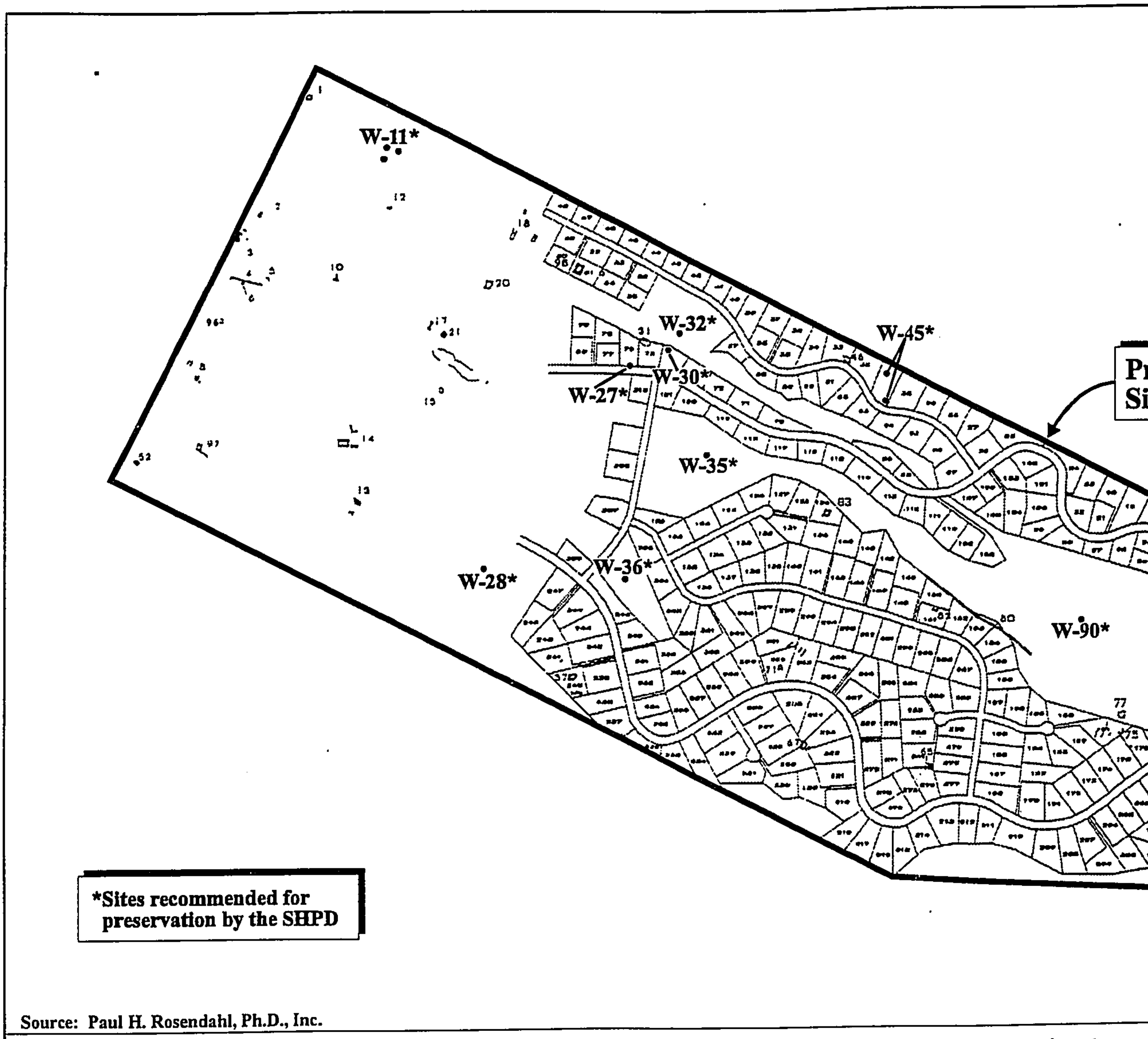
The only endemic native landbird recorded during the survey was the Common Amakihi, the most abundant and widespread of the native landbirds. Although the Short-earred Owl (a.k.a., Pueo) occurs in the Kula and the Upcountry region, none were recorded during the survey. The Pacific Golden-Plover was the only indigenous native migratory species observed during the survey and is the most abundant of the shorebird species which winters in Hawaii. The only other migrant species which may occur in this region is the Ruddy Turnstone. No indigenous native seabirds or waterbirds were recorded, or would be expected on the project site. During the survey, a total of fourteen (14) exotic birds, that is introduced to the Hawaiian Islands, were recorded.

Mammals recorded during the survey include cats, Axis Deer and the Small Indian Mongoose. During the survey, a Hawaiian Hoary Bat was once observed foraging above the pasture lands near the Kula Highway at the northeast edge of the project site. This species is known to roost solitarily in trees and forages for flying insects using echolocation. In addition, these bats have been reported from a variety of habitats including ranch and agricultural lands, native forest and alpine environs, ponds and bays, second growth forest, and urban areas. Since the occurrence and abundance of the Hawaiian Hoary Bat on Maui has not been extensively studied, little is known about the life history of this endemic and endangered species.

7. ***Archaeological Resources***

An archaeological inventory survey of the DHHL's *Waiohuli and* Keokea sites was conducted by Paul H. Rosendahl, Inc. (PHRI) in 1989. See Appendix C. The inventory survey encompassed 674 acres in Waiohuli and 351 acres in Keokea, and included aerial reconnaissance as well as variable-intensity pedestrian surveys. Of the 159 sites identified during the survey, 51 sites were located in Waiohuli. See Figure 6.

Of the 51 sites located in Waiohuli, 42 were assessed as significant for information content. Thirty-three (33) of the 42 sites were recommended for further data collection, while nine (9) required no further work. Three (3) of the remaining nine (9) sites were assessed as significant for information content and as culturally significant (Sites W-27, W-28, W-36). Further data collection and preservation with interpretive development were recommended for those three (3) sites. Two (2) of the remaining six (6) sites were assessed as significant for information content and were provisionally assessed as having cultural value (Sites W-30, W-32). In addition to further data collection, preservation with interpretive development was provisionally recommended for those two (2) sites. The final four (4) sites were variously assessed with differing treatments recommended (Sites W-11, W-35, W-45, W-90).



Source: Paul H. Rosendahl, Ph.D., Inc.

Figure 6

DHHL Kula Residential Lot, Unit 1
Archaeological Site Location Map

Prepared for: State of Hawaii, Dept. of Hawaiian Home Lands

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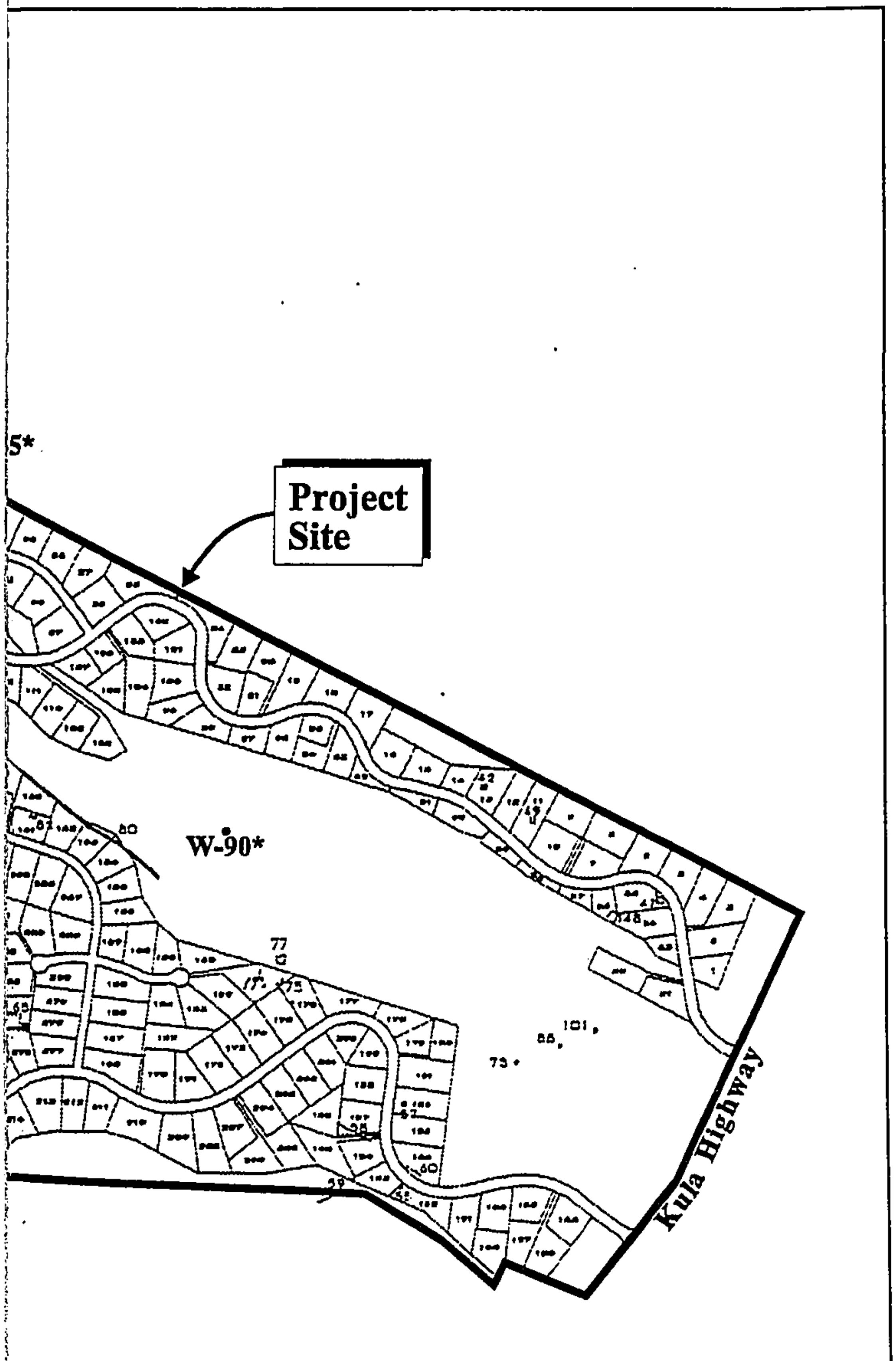

Lot, Unit 1
tion Map

NOT TO SCALE

The following Waiohuli sites were recommended for either preservation as is, or preservation with some level of interpretive development: Sites W-11, W-27, W-28, W-30, W-32, W-35, W-36, W-45, and W-90.

It should be noted that Site W-11, provisionally assessed for preservation with some level of interpretive development, is situated well beyond the limits of the project site.

8. ***Air Quality***

There are no point sources of airborne emissions in the immediate vicinity of the project site. The air quality in the Kula region is considered good, with existing airborne pollutants attributed primarily to vehicle-generated exhaust from the region's roadways. Other sources of airborne pollutants typically include dust and equipment emissions resulting from agricultural activities and smoke from sugar cane harvesting operations occurring in the Central Maui plain. These sources are considered intermittent and the generated particulates are quickly dispersed by the prevailing tradewinds.

9. ***Noise Characteristics***

Noise levels in the Kula region are characteristic of its rural surroundings and are considered relatively low. Ambient noise levels in the vicinity of project site are attributed to natural (e.g. wind) conditions, traffic along the Kula Highway, and agricultural activities involving the intermittent operation of equipment, such as tractors, sprayers, and trucks.

10. *Scenic and Open Space Resources*

Situated on the slopes of Haleakala, Kula provides expansive scenic views of the Central Maui isthmus, off-shore islands, and the West Maui Mountains. From clearings throughout the project site, Maui's central isthmus and the northern and southern shorelines of Maui can be seen makai (northwest and southwest, respectively) of the project area. Mauka of the site, Haleakala is clearly visible, while makai of the site, the West Maui Mountains are visible. Further off in the distance, to the southwest, are the islands of Lanai and Kaho'olawe.

B. *SOCIO-ECONOMIC ENVIRONMENT*

1. *Community Character*

From a regional standpoint, the project site is part of the Makawao-Pukalani-Kula Community Plan region. The region includes a diverse range of physical and socio-economic environments. With its temperate climate, fertile soil, and sweeping views, Kula has grown steadily over the past few years. The project site is situated along the southwestern flank of Haleakala in an area which is generally characterized by low-density rural residential properties, small farms, and lands engaged in agricultural cultivation and ranching activities.

2. *Population*

The population of Maui County has exhibited relatively strong growth over the past decade with the July 1990 population of 101,400 reflecting a 41.6 percent increase over the July 1980 population of 71,600 (Maui County Data Book, December 1993). 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).

The 1990 population of the Makawao-Pukalani-Kula region was 18,923. A projection of the region's population shows an increase to 21,760 by the year 2000 and 24,613 by the year 2010 (Community Resources, Inc., January 1994).

3. *Economy*

Agriculture and tourism are vital components of Maui's economy. The cultivation of pineapple and sugar cane and the visitor industry provide for much of the island's economic stability.

The economy of Kula is heavily dependent upon agriculture. Its rich soil has made the region renown for the quality of its produce and flowers which are exported to domestic, mainland, and international markets. Cattle ranching and alternative ranching activities, such as sheep and llama herding, are also an important element of Kula's economy.

C. *PUBLIC SERVICES*

1. *Police and Fire Protection*

The Maui Police Department (MPD) is responsible for the preservation of the public peace, prevention of crime, and protection of life and property. On Maui, the MPD consists of 369 administrative, patrol, and support personnel. MPD's Uniformed Services Bureau includes the uniformed patrol services in the following patrol districts: Wailuku, Lahaina, Hana, Molokai, and Lanai. The Wailuku station, which services the Haiku, Paia, and

Makawao-Pukalani-Kula regions, is situated to the northwest, approximately nineteen (19) miles from the project site.

Police services for the Makawao-Pukalani-Kula beats are provided by two (2) patrol officers per eight-hour shift. A single patrol officer is assigned to each of the Haiku and Paia beats and is responsible for responding to emergency situations involving the Upcountry beats. The Makawao and Paia beats also include a single community police officer permanently assigned to each town (telephone conversation with Maui Police Department employee, Sgt. Larry Hudson, September 1994).

Fire prevention, protection, and suppression services are provided by the Maui Fire Department's (MFD) recently completed Kula station. Situated approximately three (3) miles northeast of the project site, the Kula facility contains a new 750 gallon pumper with a delivery rate of 1,500 gallons per minute (GPM).

The new facility is staffed by one (1) officer, one (1) driver, and three (3) firefighters per eight-hour shift.

The Makawao and Paia fire stations provide additional firefighting support for the Kula region, and are situated approximately eight (8) and fourteen (14) miles to the north of the project site, respectively. The Makawao and Paia stations also include a single pumper and a staff of five (5) men (telephone conversations with Maui Fire Department employees, Deputy Chief Ron DeMello and Capt. Charles Ledward, September 1994).

2. **_Medical Facilities_**

Maui Memorial Hospital, the only major medical facility on the island, is approximately nineteen (19) miles to the northeast of the project site.

The 145-bed, State-operated facility provides acute, emergency, general, and obstetric care services. Several medical and dental care facilities are located in Makawao and Pukalani to serve Upcountry residents.

Consisting of 105 total beds, Kula General Hospital is situated about two (2) miles to the southwest of the project site. The State-owned facility provides 94 beds for long-term care, eight (8) beds for the developmentally disabled, two (2) beds for acute care, and one (1) bed for tuberculosis (TB) care.

An out-patient clinic for the area's residents operates from 8:00 a.m. to 4:30 p.m. on weekdays, and is staffed by two (2) physicians, a registered nurse, and a clerk. Hospital pharmacy services are also available to the clinic's patients (telephone conversation with Kula Hospital employee, Natalie Kahoohanohano, September 1994).

3. **_Solid Waste_**

Single-family residential waste collection service is provided by the County of Maui on a once-a-week basis.

Residential solid waste disposal is provided on a weekly basis by the County's Department of Public Works and Waste Management (DPWWM), Solid Waste Division.

With the closure of the County's Makani Sanitary Landfill in Makawao in June 1992, all solid waste generated in the Upcountry region is transported to the Central Maui Landfill off Pulehu Road, approximately six (6) miles northwest of the project site. Other than the Hana Landfill, the Central Maui Landfill is the only disposal site on the island of Maui which accepts County-hauled residential waste, commercially-hauled commercial waste, and self-hauled waste.

According to the Solid Waste Characterization Study that was prepared for the DPWWM, Solid Waste Division (R.W. Beck/DPWWM, December 1994), the Central Maui Landfill accommodates approximately 146,000 tons of solid waste annually. Of the estimated 400 tons of solid waste accommodated daily by the Central Maui Landfill, approximately 64 tons are attributable to the Makawao-Pukalani-Kula region..

The study also indicated that regional solid waste quantities are consistent with the demographics and socio-economic conditions for the respective geographic areas. For example, in the Upcountry region, much of the solid waste is self-hauled due to the region's close proximity to the landfill.

4. ***Schools***

The State of Hawaii, Department of Education (DOE), operates four (4) public schools in Upcountry Maui. They are (with 1994 enrollment in parenthesis): Makawao Elementary School (778), Pukalani Elementary School (551), Kula Elementary School (573), and Kalama Intermediate School (1,284).

Makawao, Pukalani, and Kula Elementary Schools provide educational services for students from Kindergarten to Grade 5, while Kalama Intermediate School in Makawao, provides instruction for students from Grades 6 to 8.

Students in Grades 9 to 12 currently attend Maui High School in Kahului, approximately 17 miles northwest of the project site. During the 1993 school year, Maui High School had an enrollment of 1,928 students.

It is noted that the new King Kekaulike High School, will service students beginning in September, 1995. During its first year of operation, the new facility is projected to have an enrollment of 410 students and a staff of 25 to 30.

By the 1998 school year, enrollment is estimated to reach 1,605 students (telephone conversation with Department of Education employee, Peter Daniels, September 1994).

The region is also served by privately operated facilities such as Haleakala School (Grades K to 8) and Seabury Hall (Grades 6 to 12).

5. ***Recreational Facilities***

County recreational facilities in the Upcountry region include five (5) neighborhood parks and three (3) district parks, with a total of 74.6 acres.

Neighborhood parks and facilities include Haliimaile Park, Kula Community Center, Waiakoa Gym, Harold Rice Memorial Park, and

Keokea Ball Park. The district parks include the Eddie Tam Memorial Center, Pukalani Park and Community Center, and the recently completed Kula Recreational Center.

Situated along the higher elevations of Haleakala, Polipoli State Park, and Haleakala National Park provide camping, hiking, and sight-seeing opportunities for residents and visitors alike.

Recreational facilities within the region include four (4) tennis courts, nine (9) sports fields, three (3) sports courts, five (5) community centers, and three (3) gyms. In addition, the existing public schools in the area do have limited recreational space and facilities that are available as a supplement to the community's residents. It is also anticipated that the recreational facilities for the King Kekaulike High School will contribute toward meeting the park needs of the community (telephone conversations with Department of Parks and Recreation employees, Leonard Costa and Pat Matsui, September 1994; R. M. Towill Corp., August 1992).

D. INFRASTRUCTURE

1. Roadways

Access to the Upcountry region from Central Maui is provided by a network of arterial, collector, and rural roadways. See Appendix D.

Hana Highway is the primary roadway connecting Central and East Maui. To the east of its intersection with Haleakala Highway, Hana Highway functions as a two-lane roadway, while to the west, Hana Highway operates as a four-lane, divided highway with major, channelized intersections.

Haleakala Highway is the principal roadway linking the Upcountry region with Central Maui. Between Hana Highway and the Pukalani Bypass, Haleakala Highway consists of two (2) lanes in the southbound direction and one (1) lane in the northbound direction. Extending from the northern junction of the Bypass to Hana Highway, contra-flow operations during AM peak hour traffic provide two (2) northbound lanes and one (1) southbound lane. Between its intersection with the Bypass and Kula Highway (a.k.a., Five Trees), Haleakala Highway functions as a two-lane roadway serving the town of Pukalani. Proceeding east from this intersection, Haleakala Highway functions as a two-lane roadway while continuing on toward Haleakala Crater.

Extending from its northern junction with Haleakala Highway, the Pukalani Bypass consists of two (2) southbound lanes and one (1) northbound lane as it proceeds to Makawao Avenue. From its intersection with Makawao Avenue, the Bypass transitions to two (2) lanes as it proceeds in a southbound direction toward Five Trees.

Kula Highway is a two-lane roadway serving the Upcountry region. Extending from Five Trees to Ulupalakua, the Kula Highway is a north-south arterial which serves the region's rural communities.

Keakaulike Avenue is a two-lane roadway which originates at Kula Highway and extends north, where it terminates at Haleakala Highway. This north-south collector also serves the region's residential and agricultural communities.

Omaopio and Pulehu Roads are two-lane roadways which originate at Kula Highway and extend northwest toward the town of Kahului. These curving, rural roadways provide alternative routes to the Upcountry region.

2. ***Wastewater***

The Makawao-Pukalani-Kula region is not serviced by a County wastewater treatment system. A portion of Pukalani is serviced by a private wastewater treatment system, while the remainder of the Upcountry area is served by cesspools or septic tanks. The State Department of Health (DOH) has designated a critical wastewater disposal area throughout most of the island, including the Makawao-Pukalani-Kula region. Within the critical area, septic tanks are required for wastewater disposal, while in the non-critical area, cesspools are permitted with DOH approval. The project site is located within the non-critical wastewater disposal area (Wilson Okamoto & Associates, Inc., September 1992).

3. ***Water***

Although Makawao and Pukalani are gradually evolving into suburban communities, the Upcountry area remains rural and agricultural in nature. Dominant water uses in the region are attributed to agricultural activities.

Water service to the Makawao-Pukalani-Kula region is provided by the County Department of Water Supply (DWS). The region is supplied primarily by surface water sources, with distribution handled by the Makawao and Kula systems.

The Kula system consists of an upper and lower system, with the upper system located along the 4,000 foot elevation, and the lower system originating at the 3,000 foot elevation. The Lower Kula System serves the Omaopio, Olinda, and lower Kula communities, while the Upper Kula System serves the remaining communities. The upper system collects water from Haipuaena, Puohakamoa, and Waiakamoi Streams, while the lower system diverts water from the Haipuaena, Puokakamoa, Waiakamoi, and Honomanu Streams.

The DWS operates a water treatment plant at Olinda with a capacity of 1.7 million gallons per day (MGD). Major storage reservoirs supporting the Upper Kula System include a 10 million gallon (MG) upper Waiakamoi dam/reservoir, a lower Waiakamoi concrete dam, two (2) 15 MG Waiakamoi concrete tanks, and a 3 MG Olinda steel tank. The recently constructed Kahakapao Reservoirs, consisting of two (2) 50 MG reservoirs in the vicinity of the Waiakamoi Reservoirs, also provide additional storage capacity for the upper system.

During dry periods, the Kula system is supplemented by water pumped from the Makawao system (Wilson Okamoto & Associates, September 1992).

There is no existing water system within the project site. See Appendix E. Situated within proximity of the project site, the DWS owns and maintains 6-inch waterlines that terminate at Kula Highway's intersections with Polipoli Road and Lepelepe Place. Both waterlines are serviced by the Upper Kula System.

4. ***Drainage***

The Upcountry region is situated along the upland slopes of Haleakala and ranges from 800 to 10,000 feet above mean sea level (AMSL).

Most of the developed and agricultural areas are located between the 1,500 to 3,000 foot elevations. The Upcountry region is characterized by broad, rolling ridge tops; deep, precipitous gulches; and slope increases along ridges as terrain ascends in elevation. Due to the many gulches separating the region's arable lands into smaller areas, the Upcountry area is considered better suited for smaller-scale agricultural operations.

Currently, storm runoff sheetflows in northwesterly direction across the project site. Gullies and gulches located within the project site convey runoff through the site toward Kaakaulua Gulch to the north and Waiohuli Gulch to the south. Refer to Appendix E.

Downstream of the project site, Kaakaulua Gulch and Waiohuli Gulch discharge runoff into Kulanihakoi Gulch and Waipuilani Gulch, respectively. Runoff from these gulches is ultimately discharged into the ocean.

5. ***Electrical and Telephone Services***

Electrical and telephone service to the project site will be provided by Maui Electric Company, Ltd. and GTE Hawaiian Telephone, respectively.

Electricity and telephone service in the vicinity of the project site is currently provided by existing overhead facilities.

Chapter III

Potential Impacts and Mitigation Measures

III. POTENTIAL IMPACTS AND MITIGATION MEASURES

A. *IMPACTS TO THE PHYSICAL ENVIRONMENT*

1. *Surrounding Land Uses*

The project site is located in a rural, agricultural area characterized by low-density residential housing units and lands engaged in farming and ranching activities. Interspersed pockets of rural designated lands, characterized by single-family dwellings, lie along the *mauka (eastern) side of Kula Highway in proximity* of the project site. Agricultural zoned properties, consisting of farm, pastoral and undeveloped lands, adjoin the makai (western) side of the highway and also extend mauka of existing rural residential development.

Ranging in size from one-half to one (1) acre, the proposed project will establish a low-density, rural residential neighborhood.

The land underlying the project site has been designated "Agricultural" by both the State Land Use Commission (SLUC) and the Makawao-Pukalani-Kula Community Plan. See Figure 7 and Figure 8. It should be noted, however, that Hawaiian homestead lands utilized for the purposes of the Act are exempt from County regulatory requirements.

Although the proposed project will result in changes relating to land use density, the overall rural, residential character of the project is not considered inconsistent with surrounding uses.

2. *Topography and Landform*

The proposed project will involve the clearing, grubbing and grading of approximately 460 acres of land that is presently

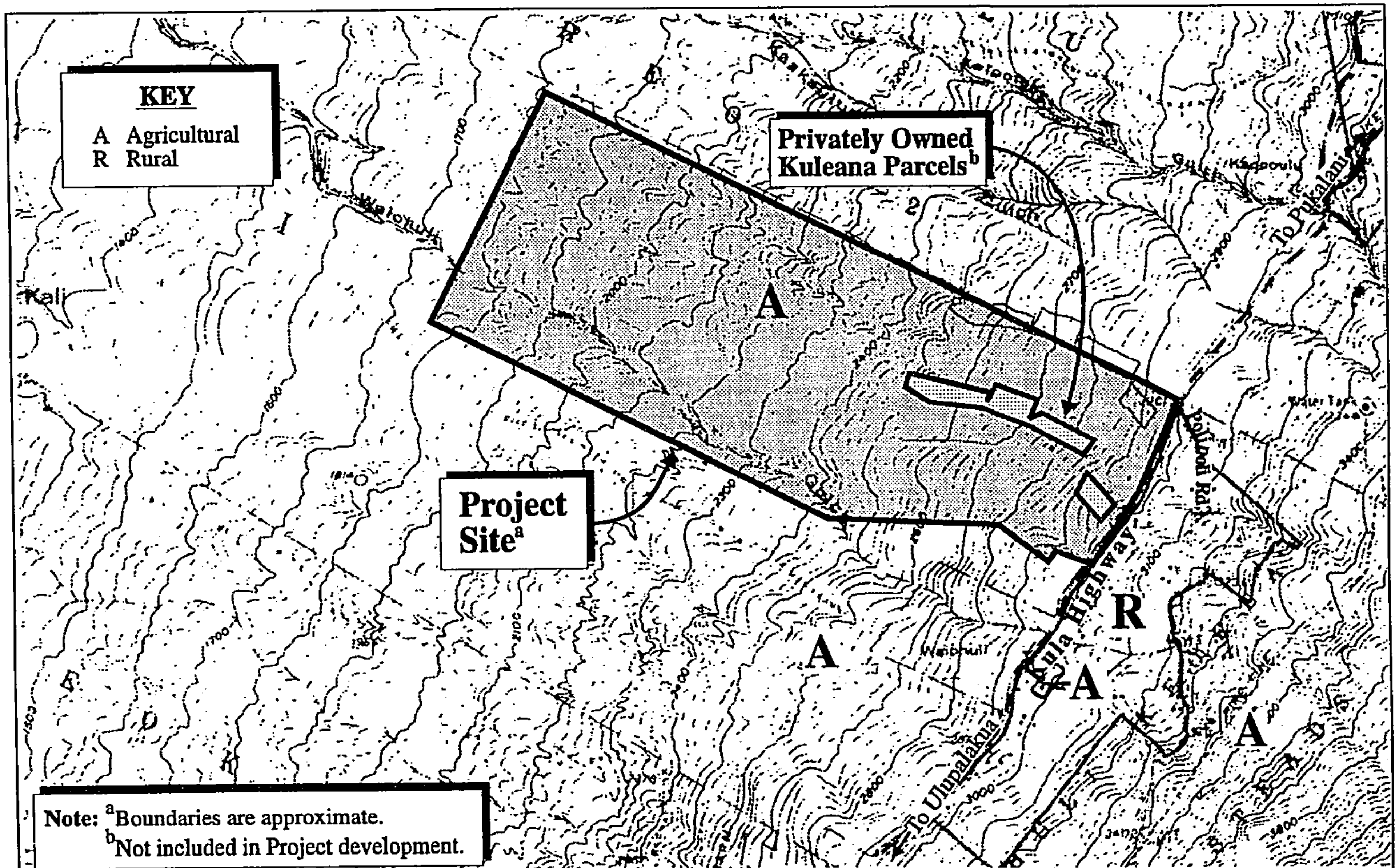

Figure 7

DHHL Kula Residential Lot, Unit 1

State Land Use District Classifications

0 1000 2000 4000 Feet

MUNEKIYO & ARAKAWA, INC.

Prepared for: State of Hawaii, Dept. of Hawaiian Home Lands

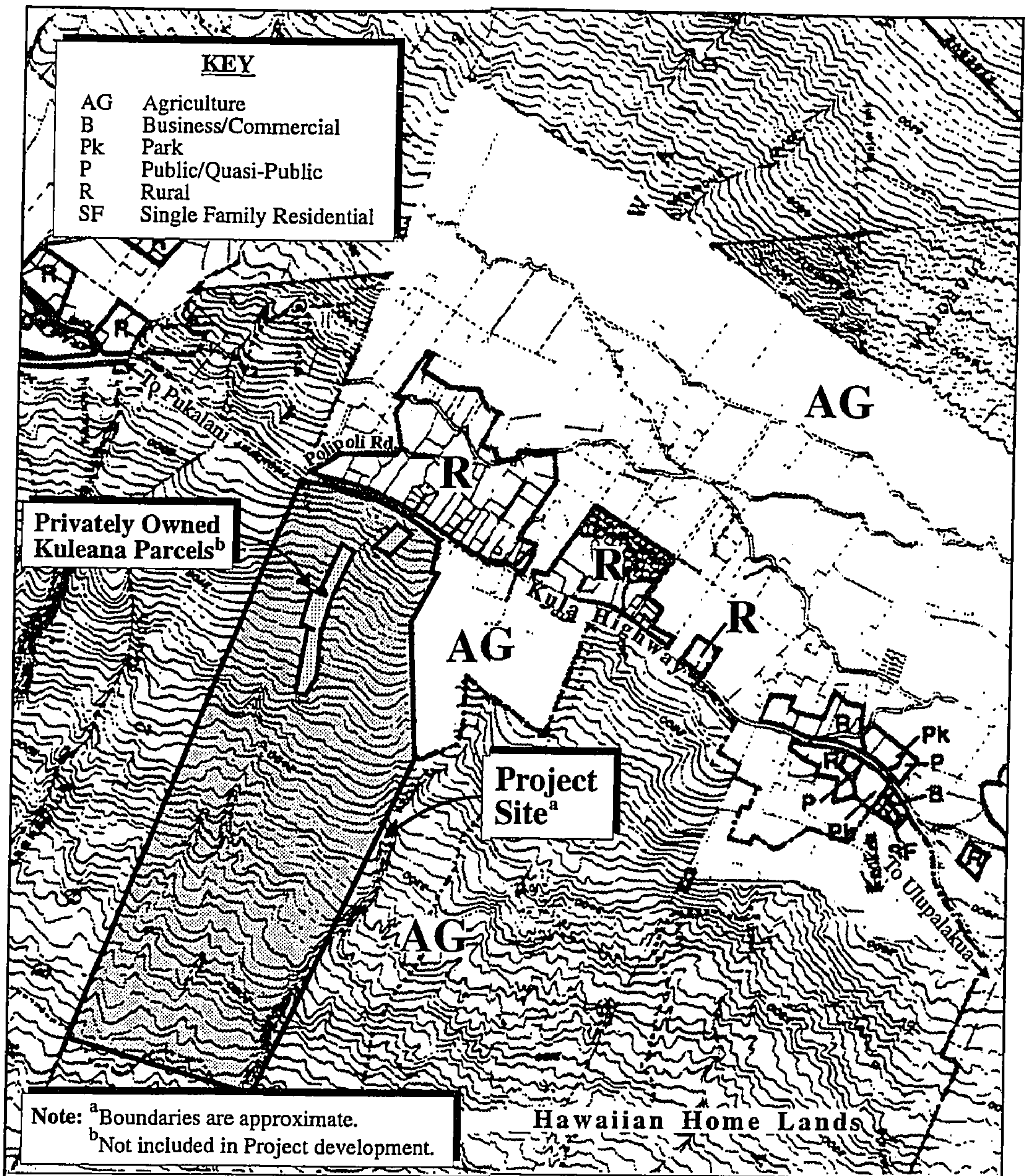

Figure 8

DHHL Kula Residential Lot, Unit 1

Makawao-Pukalani-Kula Community Plan Land Use Designations

MUNEKIYO & ARAKAWA, INC.

Prepared for: State of Hawaii, Dept. of Hawaiian Home Lands

NOT TO SCALE

undeveloped. Grading for the project site will involve excavation and embankment within the roadway right-of-way and within some of the adjoining lots. In general, finished contours will follow existing grades to minimize earthwork costs and maintain existing drainage patterns. Therefore, the proposed project is not expected to result in any adverse effects to the topography or landform.

3. ***Flora***

As previously indicated, the botanical survey of the project site identified three (3) major vegetation types. Refer to Appendix A. Ranging in elevation from approximately 3,000 to 2,350 feet, a dense forest of black wattle trees predominate the upper section of the project site. Dense patches of lantana and clumps of prickly pear cactus (a.k.a., panini) encompass an area extending from the black wattle forest to the project's boundary and beyond. Gulch vegetation, typified by dense clumps of guinea grass with scattered stands of Chinaberry trees, comprise the third vegetation type observed during the survey.

There are no known rare, endangered or threatened species of flora within the project site. As such, the removal of existing vegetation is not considered an adverse impact to this component of the environment.

4. ***Fauna***

A survey of avifauna and feral mammals was undertaken to record birds and mammals within the project site. Refer to Appendix B. As reflected by the survey, the only endemic native landbird recorded was the Common Amakihi, while the Pacific Golden-Plover was the only indigenous native migratory species observed.

Although the Short-earred Owl (a.k.a., Pueo) occurs in the Kula and Upcountry region, none were located during the survey. None of the avifauna, with the exception of the Pueo, which is endangered on the island of Oahu, is listed as rare, threatened or endangered.

Mammals recorded during the survey include cats, Axis Deer, and the Small Indian Mongoose. A Hawaiian Hoary bat was once observed foraging above the pasture lands near the Kula Highway at the northeast edge of the project site. Since, the occurrence and abundance of the Hawaiian Hoary Bat on Maui has not been extensively studied, little is known about the life history of this endemic and endangered species. With the exception of this sighting, none of the mammals observed are listed as rare, threatened, or endangered species.

5. Archaeological Resources

As a result of the current consolidation and resubdivision process involving the project site, the State Historic Preservation Division (SHPD) was consulted to confirm the significance assessments of the 51 sites identified by PHRI's archaeological inventory survey. In addition, recommendations for appropriate buffer zones and mitigation measures for each of the significant sites was also requested. See Appendix C-1.

As indicated by the SHPD, nine (9) sites required no further data collection. Since a reasonable amount of significant information was collected from these sites, they are considered "no longer significant". Of the remaining 42 sites, two (2) different mitigation measures are recommended.

Thirty-three (33) sites are considered significant solely for their information content and will require further data collection. Refer to Appendix C. Prior to any data recovery work, a data recovery plan will be submitted to the SHPD for approval. Until data recovery has been completed, the SHPD has indicated that 15-foot buffer zones around each site's perimeter will be required. Upon the completion of data recovery operations, these sites can be either preserved or destroyed.

Nine (9) sites are recommended for preservation as is, or preservation with interpretive development. These sites are identified as W-11, W-27, W-28, W-30, W-32, W-35, W-36, W-45, and W-90. Refer to Appendix C-1. These sites will require larger buffer zones to allow the surrounding terrain to preserve the visual and physical context of the site.

Typically, buffer zones are adjusted to the terrain. As an example, Sites W-35 and W-90 are located in gulches, while Site W-11 is situated well beyond the limits of the project site. Accordingly, these three (3) sites will not require any buffer zones, provided of course, that these sites are not affected by any construction activities.

It should be noted that coordination with the SHPD will be continued in order to establish acceptable buffer zones for the remaining six (6) sites. In addition, preservation plans for these sites will also be submitted to the SHPD for approval prior to their implementation.

Individual lot owners will also be notified of the presence of sites on their lots that have not yet been data recovered, or the presence of sites on their lots that are scheduled for preservation. Mitigation and preservation concerns will also be explained to the awardees. Prior to any land altering construction activities, buffer zones will be delineated with plastic construction fencing and their locations verified by an archaeologist.

Upon the execution of the SHPD's recommendations, the proposed project will have "no adverse affect" on the significant historic sites.

6. *Air Quality*

Emissions from construction equipment and other vehicles involved in construction activities may temporarily affect the ambient air quality within the immediate vicinity. However, these effects can be minimized by properly maintaining construction equipment and vehicles.

In addition, dust generated during construction, especially from earth-moving operations, such as clearing, excavating, and trenching, may also result in a temporary decrease in ambient air quality. Mitigation measures include utilizing dust barriers, waterwagons and/or sprinklers to control dust, and watering graded areas after construction activity has ceased for the day. Water is also recommended during weekends and holidays to the extent practicable.

On a long-term basis, once construction activities have been completed, project-related vehicular traffic will generate automotive emissions. However, these emissions are not expected to adversely impact local and regional ambient air quality conditions.

7. ***Noise Characteristics***

Ambient noise conditions will be temporarily affected by construction activities. Heavy construction equipment, such as bulldozers, dump trucks, front-end loaders, and material-transport vehicles, are anticipated to be the dominant noise-generating source during the construction period.

Proper equipment and vehicle maintenance are anticipated to minimize noise levels. In addition, equipment mufflers or other noise attenuating equipment may be necessary if noise levels are determined to be excessive. All construction activities are expected to be limited to daylight working hours.

Once completed, vehicles traveling along the region's roadways will be the primary source of long-term noise in the project area. However, vehicular traffic is not expected to generate any significant and unfavorable noise conditions.

8. ***Scenic and Open Space Resources***

The Kula region includes a diverse range of scenic and open spaces. Cultivated fields, pastoral ranch lands, and vacant, undeveloped properties typify the rural open space character of the region. The project site is situated along the southwestern slopes of Haleakala between the elevations of 1,800 to 3,000 feet. Due to its elevation and depending on topography and vegetation, views of the Central Maui plain, offshore islands, and coastline are available from the project site.

The proposed subdivision is not part of a scenic corridor and is not expected to have an adverse impact upon the visual character of the surrounding area.

B. IMPACTS TO THE SOCIO-ECONOMIC ENVIRONMENT

1. Community Character

The community character of the Makawao-Pukalani-Kula region is generally thought of as rural and agricultural. Flower and vegetable farms comprise the agricultural fabric of the region and range from small growers raising truck crops to larger operations cultivating crops for export. Although there are a few large working ranches, ranching activities are generally characterized by smaller family operations. Small neighborhood enterprises provide commercial goods and services to the local community. In addition to individually developed residential parcels, the Kula region also includes areas which contain low-density rural and agricultural subdivisions.

The proposed subdivision will consist of approximately 460 acres and will include 386 residential homestead lots ranging from one-half to one (1) acre.

Ranging in size from 0.45 to 5,966.72 acres, Agricultural zoned parcels adjoin the project site along the mauka side of Kula Highway. The similarly zoned parcels surrounded by the project site range in size from 1.25 to 8.20 acres. Along Kula Highway, across from the project site, Rural zoned parcels range in size from 0.21 to 15.20 acres. Within the immediate vicinity, single-family dwellings appear to occupy at least one-half of the parcels within proximity of the project site.

With lot sizes ranging from one-half to one (1) acre, the proposed development is anticipated to maintain the rural, residential character of the Kula region. At full build-out, the 386 residential units will add to the diversity of residential settings in the Makawao-Pukalani-Kula region.

2. *Population and Local Economy*

The population of Maui has exhibited relatively strong growth over the past decade, with the 1990 population of 91,361 reflecting a 45 percent increase over the 1980 population of 62,823.

Population gains were especially pronounced in the 1970's as the rapidly developing visitor industry attracted many new residents to Maui in search of employment.

Just as the island's population has grown, the resident population of the Upcountry region has increased significantly in the last two (2) decades.

The 1990 resident population of the Makawao-Pukalani-Kula region was approximately 18,923. Regional projections for the years 2000 and 2010 reflect population estimates of 21,760 and 24,613, respectively. Compared to 1990, these estimates reflect increases of approximately 15 percent and 30 percent for the years 2000 and 2010, respectively (Community Resources, Inc., January 1994).

Based on the 6,179 households in the Upcountry region noted in 1990, projections for the years 2000 and 2010 reflect increases of approximately 17 and 35 percent, respectively. These estimates respectively reveal a total of 7,216 and 8,313 households for the years 2000 and 2010 (Community Resources, Inc., January 1994).

Assuming three (3) persons per household, and a total of 386 new households upon full build-out, the proposed subdivision is anticipated to contribute an estimated 1,158 residents to the region's population.

From a regional perspective, Wailuku and Kahului serve as the population and employment center of Maui. In the long-term, the proposed development is not anticipated to be a significant employment source.

On a short-term basis, the proposed project will support construction and construction-related employment.

Once fully developed and occupied, the subdivision's residents are anticipated to contribute to the long-term support of the regional economy through their purchases of goods and services from local merchants.

3. *Police and Fire Protection*

The MPD's Wailuku headquarters, located approximately nineteen (19) miles from the project site, services the Makawao-Pukalani-Kula region.

Currently, the Upcountry region is served by two (2) police beats, with each beat patrolled by a single officer. Additional support, if required, is provided by officers from the Haiku and Paia beats, with supplemental assistance provided by officers from the Kahului, Wailuku, and Kihei beats, respectively. Due to MPD's centralized facilities and the Upcountry region's topography and large geographical area, response times to incidents in outlying areas can be delayed.

In the short-term, additional beats may be created in the Upcountry region as population increases warrant the need for further police services.

On a long-term basis, the MPD is projecting the development of a sub-station facility in the Upcountry region in the next ten (10) years (R. M. Towill Corp., August 1992; telephone conversation with Maui Police Department employee, Sgt. Larry Hudson, September 1994).

Fire protection services for the Upcountry region are provided by the MFD's Kula and Makawao station. The recently completed Kula facility is situated approximately three (3) miles to the northeast of the project site, while the Makawao station is approximately eight (8) miles to the north. Additional assistance, if required, is provided by the Paia station about fourteen (14) miles to the north, and the Kahului and Wailuku stations about sixteen (16) and nineteen (19) miles to the northwest, respectively.

Previously, the Makawao station was the only facility serving the Upcountry region. The recently completed Kula facility has reduced the service area radius of the Makawao station and improved fire protection service in the Upcountry region. The proposed subdivision is located within the two (2) to three (3) mile residential service radius of the Kula station.

On a short-term basis, the MFD projects the assignment of a 3,000 gallon tanker and a driver/firefighter to the Kula station. A similar assignment is also anticipated for the Paia station.

In the long-term, the MFD is projecting the development of a fire station in Haiku. This facility would provide the Upcountry stations with additional fire protection support as needed (R.M. Towill Corp., August 1992; telephone conversations with Maui Fire Department employees, Deputy Chief Ron DeMello and Capt. Charles Ledward, September 1994).

The proposed project is not anticipated to adversely affect police and fire protection services in the region.

4. ***Medical Facilities***

Kula Hospital is located approximately two (2) miles from the project site and provides out-patient medical services for the Kula region. In addition, several medical and dental care facilities are located in Makawao and Pukalani to serve Upcountry residents.

The hospital, in connection with the State Department of Health (DOH), has recently submitted a five (5) year strategic plan which requests a legislative appropriation for the expansion of services and facilities for the existing out-patient clinic (telephone conversation with Kula Hospital employee, Natalie Kahoohanohano, September 1994).

The proposed project is anticipated to increase the need for additional medical care services in the Upcountry region.

5. ***Solid Waste***

Solid waste from the Upcountry region is currently transported to the Central Maui Landfill near Puunene, approximately nine (9) miles from the project site.

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 (DPWWM) for the disposal of clearing and grubbing material from the project site during construction. Solid waste from the project will be disposed of at the Central Maui Landfill.

The County of Maui is currently negotiating to acquire additional acreage from A & B, Inc. for the expansion of the existing landfill. If successful, the expanded facility would be able to accommodate solid waste disposal needs for the next twelve (12) to twenty (20) years. In addition, the County has also commenced planning efforts for an integrated solid waste management system. Locations for a new regional landfill site are also being examined (conversation with Solid Waste Division employees, Dave Wissmar and Andy Hirose, July 1994).

Upon completion of the project, solid waste collection and disposal services will be provided by the County of Maui. The proposed project will require additional solid waste collection service from the County of Maui. However, this additional requirement is not considered significant. The project is not anticipated to adversely impact solid waste disposal facility requirements.

6. *Schools*

The State Department of Education (DOE) estimates that the proposed project will generate an additional 140 students for Grades K to 5, 55 students for Grades 6 to 8, and 62 students for Grades 9 to 12 (telephone conversation with Department of Education employee, Tom Saka, September 1994).

Kula Elementary School has an estimated 1994 enrollment of 573 students, while Kalama Intermediate School has an estimated 1994 enrollment of 1,284 students. King Kekaulike High School, scheduled to open in 1995, has a projected first year enrollment of 410 students, with projections for the years 1996 to 1999 revealing enrollments ranging from 818 to 1,623 students.

Currently, there are no facility expansion plans for Kula Elementary School. In order to accommodate the 140 students projected for Grades K to 5, portable classrooms will have to be developed. A re-districting alternative, which would permit students to attend Pukalani Elementary School, may also be considered. However, the effect of this alternative is considered nominal since Pukalani Elementary School is not anticipated to absorb the majority of grade school students generated by the project.

Eight (8) classroom buildings were recently constructed on the Kalama Intermediate School campus. In addition, new library and administration facilities are being proposed to replace the temporary structures currently being used. Upon completion of the new facilities, the former library and administration buildings will be utilized for classrooms.

With a design enrollment of 1,740 students, King Kekaulike High School has sufficient capacity to accommodate the 62 students generated by the proposed project (Wilson Okamoto & Associates, May 1991; R.M. Towill Corp., August 1992; telephone conversation with Department of Education employee, Peter Daniels, September 1994).

With the exception of Grades K to 5, the students generated by the proposed project are not expected to create a significant increase in facility requirements.

Coordination with the DOE shall be undertaken to discuss alternative measures for providing adequate educational facilities for the additional students in Grades K to 5 generated as a result of the proposed project.

7. ***Recreational Facilities***

County recreational facilities in the Upcountry region consist of five (5) neighborhoods and three (3) district parks. Neighborhood parks in the Kula area include Kula Community Center, Waiakoa Gym, Harold Rice Memorial Park, and Keokea Ball Park.

The Upcountry region's expansive geographic area and widely dispersed population centers limit the provision of recreational services due to the travel involved to reach the larger park facilities. In addition, development and maintenance costs also affect the establishment of new park facilities or the expansion of those currently existing. Consequently, the development of larger, more centralized facilities may be considered as an alternative.

Dedicated in 1994, Kula Recreational Center is located approximately three (3) miles from the project site and is anticipated to accommodate the current need for recreational facilities in the Kula area. The recently completed 10.3-acre facility serves as the region's only district park and includes multi-purpose ball fields, picnic sites, a fitness area with exercise stations, paved pathways, a comfort station, and parking areas (R.M. Towill Corp., August 1992; telephone conversations with Department of Parks and Recreation employees, Leonard Costa and Pat Matsui, September 1994).

The proposed subdivision consists of a 16-acre park site which will be set aside for future development. In the short-term, the proposed project is not anticipated to generate an immediate demand for recreational facilities. On a long-term basis, the development of the park site will expand the Upcountry region's network of recreational facilities, as well as accommodate the recreational needs of the community.

C. *IMPACTS TO THE INFRASTRUCTURE*

1. *Roadways*

A Traffic Impact Analysis Report (TIAR) has been prepared for the proposed project. See Appendix D. The findings and conclusions of the report are summarized below.

The TIAR analyzed five (5) existing and two (2) future intersections within the study area. These intersections were analyzed during the AM and PM peak traffic hours with respect to existing conditions, the Year 2005 Base without project conditions, and the Year 2005 with project conditions. These intersections include:

1. Hana Highway and Haleakala Highway (signalized);

2. Pukalani Bypass and Makawao Avenue (stop-controlled);

3. Pukalani Bypass/Kula Highway and Haleakala Highway or "Five Trees" (stop-controlled);

4. Kula Highway and Omaopio Road (stop-controlled);

5. Kula Highway and Kekaulike Avenue (stop-controlled);

6. Kula Highway and Project Access Road "A" (future stop-controlled); and

7. Kula Highway and Project Access Road "B" (future stop-controlled).

Under existing 1994 traffic conditions, three (3) of the five (5) analyzed intersections are currently operating at an undesirable level of service (LOS) (i.e., LOS "E" or "F") during the AM or PM peak hour, or both. LOS is a qualitative measure used to describe operational conditions within a traffic stream. In determining LOS, factors such as speed, delay safety, driver comfort, traffic interruptions, vehicle density, and freedom to maneuver are considered. LOS "A", "B", and "C", are considered satisfactory levels of service. LOS "D" is generally considered a "desirable minimum" operating level of service, while LOS "E" and LOS "F" are considered undesirable and unacceptable conditions, respectively.

Intersection improvements expected to be implemented by the Year 2005 include the signalization of the Pukalani Bypass/Makawao Avenue intersection and the Pukalani Bypass/Kula Highway/Haleakala Highway (a.k.a., "Five Trees") intersection.

Under the Year 2005 Base without project conditions, only the Hana Highway/ Haleakala Highway intersection will be operating at LOS "F" during the AM peak hour. The remaining four (4) intersections will be operating at acceptable levels of service (i.e., LOS "D" or better).

Under the Year 2005 with project conditions, all of the intersections will be operating at acceptable levels of service (i.e., LOS "D" or better) except for the intersection of Hana Highway and Haleakala Highway. It should be noted that this intersection is currently operating at LOS "F" during the AM peak hour and will continue to operate at this level of service, with or without the development of the project.

As reflected in the TIAR, a connector road between the Upcountry and Kihei regions could mitigate this undesirable level of service by redistributing traffic and alleviating traffic congestion at the Hana Highway/Haleakala Highway intersection. In addition, upgrading either Omaopio Road or Pulehu Road could also reduce traffic congestion as well as provide an alternative route to West Maui. It should be noted that a development study for an Upcountry/Kihei Connector Road is currently underway.

The proposed project's 386 single-family residential units are anticipated to generate an average of 3,686 trips daily, with approximately 286 and 390 trips occurring during the AM and PM peak hours, respectively. The intersection of Kula Highway and the proposed project's access roads are anticipated to operate at LOS "B" during both the AM and PM peak hours. Based on the estimated traffic volume projections for the proposed project, no roadway improvements to Kula Highway will be necessary in the vicinity of both project access roads. Based on the results of the TIAR, it has been concluded that the proposed project will not have any significant traffic impacts on any of the analyzed intersections.

2. ***Water***

The proposed water system will be constructed in accordance with standards established by the DWS and will be comprised of four (4) service zones. Refer to Appendix E. Service zone 1 will connect to the existing Upper Kula System, while service zone 2 will consist of a reservoir tank with a capacity of approximately 1.5 MG. Service zones 3 and 4 will feature reservoir tanks with capacities of approximately 0.2 MG and 0.1 MG, respectively. With the exception of service zone 1, the remaining services zones will utilize waterlines ranging in diameter from six (6) to twelve (12) inches.

Water from the existing Lower Kula System will flow into the approximately 0.2 MG tank proposed in service zone 3 via a new transmission line from Naalae Road. Consisting of approximately 9,000 linear feet of 18-inch ductile iron pipe, the new transmission line would connect to the existing 18-inch lower Kula waterline at Naalae Road and extend in a southwesterly direction toward the project site (Final Environmental Assessment for the Kula Water Transmission Main, Phase I, R.T. Tanaka Engineering, Inc., September 1995). The average daily demand for the proposed project is estimated to be approximately 305,000 gpd.

The proposed project will utilize applicable xeriscape principles and water conservation techniques for landscaping and irrigation. With the implementation of the proposed water system improvements, the proposed project is not anticipated to have an adverse effect on water sources, storage facilities, and distribution and transmission systems. In addition, the new transmission line is not anticipated to result in any significant short- or long-term environmental impacts (Final Environmental Assessment for the Kula Water Transmission Main, Phase I, R.T. Tanaka Engineering, Inc., September 1995).

3. ***Drainage and Erosion Control***

The drainage plan for the proposed project will include roadway culverts, detention basins, a subsurface drainage system, diversion ditches and swales, grassed and paved swales along roadways, and the realignment of an existing gulch drainageway. Refer to Appendix E. The subsurface drainage system will consist of drain lines, inlets and manholes, as well as outlet structures.

In general, the Rational Method will be used to determine onsite storm runoff quantities. In addition to the subsurface drainage system, roadway and diversion swales will be designed for a 10 year storm recurrence interval of one (1) hour duration. Roadway culverts and detention basins will be designed for a 50 year storm recurrence interval of one (1) hour duration.

Using the method described in the Erosion and Sediment Control Guide for Hawaii, NRCS, March 1981, preliminary calculations of peak offsite storm runoff what flow through the project site have been completed. The peak flows for the existing culvert crossings at Kula Highway are reflected in Appendix E.

The proposed drainage system improvements will be designed to produce no adverse effect by storm runoff to downstream and adjacent properties. All drainage system improvements will conform to, and be coordinated with, applicable governmental standards and agencies.

Erosion control measures recommended during construction include the following:

1. Minimize the time of construction;
2. Retain existing ground cover as long as possible in order to complete construction;
3. Implement the early construction of drainage control features;
4. Use temporary area sprinklers in non-active construction areas when ground cover is removed;
5. Utilize onsite waterwagons for immediate sprinkling, as needed, in active construction areas;
6. Use temporary berms, cut-off ditches, or silt screen fencing, where needed, to control soil erosion;
7. Water graded areas thoroughly after construction activity has ceased for the day, as well as on weekends and holidays;
8. All cut and fill slopes shall be sodded or planted immediately after grading work has been completed;
9. Upon completion of finish grading, cover all exposed areas with grass or an appropriate cover material; and
10. Ensure that adequate measures are implemented to prevent sediment-laden runoff from leaving the project site.

4. ***Wastewater***

The proposed project will utilize cesspools as individual wastewater systems for each lot. Refer to Appendix E. Since the proposed project will exceed the 50-lot limit established by the DOH, a variance will be sought in order to allow the project to be developed by utilizing cesspools as individual wastewater systems.

5. ***Electrical and Telephone Services***

Overhead lines for electrical, street lighting, telephone, and cable television services will be provided by the respective utility companies. The proposed project is not anticipated to adversely impact electrical and telephone services in the Upcountry region.

D. *CUMULATIVE AND SECONDARY IMPACTS*

Cumulative impacts are defined as impacts resulting from other past, present, and reasonably foreseeable future actions, while secondary impacts are impacts resulting from indirect actions. Cumulative impacts related to the development of the proposed subdivision include increases in traffic, as well as vehicle-generated noise and emissions.

Based on estimated traffic volume projections and an analysis of intersections in the region, traffic-related impacts are not anticipated to be adverse. Although, project-related traffic will generate noise and emissions, these impacts are not expected to significantly affect ambient air quality or result in any adverse noise conditions. It should be noted that the new water transmission line is anticipated to provide beneficial impacts by facilitating the development of the remainder of the Waiohuli parcel at such time any future development is programmed.

Secondary impacts associated with the development of the proposed subdivision and water transmission line include the effect of induced growth in the region, as well as additional requirements for infrastructure and public services. As previously noted, these long-term effects are not anticipated to result in any significant adverse impacts.

It should be noted that at the present time, DHHL has not programmed any commitments for any larger actions in the future.

Chapter IV

Summary of Unavoidable, Adverse Environmental Effects; Alternatives to the Proposed Action; and the Irreversible and Irretrievable Commitment of Resources

IV. SUMMARY OF UNAVOIDABLE, ADVERSE ENVIRONMENTAL EFFECTS; ALTERNATIVES TO THE PROPOSED ACTION; AND THE IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

A. UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

The proposed project will result in some 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 significant, long-term, adverse environmental effects.

B. ALTERNATIVES TO THE PROPOSED ACTION

1. No Action Alternative

As previously indicated, there was a total of nearly 5,000 Native Hawaiians on the waiting list for homestead lands on Maui. Of this total, approximately 2,400 Native Hawaiians are on the waiting list for residential lots. Pursuant to the HHCA, the "no action" alternative does not represent a responsible option toward addressing the entitlements and housing needs of Native Hawaiians.

Given the adequacy and cost of housing in Hawaii, and considering the very low, long-term lease rents associated with Hawaiian homestead lands, the proposed project will provide Native Hawaiians with the opportunity to become homeowners and consequently, narrow the gap created by the shortage of affordable housing units in Hawaii.

C. ***<u>IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES</u>***

The development of the proposed project would involve the commitment of fuel, labor, funding, and material resources.

In addition, the development of the proposed project will involve the commitment of land for improvements which will preclude other land options for the site. This commitment of land resources implements the mandate of the HHCA and is consistent with existing and future land uses in and around the project area.

Chapter V

Findings and Conclusion

V. FINDINGS AND CONCLUSION

The proposed project will involve the development of a residential subdivision and related infrastructure improvements. The project site and a portion of an adjoining parcel are currently undergoing consolidation and resubdivision. Upon completion of the subdivision process, the project site will encompass approximately 460 acres and will consist of 386 single-family lots ranging in size from one-half to one (1) acre. In addition, a 16-acre park site will be set aside for future development, as well as other parcels which will be used for utility sites and community-related needs. It should also be noted that a separate Environmental Assessment was prepared for the new water transmission line which will serve the needs of the proposed subdivision, as well as the kuleana parcels within the subdivision and the privately owned parcels along its alignment (Final Environmental Assessment for the Kula Water Transmission Main, Phase I, R.T. Tanaka Engineering, Inc., September 1995).

Since the proposed project involves State land and funding, this Environmental Assessment has been prepared pursuant to Chapter 343, HRS, and Chapter 200 of Title 11, Administrative Rules of the State Department of Health.

The development of the proposed project will involve short-term environmental effects typically associated with construction activities. To mitigate air quality and noise impacts, construction activities will be limited to daylight hours. Appropriate dust control measures such as revegetation, sprinkling, watering, and silt screen fencing, will be undertaken to minimize fugitive dust. Although ambient noise conditions may be temporarily affected by construction activities, no significant adverse effects are anticipated.

From a long-term perspective, the proposed project is not anticipated to result in any adverse environmental impacts. A botanical survey indicated that there are no rare, endangered, or threatened species of flora located within the project site. Although a Hawaiian Hoary Bat was once observed foraging above the northeast corner of the project site, little is known about the life history of this endemic and endangered species. With the exception of this sighting, the avifauna and mammal survey revealed that none of the mammals observed are rare, endangered, or threatened species.

As a result of the current consolidation and resubdivision process, the SHPD was consulted concerning significance determinations, mitigation measures, and construction buffer zones for the 42 significant sites identified by the PHRI *archaeological inventory survey*. Coordination with the SHPD will be continued to ensure that buffer zones, mitigation measures, and data recovery and preservation plan requirements will be addressed.

With regard to short-term, socio-economic impacts, construction-related employment is anticipated to have a positive effect on the local economy. In addition, the proposed project is anticipated to fulfill an immediate for homesteading opportunities for Native Hawaiians. With the exception of Grades K to 5, the students generated by the proposed project are not expected to create a significant increase in facility requirements. Coordination with the DOE will be undertaken to discuss alternative measures for providing adequate education facilities for the additional students in Grades K to 5 generated as a result of the proposed project. The proposed project is not anticipated to create an immediate demand for new offsite recreational facilities.

Once fully developed and occupied, the subdivision's residents are anticipated to contribute to the long-term support of the regional economy through their purchases of goods and services from local merchants. The development of the project's 16-acre park site will expand the Upcountry region's network of recreational facilities, as well as accommodate the recreational needs of the community.

Applicable infrastructure improvements will be implemented for the development of the project. With the exception of certain specified exemptions, the design of the infrastructure improvements will comply with applicable County design standards. It should be noted that, pursuant to Section 220 of the HHCA, Hawaiian homestead lands utilized by the Act are exempt from County regulatory requirements.

Based on an assessment of the proposed project, the development of the DHHL Kula Residential Lot, Unit 1 Subdivision is not anticipated to result in any significant environmental impacts.

Chapter VI

Agencies Contacted in the Preparation of the Draft Environmental Assessment

VI. AGENCIES CONTACTED IN THE PREPARATION OF THE DRAFT ENVIRONMENTAL ASSESSMENT

1. County of Maui
   Department of Water Supply
   200 South High Street
   Wailuku, Hawaii 96793

2. County of Maui
   Department of Public Works and Waste Management
   Engineering Division
   200 South High Street
   Wailuku, Hawaii 96793

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

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

5. State of Hawaii
   Department of Transportation
   Highways Division
   650 Palapala Drive
   Kahului, Hawaii 96732

6. State of Hawaii
   Department of Land and Natural Resources
   State Historic Preservation Division
   33 S. King Street, 6th Floor
   Honolulu, Hawaii 96813

Chapter VII

Correspondence Received During the Public Comment Period and Responses to Substantive Comments

FILE COPY

BENJAMIN J. CAYETANO
[redacted]
GOVERNOR

GARY GILL
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
220 SOUTH KING STREET
FOURTH FLOOR
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-2452

September 26, 1995

Mr. Michael L. Crozier, Administrator
Land Development Division
State of Hawai'i, Department of Hawaiian Home Lands
Old Federal Building
335 Merchant Street, Third Floor
Honolulu, Hawai'i 96813

Dear Mr. Crozier:

We are writing in response to your September 5, 1995, letter (MC:PY:0345B) submitting a Final Environmental Assessment/Negative Declaration for the Kula Water Transmission Main, Phase 1, and your September 12, 1995, letter, submitting a Draft Environmental Assessment for Kula Residence Lots, Unit 1. The Office of Environmental Quality Control (OEQC) must remind you that the law specifically disallows segmentation of a project into parts and submitting those parts, one at a time, to environmental review. We believe your Department has segmented a larger project into at least these two parts.

For reasons set forth in the next section, we advise the Department of Hawaiian Home Lands (DHHL) to perform the following tasks in its assessment of significance in the Final Environmental Assessment/Notice of Determination for the Kula Residence Lots.

1) Incorporate all information on water transmission from the Final Environmental Assessment/Negative Declaration for the Kula Water Transmission Main into the Final Project Environmental Assessment for the Kula Residence Lots.

2) Analyze and reassess the significance (under section 11-200-12, Hawaii Administrative Rules) of the proposed Kula Residence Lots project considering the incorporated water transmission information above, especially with respect to the following:

   A) The two projects cited above have phase/unit number designations attached to the project title; the DHHL must consider every phase of a proposed action (or related group of actions), the expected consequences, and the cumulative as well as the short and long-term effects of the action.

   B) Describe whether the proposed action (or a group of related proposed actions such as the water transmission line and residence lots development) involve substantial secondary impacts. Population changes or effects on public facilities such as a water transmission line among other things should be considered secondary impacts.

   C) Assess if and how the proposed action may have a cumulative effect upon the environment when past and future projects are considered.

D) Analyze if the proposed action involves any commitment for larger actions in the future.

BACKGROUND

We became concerned about project segmentation when, within a period of seven days, we received a final environmental assessment/negative declaration for the Kula Water Transmission Line, Phase I, and the draft environmental assessment/anticipated negative declaration for the Kula Residence Lots, Unit I project. Although the projects are obviously related to one another, we are unable to find explicit links between the two in any of their related documents.

While we recognize that different consultants prepared the environmental documents for the above projects, we believe that the DHHL has a responsibility to: 1) effectively coordinate/communicate with the consultant the status of pending projects for public disclosure in the environmental documents so that the public will be able to make informed comment on proposed actions; and 2) inform the Office/public of potential relationships between various proposed actions.

It is our duty to remind you that Section 11-200-7, Hawaii Administrative Rules, states in pertinent part that "[a] group of actions proposed by an agency ... shall be treated as a single action when ... (1) [t]he component actions are <u>phases or increments</u> of a larger total undertaking; (2) [a]n individual project is a <u>necessary precedent for a larger project</u>; (3) [a]n individual project represents a <u>commitment to a larger project</u>; <u>or</u> (4) [t]he actions in question are essentially identical and a single statement will adequately address the impacts of each individual action and those of the group of actions as a whole." [Underscoring supplied for emphasis].

An examination of our records failed to produce any environmental impact statement for proposed residence/infrastructure developments on Maui.

While we acknowledge DHHL's need to fulfill its constitutional mandate as set forth in the Hawaiian Homes Commission Act, we also believe that DHHL, as an agency of the State, must comply with the procedures for environmental review set forth in Chapter 343, Hawaii Revised Statutes. Accordingly, we echo Dr. John Harrison's concerns (see enclosed August 22, 1994, letter to your agency) concerning segmentation and remind you that in determining whether an action may have a significant effect on the environment, the Department <u>must</u> consider <u>every phase</u> of the proposed action, the expected consequences, both primary and secondary, and the cumulative as well as the short and long-term effects of the action.

If there are any questions, please call me or Mr. Leslie Segundo at 586-4185. Thank you for your cooperation.

Sincerely,

GARY GILL
Director

Enclosure

MAR 2 1 1996

BENJAMIN J. CAYETANO
GOVERNOR
STATE OF HAWAII

KALI WATSON
CHAIRMAN
HAWAIIAN HOMES COMMISSION

JOBIE M. K. M. YAMAGUCHI
DEPUTY TO THE CHAIRMAN

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P.O. BOX 1879
HONOLULU, HAWAII 96805

March 20, 1996

Mr. Gary Gill, Director
Office of Environmental Quality Control
State of Hawaii
220 South King Street, 4th Floor
Honolulu, Hawaii 96813

Dear Mr. Gill:

SUBJECT: Kula Residence Lots, Unit 1
Kula, Island of Maui

Thank you for providing the Department of Hawaiian Home Lands (DHHL) with your comments concerning the subject's Draft Environmental Assessment (EA). Pursuant to your September 26, 1995 letter, we would like to note that information contained in the Final EA for the Kula Water Transmission Main, Phase 1, (R.T. Tanaka Engineering, Inc., September 1995) has been included in the subject's Final EA.

In addition to the potential short- and long-term effects which were previously described, the subject's Final EA includes a description of cumulative and secondary impacts as well.

Please feel free to contact me should you require any additional information.

Sincerely,

Mike Crozier, Administrator
Land Development Division

cc: Austin, Tsutsumi & Assoc.
Munekiyo & Arakawa, Inc.

University of Hawai'i at Mānoa

Environmental Center
A Unit of Water Resources Research Center
Crawford 317 · 2550 Campus Road · Honolulu, Hawai'i 96822
Telephone: (808) 956-7361 · Facsimile: (808) 956-3980

October 23, 1995
EA: 0134

Mr. Kali Watson
Department of Hawaiian Home Lands
P.O. Box 1879
Honolulu, Hawaii 96805

Mr. Watson:

Draft Environmental Assessment (EA)
Kula Residential Lot, Unit 1
Kula, Maui

The State of Hawaii, Department of Hawaiian Home Lands is proposing to develop a 386-lot residential subdivision on Hawaiian homestead lands in Kula, Maui. Pursuant to Section 204 of the Hawaiian Homes Commission Act (HHCA), the proposed project addresses the demand for developed homestead lots for Native Hawaiians by providing improved homesites for residential construction and occupancy by land awardees. The proposed project will encompass approximately 460 acres, comprised of homesites ranging in size from approximately 1/2 to one acre. In addition, the proposed project will involve construction of related roadway, wastewater, water and drainage system improvements.

This review was completed with the assistance of Kem Lowry, Urban and Regional Planning; Terry Hunt, Archaeology and Tom Hawley, Environmental Center.

This draft EA generally is well-prepared and addresses major environmental consequences of the proposed project. Our reviewers noted that the traffic section is especially thorough. However, we are concerned about the proposed use of cesspools in lieu of county-provided wastewater disposal. We note that the project will require an exemption from State Department of Health regulations which prohibit the use of cesspools in developments of larger than 50 lots. Any waiver, and particularly one seeking a six-fold exceedence of standards, should be accompanied by a more detailed and thorough discussion of possible consequences and proposed mitigative measures than occurs in this draft EA.

Mr. Kali Watson
October 23, 1995
Page 2

Our reviewers generally concurred with the archaeological inventory survey and testing methodologies, but they noted that some of the research questions seemed naive. A more productive approach would be to incorporate results of future work in this project area to regional patterns of land use and chronology. We note that salvage archaeology must collect information for a broad range of people. If research questions imply a limited range of data acquisition (i.e. a deductive approach), then specifying them as a limiting factor is short-sighted. In short, salvage archaeology must be more than research archaeology. Because the sites will be forever buried under the proposed development, the archaeological report should include a wide range of preservation options and provide as many research resources for emerging archaeological questions as possible.

Furthermore, we note that this project and another DHHL project, the Kahikinui Kuleana project in Kahikinui, Maui are proceeding simultaneously. Given the relative proximity of the two projects, we suggest that the two draft EA's each should consider "overall and cumulative effects" of the other pursuant to Section 11-200-12, DOH Administrative Rules. Given potential significance to the Native Hawaiian community and to the wider East Maui area, we suggest that perhaps a full environmental impact statement would better cover the range of possible impacts these two projects entail.

Finally, we are concerned that the Department of Hawaiian Home Lands is both the proposing agency and the accepting authority for this project. This clearly represents a conflict of interest and effectively circumvents the spirit of the EIS process. Certainly the process of objective review is ill-served by such a situation. Public concerns regarding any project must be allowed a fair hearing in as neutral a forum as possible and must be given an honest chance to be addressed. The current situation compromises that possibility.

Thank you for the opportunity to comment.

Sincerely,

John T. Harrison
Environmental Coordinator

cc: OEQC
Roger Fujioka
Department of Hawaiian Home Lands
Munekiyo and Arakawa, Inc. ✓
Kem Lowry
Terry Hunt Tom Hawley

BENJAMIN J. CAYETANO
GOVERNOR
STATE OF HAWAII

KALI WATSON
CHAIRMAN
HAWAIIAN HOMES COMMISSION

JOBIE M. K. M. YAMAGUCHI
DEPUTY TO THE CHAIRMAN

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P.O. BOX 1879
HONOLULU, HAWAII 96805

April 2, 1996

University of Hawaii
Environmental Center
Crawford Hall, Room 317
2550 Campus Road
Honolulu, Hawaii 96822

Attention: Mr. John T. Harrison, Coordinator

Gentlemen:

SUBJECT: Draft Environmental Assessment, Kula Residence Lots, Unit 1
Kula, Island of Maui

Under the Department of Hawaiian Home Lands (DHHL) Acceleration Program of 1986, 308 of the 386 residential lots were awarded to native Hawaiian beneficiaries. The preliminary design for this area consisted of a roadway system, a drainage system, a water system, and an overhead electrical distribution system to service this Hawaiian Homes subdivision. All of the improvements were designed to meet minimum county standards. During this period, the use of cesspools for waste disposal was permitted and no alternative system was considered. During the award phase of this project, lessees were informed of the lack of Capital Improvement Program funds and the minimum improvements that would be constructed for this subdivision when funds became available from the legislature.

A Department of Health (DOH) Variance is being requested by the DHHL to utilize cesspools for waste disposal. The entire site is within an area designated not critical, and no existing sewer system is in the vicinity of the proposed project. The cost associated with an on-site sewage system would result in economic hardship to the DHHL as well as to its beneficiaries. A detailed report has been provided to the Department of Health, with whom the DHHL will work to address their comments and concerns.

The concern you raised regarding the coordination and proximity of the DHHL's Kahikinui Kuleana project has been addressed in a letter to you dated October 27,1995. This letter explained that the projects were not related, and that both projects were planned independently and at different times. The letter also states that the only service which the DHHL will provide to the caretakers of this parcel is the surveying services. All additional infrastructure development will be initiated by caretakers of the kuleana program; without this arrangement, this area would not be inhabited for another fifty (50) or so years. The Kahikinui Kuleana Project is the first attempt by DHHL which allows settlement on "raw" lands using limited state assistance.

Thank you for your interest in this project. We apologize for the time taken to respond to your concerns. Should you have any questions, please feel free to contact Mr. Patrick Miyahira of Austin, Tsutsumi and Associates, Inc. at 244-8044.

Sincerely,

Mike Crozier, Administrator
Land Development Division

cc: OEOC

ATA, Inc.

Tanaka Engineers, Inc

References

References

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

Maui Economic Development Board, Inc., Maui County Data Book, December 1993.

Michael T. Munekiyo Consulting, Inc., Final Environmental Assessment - Kula Fire Station, April 1993.

Office of Hawaiian Affairs, Native Hawaiian Rights Handbook, 1991.

R. M. Towill Corp., Public Facilities Assessment Report, August 1992.

R. T. Tanaka Engineers, Inc., Final Environmental Assessment for Kula Water Transmission Main, Phase I, September 1995.

R.W. Beck, Solid Waste Characterization Study, December 1994.

Telephone conversation with Department of Education employees, Peter Daniels and Tom Saka, September 1994.

Telephone conversation with Department of Hawaiian Home Lands employees, Joe Chu, September 1994 and Patrick Young, April 1996.

Telephone conversation with Kula Hospital employee, Natalie Kahoohanohano, September 1994.

Telephone conversations with Maui Fire Department employees, Deputy Chief Ron DeMello and Captain Charles Ledward, September 1994.

Telephone conversations with Department of Parks and Recreation employees, Leonard Costa and Pat Matsui, September 1994.

Telephone conversation with Maui Police Department employee, Sergeant Larry Hudson, September 1994.

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.

Wilson Okamoto and Associates, Maui Community Plan Update Infrastructure Assessment, September 1992.

Wilson Okamoto and Associates, Site Selection Report and Draft Environmental Impact Statement for the Proposed Upcountry Maui High School, May 1991.

Woolsey, Miyabara & Associates, Inc., Kula Development Plan, December 1983.

Appendices

Appendix A

Botanical Survey

BOTANICAL SURVEY
DHHL KULA RESIDENTIAL LOT, UNIT 1
KULA, MAKAWAO DISTRICT, ISLAND OF MAUI

by

Winona P. Char

CHAR & ASSOCIATES
Botanical Consultants
Honolulu, Hawai'i

Prepared for: Munekiyo & Arakawa, Inc.

October 1994

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BOTANICAL SURVEY
DHHL KULA RESIDENTIAL LOT, UNIT 1
KULA, MAKAWAO DISTRICT, ISLAND OF MAUI

INTRODUCTION

The ±655-acre Department of Hawaiian Home Lands (DHHL) project site, TMK: 2-2-02: 56, is found on the northwest slope of Haleakala, near Keokea. The property is bounded to the east by Kula Highway, and on the remaining three sides primarily by undeveloped lands used for pasture. Elevation on the property ranges from about 1,800 ft. along the lower, makai boundary to roughly 3,000 ft. along the upper, mauka boundary where it abuts the Kula Highway. Annual rainfall is about 15 inches on the lower one-quarter of the property, increasing gradually as one moves upslope to 30 inches per year on the upper section.

Only about two-thirds of the project site are planned for residential development. This upper portion of the property is the most suitable for the proposed land use. The climatic conditions are pleasant, with temperatures ranging from the low 60's to the mid-80's, rainfall from 20 to 30 inches annually, and the soil conditions favorable. The site offers spectacular views of the Maui isthmus and the West Maui mountains beyond (Woolsey, Miyabara & Associates 1983).

Field studies to assess the botanical resources found on the DHHL project site were conducted on 08 and 22 to 23 September 1994. The primary objectives of the field studies were to:
1) provide a description of the major vegetation types;
2) inventory the flora; 3) search for threatened and endangered

species as well as rare and vulnerable plants; and 4) identify areas of potential environmental problems or concerns and propose appropriate mitigation measures.

SURVEY METHODS

Prior to undertaking the field studies, a search was made of the pertinent literature to familiarize the principal investigator with other botanical studies conducted in the general area. Topographic maps and recent black and white aerial photographs were examined to determine vegetation cover patterns, terrain characteristics, access, boundaries, and reference points.

Access was from the Kula Highway and then onto the main jeep road which runs the length of the property, following along the southern boundary near Waiohuli Gulch. From the main jeep road, a number of smaller side roads and bulldozer tracks can be accessed. A less well traveled jeep road on the northern portion of the property is found off of the dirt road which provides access to several privately-owned landlocked parcels.

A walk-through survey method was used. The less disturbed areas such as the larger gulches were more intensively surveyed as such areas are more likely to harbor native plant communities, and, perhaps, rare species. Notes were made on plant associations and distribution, substrate types, topography, exposure, grazing damage, drainage, etc. Plant identifications were made in the field; plants which could not be positively identified were collected for later determination in the harbarium, and for comparison with the most recent taxonomic literature.

The species recorded are indicative of the season ("rainy" vs. "dry") and the environmental conditions at the time of the survey. A survey taken at a different time of the year and under varying environmental conditions would no doubt yield slight variations in the species list, especially of the weedy, annual plants.

DESCRIPTION OF THE VEGETATION

An earlier archaeological survey (PHRI 1989) included a very short description of the vegetation observed on the project site, then identified as the Waiohuli parcel. Black wattle forests dominated the eastern half of the parcel, while lantana and prickly pear cactus were codominate on the lower western half. A recent botanical reconnaissance assessment (Char 1994) of the lands immediately north of the study site for a proposed waterline which will serve the residential lot also described similar vegetation types in more detail.

The black wattle forest occurs on the upper section of the project site from about the 2,350-foot elevation contour up to the highway. The forest is more or less confined to Kula cobbly loam, 12% to 20% slopes, identified as "KxaD" on the soil maps (Foote et al. 1972). These are well-drained, dark reddish-brown soils found on uplands and derived from ash over pahoehoe bedrock. The lantana-cactus scrub occurs on soils mapped as "KGKC", Kamaole very stony silt loam, 3% to 15% slopes; these are dark brown to dark reddish-brown soils derived from ash over fragmental 'a'a substratum, with 'a'a outcroppings sometimes common.

These two vegetation types along with the gulch vegetation are described in more detail below. A list of all the plant species inventoried on the project site during the field studies is presented at the end of the report.

Black Wattle Forest

Black wattle (Acacia mearnsii), a native of Australia, forms a somewhat dense forest cover on the cooler, wetter, upper sections of the property, from the highway at about 3,000 ft. elevation down to about the 2,350-foot contour. The forest occurs on deep, well-developed soils. In many places, the forest appears to have been bulldozed at one time, and large stands of black wattle trees have resprouted from root suckers. In these areas, the trees are about the same size and age; the trees are mostly 18 to 25 ft. tall with trunk diameters 3 to 6 inches. Scattered through this vegetation type are mounds or piles of boulders, rubble, and trunks of larger black wattle trees. Lantana shrubs (Lantana camara) are locally common on these bulldozed piles and also within the small, shallow gullies.

Kikuyu grass (Pennisetum clandestinum), a native of Africa, forms somewhat low mats, about 6 inches tall, between the trees and in open areas. The cattle found throughout the property keep most of the grasses and other smaller species cropped low. Where the tree cover becomes denser, kikuyu grass may be replaced by two more shade-tolerant grass species; these are meadow ricegrass (Ehrharta stipoides) and a Panicum species. Other grasses found on this cooler upland section include a number of temperate species such as wild oat (Avena fatua), soft chess (Bromus mollis), ripgut grass (Bromus rigidus), and barley (Hordeum leporinum).

Seedlings of weedy, annual species and other grasses are common along the old bulldozer tracks which criss-cross the property and along the jeep roads. These include bristly foxtail grass (Setaria verticillata), peppergrass (Lepidium virginicum), keeled goose-foot (Chenopodium carinatum), Bermuda grass (Cynodon dactylon), hairy abutilon (Abutilon grandifolium), Galinsoga parviflora, owi (Stachytarpheta dichotoma), and bull thistle (Cirsium vulgare).

A few of the black wattle trees along the lower edges of the forest, where it interfaces the lantana-cactus scrub, have died back. The curled, brown leaves and seed pods still hang from the branches, suggesting, perhaps, that the trees died of drought stress.

Lantana-Cactus Scrub

This vegetation type is found at about the 2,350-foot elevation and continues downslope to the project's boundary and beyond. Basically, it consists of dense patches of lantana, a thorny shrub 3 to 6 ft. tall, and clumps of prickly pear cactus or panini (Opuntia ficus-indica), 8 to 12 ft. tall. The lantana-cactus cover is roughly 50 to 60%. A mixture of grasses and smaller, mostly weedy species fills in the matrix between the prickly scrub cover. Surveying can become difficult in the areas where the cactus plants are dense.

Two variants of the lantana-cactus scrub can be recognized in the field. The first variant is lantana-cactus scrub with scattered black wattle trees. This variant is found between the 2,350-foot elevation and the 2,000-foot elevation. Trees of black wattle are found as scattered stands among the lantana and cactus. The black wattle trees tend to occur in the shallow gullies and other low-lying areas where it may be somewhat moister. Pitted beardgrass (Bothriochloa pertusa), molasses grass (Melinis minutiflora), and Natal redtop (Rhynchelytrum repens) are the most abundant grasses. Kikuyu grass becomes uncommon, probably because of the drier conditions.

The black wattle trees thin out as one moves downslope and become uncommon at the 2,000-foot contour; rainfall below this elevation is about 15 inches per year. The second scrub variant, lantana-cactus with kiawe (Prosopis pallida) trees is found from here on down. In places, the kiawe cover is 30 to 40%, but lantana and cactus are still abundant. The grass cover changes primarily to buffel grass (Cenchrus ciliaris) with smaller patches of pitted beardgrass. This lower section is drier and the vegetation more heavily grazed. Rocky outcroppings become common. The native wiliwili tree (Erythrina sandwicensis), with flower colors ranging from pale apple green to coral, is locally common in some areas along the lower boundary.

Smaller weedy herbaceous components commonly observed in the lantana-cactus scrub include hedge mustard (Sisymbrium officinale), peppergrass, hairy abutilon, cheeseweed (Malva parviflora) -- which is more abundant during the wetter months, keeled goosefoot, and false mallow (Malvastrum coromandelianum).

Among the smaller shrubs or subshrubs encountered are the native 'uhaloa (Waltheria americana) and 'ilima (Sida fallax). One 'ulei shrub (Osteomeles anthyllidifolia), about 7 ft. tall, is found at the interface between black wattle forest and lantana-cactus scrub on a rocky outcropping. 'Ulei is an indigenous species belonging to the rose family. The hard wood was made into 'o'o or digging sticks, fish spears, and a musical instrument, the 'ukeke. The long slender flexible branches were bent into hoops for fish nets (Wagner et al. 1990).

Gulch Vegetation

The project site includes a portion of the Waiohuli Gulch on its southern periphery. The gulch has been eroded down to bedrock in most places, and there are large boulder-strewn areas along the dry streambed. Also occasional are a few "dry fall" areas where the streambed plunges over a steep face or overhang.

This gulch and also some parts of the smaller unnamed gulch on the northern portion of the property remain wetter during most of the year, and thus provide a moister habitat for plants. Gulch vegetation on the project site typically consists of dense clumps of Guinea grass (Panicum maximum), from 3 to 5 ft. tall, with scattered stands of Chinaberry trees (Melia azedarach). In places, lantana shrubs form dense, prickly patches. There are extensive groves of large wiliwili trees on the lower sections of Waiohuli Gulch.

The steep gulch walls and "dry fall" sections of the streambed are damp and remain shaded during parts of the day. Thus, it is not uncommon to find small tussocks of mosses and light green-colored patches of Dumotiera, a thalloid liverwort, on the damp soil. Almost all the ferns found during the survey occur within the gulch areas. Other species observed only in these moister habitats include Mauritius hemp (Furcraea foetida), 'ape (Alocasia macrorrhiza), tarweed (Cuphea cathagenensis), four-o'clock (Mirabilis jalapa), 'ilihe'e (Plumbago zeylanica), and pamakani (Ageratina riparia).

Many of the plants found on the cooler upland portions of the property extend further downslope, following along the bottoms of the moist gulches. These include small patches of a very thorny blackberry species (Rubus sp.), honohono (Commelina diffusa), montbretia (Crocosmia X crocosmiiflora) -- an escaped ornamental member of the iris family, meadow ricegrass, jacaranda (Jacaranda mimosifolia), castor bean (Ricinus communis), etc.

DISCUSSION AND RECOMMEDATIONS

The vegetation on the DHHL Kula Residential Lot, Unit 1, is dominated primarily by introduced or alien species. The property is presently used to graze cattle, so much of the vegetation has been browsed. There are also axis deer and feral pigs on the property. In addition, parts of the site have been bulldozed in the past, probably to control black wattle, lantana, and prickly pear cactus, and to improve pasturage for the cattle. The upper three-quarters of the property where the proposed lots will be developed appear to be the most heavily disturbed.

Certain areas do support native species. These are the larger gulches which cross the property, especially Waiohuli Gulch, and the lower section of the property where there are stands of wiliwili trees. These areas were more intensively surveyed. Several rare native species are known to occur in the area around Pu'u o Kali, between 600 and 1,400 ft. elevation (Cuddihy and Stone 1990).

Of a total of 112 plant species inventoried on the property, 95 (85%) are introduced or alien species, 2 (2%) are originally of Polynesian introduction, and 15 (13%) are native. Of the natives, 12 are indigenous, that is, they are native to the Hawaiian Islands and elsewhere, and 3 are endemic, that is, they are native only to the Hawaiian Islands. The endemic species are the kumu-niu fern (Doryopteris decipiens), wiliwili (Erythrina sandwicensis), and the native poppy or pua-kala (Argemone glauca).

None of the plants is a listed, proposed or candidate threatened and endangered species (U.S. Fish and Wildlife Service 1990, 1992, 1994). None of the plants is considered rare or vulnerable (Wagner et al. 1990). All of the plants can be found in similar environmental habitats throughout the Hawaiian Islands.

Given the findings above, the proposed development should not have a significant negative impact on the botanical resources. It is recommended, however, that areas disturbed by construction activities be revegetated as soon as possible to prevent soil loss and erosion gullying. Native species found on the site and nearby areas should be considered for landscaping. These species are adapted to the local conditions and would require less water. Some material recommended for landscaping include wiliwili, 'ulei, 'ilihe'e, and 'ilima. There are several interesting flower color forms of the wiliwili already on the project site.

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PLANT SPECIES LIST -- DHHL Kula Residential Lot

A checklist of all those vascular plant species inventoried on the project site during the field studies is presented below. The species are arranged alphabetically by families within each of three groups: Ferns and Fern Allies, Monocots, and Dicots. The taxonomy of the Ferns and Fern Allies follow Lamoureux (1988), while the flowering plants, Monocots and Dicots, are in accordance with Wagner et al. (1990).

For each species, the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name(s), when known.
3. Biogeographic status. The following symbols are used:
   E = endemic = native only to the Hawaiian Islands.
   I = indigenous = native to the Hawaiian Islands and also elsewhere throughout the Pacific.
   P = Polynesian = plants originally of Polynesian introduction prior to Western contact (Cook's discovery of the islands in 1778); not native.
   X = introduced or alien = all those plants brought to the islands by humans, intentionally or accidentally, after Western contact; not native.
4. Presence (+) or absence (-) of a particular species within each of three vegetation types recognized on the project site (see text for discussion):
   bwf = Black Wattle Forest
   l-c = Lantana-Cactus Scrub
   g = Gulch Vegetation

Scientific name	Common name	Status	Vegetation type bwf	l-c	g
FERNS & FERN ALLIES					
ADIANTACEAE (Maidenhair Fern Family)					
Adiantum hispidulum Sw.	Australian maidenhair	X	-	-	+
Adiantum raddianum Presl	maidenhair fern	X	-	-	+
BLECHNACEAE (Blechnum Family)					
Blechnum occidentale L.	blechnum	X	-	-	+
HEMIONITIDACEAE (Gold Fern Family)					
Pityrogramma calomelanos (L.) Link	silver fern	X	-	-	+
NEPHROLEPIDACEAE (Sword Fern Family)					
Nephrolepis multiflora (Roxb.) Jarrett ex Morton	hairy sword fern	X	-	-	+
PSILOTACEAE (Whisk Fern Family)					
Psilotum nudum (L.) Beauv.	moa, pipi	I	-	-	+
SINOPTERIDACEAE (Cliffbrake Family)					
Doryopteris decipiens (Hook.) J. Sm.	kumu-niu, manawahua, 'iwa'iwa	E	+	-	+
Pellaea ternifolia (Cav.) Link	kalamoho, lau-kahi	I	-	-	+
THELYPTERIDACEAE (Woodfern Family)					
Christella parasitica (L.) Levl.	woodfern, oakfern	X	-	-	+
FLOWERING PLANTS					
MONOCOTS					
AGAVACEAE (Sisal Family)					
Furcraea foetida (L.) Haw.	Mauritius hemp	X	-	-	+

Scientific name	Common name	Status	Vegetation type bwf	l-c	g
ARACEAE (Aroid Family)					
Alocasia macrorhizza (L.) Schott	'ape	P	-	-	+
COMMELINACEAE (Spiderwort Family)					
Commelina diffusa N.L. Burm.	honohono	X	+	-	+
CYPERACEAE (Sedge Family)					
Cyperus gracilis R. Br.	McCoy grass	X	+	-	+
IRIDACEAE (Iris Family)					
Crocosmia X crocosmiiflora (Lemaine ex E. Morr.) N.E. Brown	montbretia	X	+	-	+
POACEAE (Grass Family)					
Avena fatua L.	wild oat	X	+	-	+
Bothriochloa pertusa (L.) A. Camus	pitted beardgrass	X	+	+	+
Bothriochloa sp.		X	+	-	-
Bromus mollis L.	soft chess	X	+	-	-
Bromus rigidus Roth	ripgut grass	X	+	-	-
Cenchrus ciliaris L.	buffel grass	X	+	+	-
Cynodon dactylon (L.) Pers.	Bermuda grass, manienie	X	+	+	+
Digitaria radicosa (Presl) Miq.	crabgrass	X	+	-	-
Digitaria setigera Roth	itchy crabgrass, kukaepua'a	I?	+	-	-
Ehrharta stipoides Labill.	meadow ricegrass	X	+	-	+
Eleusine indica (L.) Gaertn.	wiregrass, goosegrass	X	+	-	-
Hordeum leporinum Link	barley, pale	X	+	-	-
Melinis minutiflora P. Beauv.	molasses grass	X	+	+	+
Panicum maximum Jacq.	Guinea grass	X	+	+	+
Panicum sp.		X	+	-	-
Paspalum scrobiculatum L.	ricegrass, mau'u laiki	I?	+	-	-
Pennisetum clandestinum Hochst. ex Chiov.	kikuyu grass	X	+	-	-
Rhynchelytrum repens (Willd.) Hubb.	Natal redtop	X	+	+	+
Setaria verticillata (L.) P. Beauv.	bristly foxtail	X	+	+	+
Sporobolus indicus (L.) R. Br.	Indian dropseed, rattail grass	X	+	+	+

Scientific name	Common name	Status	Vegetation type bwf	l-c	g
DICOTS					
AMARANTHACEAE (Amaranthus Family)					
Amaranthus spinosus L.	spiny amaranth, pakai kuku	X	+	+	-
APIACEAE (Parsley Family)					
Anethum graveolens L.	dill	X	+	-	-
ASCLEPIADACEAE (Milkweed Family)					
Asclepias physocarpa (E. Mey.) Schlechter	balloon plant	X	+	+	-
ASTERACEAE (Daisy Family)					
Ageratina riparia (Regel) R. King & H. Robinson	pamakani	X	-	-	+
Artemisia sp.		X	+	-	-
Bidens cynapiifolia Kunth	West Indian beggar's tick	X	+	-	+
Bidens pilosa L.	Spanish needle, beggar's tick, ki, ki nehe	X	+	-	+
Cirsium vulgare (Savi) Ten.	bull thistle	X	+	-	-
Conyza bonariensis (L.) Cronq.	hairy horseweed, ilioha	X	+	-	+
Emilia fosbergii Nicolson	pualele	X	-	-	+
Galinsoga parviflora Cav.		X	+	+	+
Gnaphalium purpureum L.	purple cudweed	X	+	-	-
Hypochoeris glabra L.	smooth cat's ear	X	+	-	-
Pluchea symphytifolia (Mill.) Gillis	pluchea, sourbush	X	+	-	+
Sigesbeckia orientalis L.	small yellow crown-beard	X	+	-	-
Sonchus oleraceus L.	sow thistle, pua-lele	X	+	-	+
Tridax procumbens L.	coatbuttons	X	+	-	+
Zinnia peruviana (L.) L.	wild zinnia	X	-	-	+
BIGNONIACEAE (Bignonia Family)					
Jacaranda mimosifolia D. Don	jacaranda	X	+	-	+

Scientific name	Common name	Status	Vegetation type bwf	l-c	g
BRASSICACEAE (Mustard Family)					
Lepidium virginicum L.	peppergrass	X	+	+	+
Sisymbrium officinale (L.) Scop.	hedge mustard	X	+	+	-
CACTACEAE (Cactus Family)					
Opuntia ficus-indica (L.) Mill.	prickly pear, panini	X	+	+	+
CARYOPHYLLACEAE (Pink Family)					
Polycarpon tetraphyllum (L.) L.	allseed	X	+	-	-
Silene gallica L.	small-flowered catchfly	X	+	-	-
CHENOPODIACEAE (Goosefoot Family)					
Chenopodium carinatum R. Br.	keeled goosefoot	X	+	+	-
CONVOLVULACEAE (Morning-glory Family)					
Ipomoea alba L.	moonflower, koali pehu	X	-	-	+
Ipomoea indica (J. Burm.) Merr.	koali 'awa, koali 'awahia	I	+	+	+
CRASSULACEAE (Orpine Family)					
Kalanchoe pinnata (Lam.) Pers.	air plant	X	+	-	+
EUPHORBIACEAE (Spurge Family)					
Euphorbia heterophylla L.	kaliko	X	-	-	+
Ricinus communis L.	castor bean, koli	X	+	-	+
FABACEAE (Pea Family)					
Acacia farnesiana (L.) Willd.	klu	X	-	+	-
Acacia mearnsii De Wild.	black wattle	X	+	+	+
Chamaecrista nictitans (L.) Moench	partridge pea, lauki	X	+	-	+
Crotalaria pallida Aiton	smooth rattlepod, pikakani	X	-	-	+
Desmodium sandwicense E. Mey.	Spanish clover, ka'imi	X	+	-	-
Erythrina sandwicensis Degener	wiliwili	E	-	+	+
Glycine wightii (Wight & Arnott) Verdc.	glycine	X	+	-	+
Indigofera suffruticosa Mill.	indigo, 'iniko	X	+	+	+

Scientific name	Common name	Status	Vegetation type bwf	Vegetation type 1-c	Vegetation type g
Leucaena leucocephala (Lam.) de Wit	koa-haole	X	-	-	+
Macroptilium lathyroides (L.) Urb.	wild bushbean, cowpea	X	-	+	-
Medicago lupulina L.	black medic	X	+	-	-
Medicago polymorpha L.	bur clover	X	+	-	-
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe	X	-	+	+
Senna pendula (Humb. & Bonpl. ex Willd.) H. Irwin & Barneby		X	+	-	+
LYTHRACEAE (Loosestrife Family)					
Cuphea carthagenensis (Jacq.) Macbr.	tarweed, Colombian cuphea	X	-	-	+
MALVACEAE (Mallow Family)					
Abutilon grandifolium (Willd.) Sweet	hairy abutilon, mao	X	+	+	+
Malva parviflora L.	cheese weed	X	+	+	-
Malvastrum coromandelianum (L.) Garcke	false mallow, hauuoi	X	+	+	+
Sida fallax Walp.	'ilima	I	+	+	+
Sida rhombifolia L.	Cuba jute	X	+	-	-
MELIACEAE (Mahogany Family)					
Melia azedarach L.	Chinaberry, Pride of India, 'inia	X	-	+	+
MENISPERMACEAE (Moonseed Family)					
Cocculus trilobus (Thunb.) DC.	huehue	I	+	-	+
MYRTACEAE (Myrtle Family)					
Psidium guajava L.	guava, kuawa	X	+	-	-
NYCTAGINACEAE (Four-o'clock Family)					
Mirabilis jalapa L.	four-o'clock, naniahiahi	X	-	-	+
ONAGRACEAE (Evening Primrose Family)					
Oenothera stricta Ledeb. ex Link	evening primrose	X	+	-	-

Scientific name	Common name	Status	Vegetation type bwf	l-c	g
OXALIDACEAE (Wood Sorrel Family)					
Oxalis corniculata L.	yellow wood sorrel, 'ihi	P?	+	-	+
PAPAVERACEAE (Poppy Family)					
Argemone glauca (Nutt. ex Prain) Pope	native poppy, pua-kala	E	+	+	-
Bocconia frutescens L.	bocconia	X	-	-	+
PASSIFLORACEAE (Passion Flower Family)					
Passiflora subpeltata Ort.	white passion flower	X	+	+	+
PHYTOLACCACEAE (Pokeweed Family)					
Phytolacca octandra L.	southern pokeberry	X	+	-	-
PLANTAGINACEAE (Plantain Family)					
Plantago lanceolata L.	narrow-leaved plantain	X	+	+	-
PLUMBAGINACEAE (Leadwort Family)					
Plumbago zeylanica L.	'ilihe'e, hilie'e	I	-	-	+
PORTULACACEAE (Purslane Family)					
Portulaca oleracea L.	pigweed, common purslane	X	-	+	+
Portulaca pilosa L.		X	+	-	-
PRIMULACEAE (Primrose Family)					
Anagallis arvensis L.	scarlet pimpernel	X	+	-	-
ROSACEAE (Rose Family)					
Eriobotrya japonica (Thunb.) Lindl.	loquat, biwa	X	-	-	+
Osteomeles anthyllidifolia (Sm.) Lindl.	'ulei, u'ulei	I	-	+	-
Rubus sp.		X	+	-	+
SAPINDACEAE (Soapberry Family)					
Dodonaea viscosa Jacq.	'a'ali'i	I	-	+	-

Scientific name	Common name	Status	Vegetation type bwf	l-c	g
SOLANACEAE (Tomato Family)					
Solanum linnaeanum Hepper & P. Jaeger	apple of Sodom, popolo kikania	X	+	+	-
Nicotiana glauca R.C. Graham	tree tobacco	X	+	-	+
Physalis peruviana L.	poha	X	-	-	+
Solanum americanum Mill.	popolo	I?	+	-	-
STERCULIACEAE (Cacao Family)					
Waltheria indica L.	'uhaloa, hi'aloa, kanakaloa	I?	+	+	+
TILIACEAE (Linden Family)					
Triumfetta semitriloba Jacq.	bur bush	X	+	+	+
VERBENACEAE (Verbena Family)					
Lantana camara L.	lantana, lakana	X	+	+	+
Stachytarpheta dichotoma (Ruiz & Pav.) Vahl	owi, oi	X	+	-	+
Verbena litoralis Kunth	weed verbena	X	+	-	-

Appendix B

Avifauna and Feral Mammals Survey

SURVEY OF THE AVIFAUNA AND FERAL MAMMALS AT DEPARTMENT OF HAWAIIAN HOMELANDS - KULA RESIDENTIAL LOTS, UNIT I, KULA, MAUI

Prepared for

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INTRODUCTION

The purpose of this report is to summarize the findings of a three day (29 August, 28, 29 October 1994) bird and mammal field survey of approximately 655 acres at Kula, Maui (Fig. 1). Also included are references to pertinent literature and unpublished reports.

The objectives of the field survey were to:

1- Document what bird and mammal species actually or potentially occur on the property.

2- Provide some baseline data on the relative abundance of each species.

3- Note the presence or likely occurrence of any native fauna particularly those that are listed as "Endangered" or "Threatened".

4- Determine if the property contains any special or unique resources that if lost or altered by development might result in a significant impact on the native fauna in this region of the island.

SITE DESCRIPTION

This long narrow property extends from 3,000 ft. elevation down to 1,800 ft. The 655 acres contain several habitat types. The higher sections are dominated by Black Wattle. The lower elevation contains Prickly Pear Cactus and Kiawe. Cleared areas along the existing ranch roads and fenceline are in pasture with Kikuyu grass. The topography of this property is steep. No wetland habitat was found on this site.

The weather during the survey was clear and cool. Winds were light. Visual and auditory observation conditions were excellent.

STUDY METHODS

The property was surveyed on foot and by vehicle following existing roads and trails which traverse the property. Field observations were made with the aid of binoculars and by listening for vocalizations.

At scattered locations throughout the site, eight minute counts were made of all birds seen or heard. These data provide the basis for the relative abundance estimates given in Table One. Published reports of birds known from similar habitat on Maui were also consulted in order to acquire a better perspective of the possible fauna that could occur in this region and their potential relative abundance (Pratt et al. 1987, Hawaii Audubon Society 1993). Observations of feral mammals were limited to visual sightings and evidence in the form of scats and tracks. No attempts were made to trap mammals in order to obtain data on their relative abundance and distribution.

Scientific names of birds and mammals used in this report follow those given in Hawaii's Birds (Hawaii Audubon Society 1993); A field guide to the birds of Hawaii and the Tropical Pacific (Pratt et al. 1987) and Mammal Species of the World (Honacki et al. 1982).

RESULTS AND DISCUSSION

Resident Endemic (Native) Birds:

The only endemic native landbird recorded on the survey was the Common Amakihi (*Hemignathus virens*). This species is not listed as endangered or threatened. They are the most abundant and widespread of the native landbirds. Common Amakihi will utilize habitat with second growth introduced plants as well as native forest. A total of ten Common Amakihi were tallied over the course of the field survey. The Short-eared Owl or Pueo (*Asio flammeus sandwichensis*) forage in agricultural fields and pastures as well as in forested upland habitats (Hawaii Audubon

Society 1993). They are frequently seen in Kula and upcountry Maui. None were recorded on this survey, however, I have seen them in this region on past occasions. This species is listed by the State of Hawaii as endangered on the island of Oahu but not on Maui. No other native resident landbirds would be expected on this property.

Migratory Indigenous (Native) Birds:

Migratory shorebirds winter in Hawaii between the months of August through May. Some juveniles will stay over the summer months as well (Johnson et al. 1981, 1983, 1989). The most abundant shorebird species which winters in Hawaii is the Pacific Golden-Plover (*Pluvialis fulva*). Plover forage in open areas such as mud flats, lawns, pastures. plowed agricultural fields and roadsides. Plover are extremely site-faithful and most establish winter foraging territories which they defend vigorously. Such behavior makes it possible to accurately census the plover population in a particular area. These populations likewise remain relatively stable over many years (Johnson et al. 1989). A total 36 plover were recorded on the survey. These birds were seen along the ranch roads and in other open habitats on the site. The only other migrant which may occur in this area is the Ruddy Turnstone (*Arenaria interpres*). Neither the plover nor the turnstone are listed as endangered or threatened.

Resident Indigenous (Native) Seabirds:

No seabirds were recorded nor would any be expected at this location. Predators such as dogs, cats and the Small Indian Mongoose (Herpestes auropunctatus), along with human disturbance inhibit seabird nesting at all but a few isolated locations on the main Hawaiian Islands.

Resident (Native) Waterbirds:

No wetland habitat was found on this property. No waterbirds would be expected at this site. The endangered Nene or Hawaiian Goose (Neochen sandvicensis) occurs at higher elevation in Haleakala National Park. It would be unusual to find them on this property. Nene have been introduced recently to Kauai were they utilize ranchlands and pastures. On Maui they are normally seen at higher elevation in more alpine and subalpine habitat.

Exotic (Introduced) Birds:

A total of 14 species of exotic birds were recorded during the field survey. Table One shows the relative abundance of each. In addition to these species other exotic birds which potentially could occur on the property include: Chukar (Alectoris chukar), Wild Turkey (Meleagris gallopavo), Cattle Egret (Bubulcus ibis), Barn Owl (Tyto alba), Red Avadavat (Amandava amandava) and Red-crested Cardinal (Paroaria coronata) (Pratt et al. 1987; Hawaii

Audubon Society 1993).

Feral Mammals:

Small Indian Mongoose were observed on the survey. Cat tracks were also seen. Axis Deer (Axis axis) were sighted throughout the property. Based on the number of sightings and the abundance of their tracks they must be fairly numerous in this region. Records of the endemic and endangered Hawaiian Hoary Bat (Lasiurus cinereus semotus) on Maui are limited (Tomich 1986; Kepler and Scott 1990). One bat was observed at 1800 hours on 28 October. The bat was foraging over the pasture near Highway 37 at the northeast edge of the property. This species is known to roost solitarily in trees and forages for flying insects using echolocation. They have been reported from a variety of habitats including native forest, alpine habitat, agricultural lands, second growth forest, ranchlands, ponds and bays as well as in urban areas. The life history of this species is not well known. Kepler and Scott (1990) suggest that bats occur on Maui only as a "migrant, probably from the Big Island". Others (Duvall and Duvall 1991), report evidence that would suggest there may be a resident breeding population of bats on Maui.

CONCLUSION

A short field survey can only provide a limited view of the wildlife that may use the site. The number of species and their relative abundance may vary throughout the year due to resource (food, water) availability and reproductive success. Species which are migratory will only be an important part of the faunal picture at certain times during the year. Exotic species sometimes prosper for a time only to later disappear or become a less significant part of the faunal community (Williams 1987; Moulton 1990). Thus only long term studies can provide a comprehensive view of the bird and mammal populations in a particular area. However, some general conclusions related to bird and mammal activity at this site can be made. Below is a summary of the findings of this survey.

1- The site was surveyed by walking and driving the roads and trails which traverse the property. All habitat types found on the property were sampled. Census data on birds were obtained at random locations throughout the property and are reported in Table One.

2- The migratory Pacific Golden-Plover was found on the open pasture lands and along roadsides. This is a typical wintering habitat for this species. Plover are not endangered or threatened.

3- The only native resident bird found on the survey was the endemic Common Amakihi. This species is the most abundant and widespread of the native forest birds. They are not listed as endangered or threatened. The native owl (Pueo) occurs in this region but was not recorded on this survey. They are not endangered or threatened on Maui. The endangered Hawaiian Goose (Nene) occurs at higher elevation in Haleakala National Park. They would be unlikely to occur on this property.

4- The list of exotic birds recorded on the survey (Table 1) was typical for this region of Maui. No unexpected sightings were obtained. None of these species is listed as endangered or threatened.

5- Axis Deer, Small Indian Mongoose and cats were recorded at this site. The endangered Hawaiian Hoary Bat was seen foraging above the pasture lands at the NE edge of the property. The occurrence and abundance of this species on Maui has not been extensively studied.

6- This property has been significantly altered by introduced vegetation and ranching. Nevertheless, native birds and mammals were recorded. I did not find any unique or special resources on this site. Disturbed second growth forest/ranch land is common in this region of Maui.

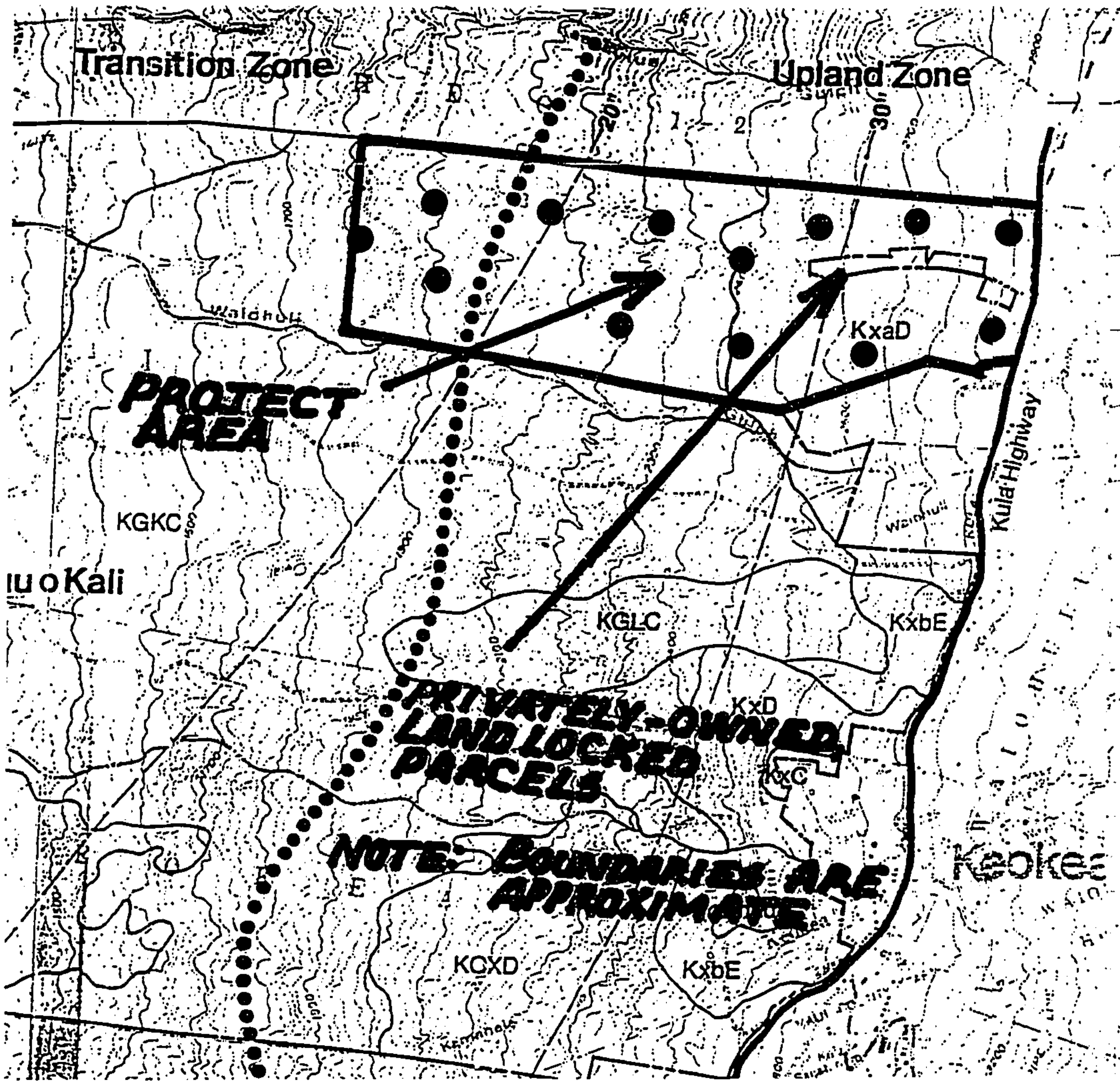

Fig. 1. Location of faunal (bird & mammal) survey with census stations marked as solid circles.

TABLE 1

Exotic species of birds recorded at the Department of Hawaiian Homelands, Kula Residential Lots, Units I, Kula, Maui.

COMMON NAME	SCIENTIFIC NAME	RELATIVE ABUNDANCE*
Ring-necked Pheasant	*Phasianus colchicus*	R = 3
Black Francolin	*Francolinus francolinus*	R = 3
Gray Francolin	*Francolinus pondicerianus*	A =12
Spotted Dove	*Streptopelia chinensis*	C = 7
Zebra Dove	*Geopelia striata*	A =10
Eurasian Skylark	*Alauda arvensis*	A =13
Common Myna	*Acridotheres tristis*	C = 9
Leiothrix	*Leiothrix lutea*	C = 6
Northern Cardinal	*Cardinalis cardinalis*	C = 6
Northern Mockingbird	*Mimus polyglottus*	C = 7
Japanese White-eye	*Zosterops japonicus*	A =10
Nutmeg Mannikin	*Lonchura punctulata*	C = 6
Warbling Silverbill	*Lonchura malabarica*	U = 4
House Finch	*Carpodacus mexicanus*	A =11

*(see page 11 for key to symbols)

KEY TO TABLE 1

Relative abundance = Number of times observed during the survey or frequency on eight minute counts in appropriate habitat.

A = abundant (ave. 10+)

C = common (ave. 5-10)

U = uncommon (less than 5)

R = recorded (seen or heard on one count only or at times other than on 8 min. counts. Number which follows is the total number of individuals seen or heard)

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Appendix C

Archaeological Inventory Survey

Report 442-050289

Archaeological Inventory Survey Keokea and Waiohuli Subdivisions

Lands of Keokea and Waiohuli Makawao District, Island of Maui

PHRI

Paul H. Rosendahl, Ph.D., Inc.

Archaeological • Historical • Cultural Resource Management Studies & Services

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Report 442-050289

Archaeological Inventory Survey Keokea and Waiohuli Subdivisions

Lands of Keokea and Waiohuli Makawao District, Island of Maui

(TMK:2-2-02:55,56)

by

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and

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Prepared for

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November 1989

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SUMMARY

At the request of the Department of Hawaiian Home Lands (DHHL), Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological inventory survey of Keokea and Waiohuli Subdivisions, situated in the Lands of Keokea and Waiohuli, Makawao (Kula) District, Island of Maui (TMK:2- 2-02:55,56). The subdivisions are comprised of 1,025 acres (351 in Keokea and 674 in Waiohuli) and range in elevation from 1,800-3,000 feet AMSL (above mean sea level). The survey field work was conducted between January 17, 1989 and March 30, 1989. During the survey, 159 sites consisting of 274 features were formally designated. Sites consisted of both single and multiple features and included a wide range of formal and functional types. Minor agricultural features in the project areas—which number in the hundreds—were not designated nor documented in detail; they were, however, generally described, and their extents and spatial relationships were plotted.

Waiohuli Subdivision has undergone extensive bulldozing. As a result, sites in Waiohuli are in generally poorer condition than those in Keokea Subdivision. Sites in Keokea are, in most instances, intact, and the area contains excellent examples of extensive agricultural and habitation complexes. Significant resources present in the project areas include heiau, human burials, intact dryland agriculture field systems, and residential complexes. These resources could be adversely affected by the proposed development.

Of the total 159 sites identified during the present survey, 108 are in Keokea and 51 are in Waiohuli. Of the 108 Keokea sites, 94 are assessed as significant solely for information content. Eighty-nine of the 94 sites are recommended for further data collection, and five of the 94 sites are recommended for no further work. Four of the remaining 14 sites are assessed as significant for information content, as an excellent example of a site type, and for cultural value. Further data collection and preservation with interpretive development are recommended for these four sites. Three of the remaining 14 sites are assessed as significant for information content and as an excellent example of a site type. For these three sites, further data collection and preservation with interpretive development are recommended. Another three sites are assessed as significant for information content and for cultural value; these three sites are recommended for further data collection and preservation as is. Three other sites are assessed as significant for information content and are tentatively assessed as

significant for cultural value. These three sites are recommended for further data collection and are provisionally recommended for preservation as is. The last site is assessed as significant for information content and as having cultural value. For this site, further data collection is recommended.

Of the 51 sites in Waiohuli Subdivision, 42 are assessed as significant solely for information content. Thirty-three of these 42 sites are recommended for further data collection, and nine of the 42 sites require no further work. Of the remaining nine sites, three are assessed as significant for information content, as excellent examples of a site type, and as culturally significant. Further data collection and preservation with interpretive development are recommended for these three sites. Two of the remaining six sites are assessed as significant for information content and are provisionally assessed as having cultural value. For these two sites, further data collection is recommended and preservation with interpretive development is provisionally recommended. The final four sites are assessed variously and require various recommended treatments (see Table 7 in Conclusions section for specific recommendations).

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INTRODUCTION

BACKGROUND

At the request of the Department of Hawaiian Home Lands (DHHL), Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological inventory survey of Keokea and Waiohuli Subdivisions, situated in the Lands of Keokea and Waiohuli, Makawao (Kula) District, Island of Maui (TMK:2-2-02:55,56). The overall objective of the survey was to provide information appropriate to and sufficient for satisfying the requirements of Chapter 6E, Historic Preservation, Hawaii Revised Statutes, as amended. Field investigations were conducted between January 17, 1989 and March 30, 1989 under the supervision of PHRI Supervisory Archaeologist Roderick S. Brown, and under the overall direction of PHRI Senior Archaeologist Dr. Alan E. Haun.

SCOPE OF WORK

The basic purpose of an inventory survey is to identify—to discover and locate on available maps—sites and features of potential archaeological significance present within a specified project area. Formerly called a reconnaissance survey and more recently referred to as an inventory survey, the survey comprises the initial level of archaeo- logical investigation. It is extensive rather than intensive in scope, and is conducted basically to determine the presence or absence of archaeological resources within a specified project area. It indicates both the general nature and variety of archaeological remains present, and the general distribution and density of such remains. Finally, it permits a general significance assessment of the archaeological resources, and facilitates formulation of realistic recommendations and estimates for such further work as might be necessary or appropriate. Such work could include intensive survey—data collection involving detailed recording of sites and features, and selected test excavations; and possibly subsequent mitigation—data recovery research excavations, construction monitoring, interpretive planning and development, and/or preservation of sites and features with significant scientific research, interpretive, and/or cultural values.

The significance of all archaeological remains identified within the project areas was to be assessed in terms of the National Register criteria contained in the Code of Federal Regulations (36 CFR Part 60.4). These criteria are used by Department of Land and Natural Resources - Historic Sites Section (DLNR-HSS) to evaluate eligibility for both the Hawaii State and National Register of Historic Places.

The specific tasks for the current inventory survey were as follows:

1. **Documentary Historical Research** - The specific purposes of this work were (a) to locate and summarize readily available relevant documentary resources (books, maps, journals, archival records, and other materials) relating to the ahupuaa and project areas; (b) to integrate and synthesize the findings of this research in order to define prehistoric, early historic, and later historic land use patterns; and (c) to assess the potential for any further research that might be appropriate in connection with subsequent mitigation work required for subdivision development.

2. **Archaeological Background Research** - The specific purposes of this work were: (a) to locate and review all prior archaeological research conducted within the project area ahupuaa; (b) to summarize the past research in terms of the extent and intensity of survey coverage and in terms of the age, function, and distribution of previously identified sites; and (c) to prepare a revised summary of past land use defined on the basis of historical documentary research.

3. **Oral Historical Research** - The specific purposes of this work were: (a) to locate and interview knowledgeable local residents to determine their knowledge of past land use patterns and to elicit information concerning the age and function of specific sites; (b) to summarize and integrate the research findings with those from the historical documentary research and archaeological survey; and (c) to assess the potential for any further research that might be appropriate in connection with subsequent mitigation work required for subdivision development.

4. **Inventory Survey Field Work** - Inventory survey field work was to consist of the following specific tasks: (a) conduct 100% coverage low-level (c. 30-50 ft altitude) aerial reconnaissance (helicopter) of the entire 1,000-acre project area, with special emphasis upon identifying all sites observed and plotting them on aerial photographs and/or maps, and identifying areas devoid of sites (e.g., mechanically altered lands); (b) conduct 100%

coverage, variable-intensity (30- to 90-ft intervals) ground reconnaissance of the entire project area, with relatively higher intensity coverage being given to undisturbed lands and relatively lower intensity coverage to mechanically altered lands; (c) record identified sites, including preparation of scaled sketch plan maps, completion of standardized PHRI site forms, and photographic recordation; and (d) conduct limited subsurface testing when necessary to accurately determine the extent (spatial and/or temporal) of site in order to assess its significance.

5. **Data Analysis and Reports** - Both Interim and Final reports were to be prepared. The Interim report was to summarize (a) the relevant project background, (b) field work completed and findings, (c) preliminary interpretation and evaluation of findings, (d) assessment of potential development impacts upon significant remains, and (e) specific recommendations for any further archaeological work that might be appropriate and/or required. The Final Report was to include (a) the full description of project findings, (b) interpretation and evaluation of these findings, and (c) specific recommendations and justifications for any subsequent mitigation work that might be necessary or appropriate.

PROJECT AREA DESCRIPTION

Both proposed subdivisions are situated on the western slope of Mt. Haleakala, in Makawao (Kula) District, Island of Maui (Figure 1). The Keokea parcel consists of 351.41 acres (142.22 hectares), and the Waiohuli parcel consists of 673.99 acres (272.76 hectares). Combined, the two parcels total 1,025.40 acres (414.99 hectares). Each subdivision comprises the north-central portion of the ahupuaa which bears its name. The parcels are both bounded on the east by Highway 37. The northern and western boundaries of both parcels are fenced. Waiohuli Gulch more or less marks the southern boundary of the Waiohuli parcel. The southern boundary of the Keokea parcel is delineated by a high, stone cattle wall.

Both parcels are characterized by gentle to moderately steep west-facing dissected alluvial and volcanic slopes. Elevation in the Keokea parcel ranges from 2,225-2,850 ft AMSL, and in the Waiohuli parcel ranges from 1,800-3,000 ft AMSL. Drainages in the Keokea parcel are small and, for the most part, are poorly defined. Three large gulches extending east to west dissect the Waiohuli parcel; the gulches are fed by many smaller channels which drain the intervening slopes. Soils over all of the Keokea parcel and the eastern majority of the Waiohuli parcel are well-drained, with medium to moderately fine-textured subsoils of the Pu'u Pa-Kula Pane association. The eastern periphery of the Waiohuli parcel is overlaid with well-drained very stony soils and fine- to medium-textured subsoils of the Keawakapu-Makena association (Foote et al 1972). The soils in both parcels are derived from decomposed lava flows and ash of the Kula and Hana Volcanic Series which are, respectively, eight and four hundred thousand years old.

Both parcels are dominated by introduced vegetation including black wattle (*Acacia decurrens* Willd.), Christmas-berry (*Schinus terebinthifolius* L.), lantana (*Lantana camara* L.), prickly pear or panini (*Opuntia megacantha* Salm-Dyck), koa-haole (*Leucaena glauca* L.), kiawe (*Prosopis pallida* L. Benth), grasses dominated by Kikuyu grass (*Pennisetun clandestinum* Hochst) and Chinaberry (*Melia azedarach* L.). Endemic vegetation includes abundant ilima (*Sida* spp.) and occasional wiliwili (*Erythrina sandwicensis* Degener).

Black wattle forests dominate the eastern halves of both parcels, probably as a result of the extensive and recurrent ground disturbance associated with recent habitation in higher elevations. Lantana is a dominant plant in the lower western portions of both parcels. Lantana is almost impenetrably dense in western Keokea where it is interspersed by occasional prickly pears. In western Waiohuli, lantana and prickly pear co-dominate and impair movement and visibility.

PREVIOUS ARCHAEOLOGICAL WORK

The only early previous archaeological work conducted in the project area was by Thrum (1907) and Walker (1931). Thrum included Papakea, Kaumeheiwa, and Molohai heiau on a list of Maui heiau sites he compiled in the early decades of this century . Later, the three heiau were placed on the Hawaii Register of Historic Places. Walker listed and described 26 heiau in the Kula region.

In 1986, DHHL contracted B.P. Bishop Museum to monitor trailblazing for subdivision fences and to conduct an archaeological reconnaissance survey of both of the present proposed subdivisions (Riford 1987). This effort resulted in the discovery of 113 archaeological sites and "more than 252 archaeological features." During the study, the above-mentioned heiau and a diversity of prehistoric and historic agricultural, residential, and ceremonial sites were recorded. The survey focused on areas where residential lot awards are proposed. More than 410 acres of the total c. 1,025 acres comprising the project area were not examined during that survey.

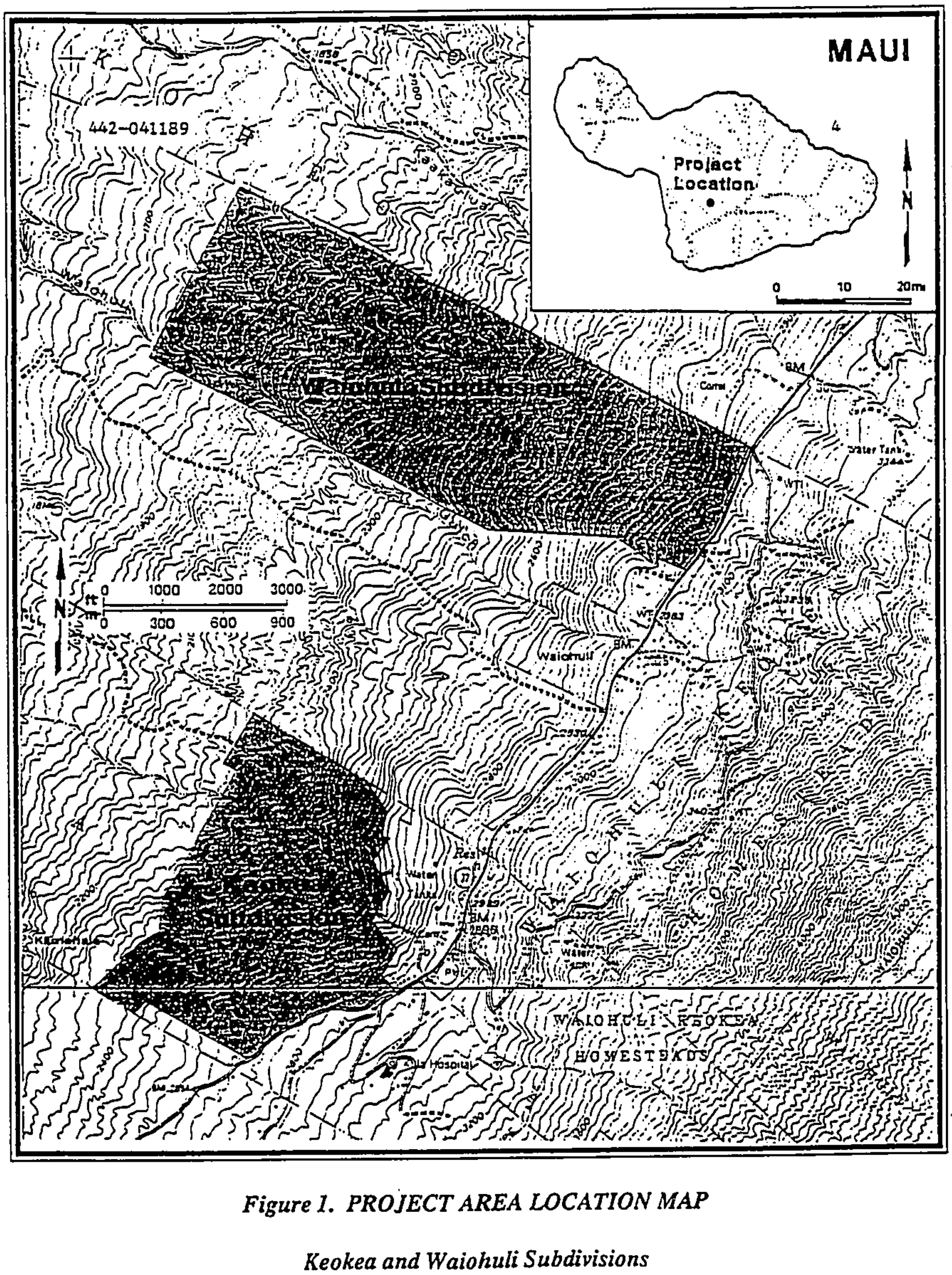

Figure 1. PROJECT AREA LOCATION MAP

Keokea and Waiohuli Subdivisions
Lands of Keokea and Waiohuli, Makawao District, Island of Maui
(TMK:2-2-02:55,56)
PHRI Project No. 88-442 April 1989

SUMMARY OF LIMITED HISTORICAL DOCUMENTARY RESEARCH AND INFORMANT INTERVIEWS

The complete limited historical documentary research for the present project was conducted by PHRI Research Historian Helen Wong Smith, B.A.. Her report includes information obtained from the usual historical sources found in libraries, and information from other sources such as land and tax records, archaeological reports, maps, and various other manuscripts. The information in Wong's report is organized into five sections: Early Historical Accounts, Heiau in the Project Area, Land Commission Award (LCA) Information, Land Use and Tenure Information, and Informant Interviews.

Early accounts concerning the Makawao District generally either describe the area or relate early historical events. Ashdown (n.d.)* writes, "kula-o-ka-ma'o-ma'o or Land of Mirages, where lost souls wandered until they could find their way to rest. The rain of Makawao is described by Mrs. Miverva Kalama to Sterling (n.d.) in this way: "'ukiu rain = a soft drizzle (the ua Kama'aina of Makawao) when the kiu rain cloud from Makawao meets the Naulu rain cloud from Kula then the rain comes, the typical Makawao rain. Other early accounts, by Fornander and Kamakau, mention Makawao in relation to early historical events.

Three heiau are present in Keokea project area—Molohai, Papakea, and Kaumiumimua heiau. Ashdown (1971:46) mentions other heiau in Keokea and Waiohuli—Ho'ola and Ho'oula Ua heiau in Keokea and Kaimupeelua heiau in Waiohuli. Other heiau mentioned by historic writers in the Makawao district include Kailua heiau (Thrum 1909:44), and Pa'uhu, Mahea, Kaumuopahu (or Kaunuopahu), Po'onahoehoe and Mana heiau. The latter heiau is now part of a modern cemetery (Ashdown 1971:57).

Although there were many small parcels granted in Keokea and Waiohuli, the Indices states that Keokea was Crown Land from the beginning and that Waiohuli was approved as such in 1890 by Kalakaua. The numerous parcels may be a result of an experiment conducted by the Kamehameha III's administration prior the Great Mahele concerning trial fee ownership runs. In a report by Riford (1987), 11 Land Commission Awards (LCA) either within or bordering the Keokea parcel and eight LCAs within the Waiohuli parcel are listed. The bulk of the parcels are designated as kula land and houselots (1987).

Concerning land use and tenure, Kula has been used primarily for agriculture throughout history. C. Speakman, in his book entitled MOWEE mentions the fervor of cash-cropping in Kula:

> During the gold [potatoes] rush, hundreds of Hawaiians were going into business for themselves on Maui-growing potatoes and hauling them to the port where they were snapped up and shipped to San Francisco. The Maui fields were called Nu Caliponi, or New California; potatoes were gold, and a fortune could be dug out of the ground by one man (1978:116).

In addition to Irish potatoes, the Kula farmers planted corn, beans, onions, Chinese cabbage, round cabbage, sweet potatoes, wheat and other grains, and even cotton. In the early 1970s, 35% of Hawaii's vegetables were grown in Kula, including a large percentage of the state's head lettuce, dry onions, and tomatoes. Much of the remaining land was devoted to livestock breeding by about 20 full and part-time ranchers. Today the cash crops in Kula are vegetables other than corn and potatoes, and flowers.

Wong's report includes information on Kula Sanatorium, and also includes informant interviews. Kula Sanitorium was founded for the care of tuberculosis sufferers. Initially the sanitorium consisted of two tent-houses which accomodated 12 patients. The tent-houses, which included kitchen and dining facilities, was financed by the County and Territory and cost $500.00. The first permanent ward was built by W.E. Foster, former patient and superintendent. Wong's informant interviews provide information primarily on Kaonoulu Ranch, for which the interviewees once worked.

According to Wong, during this century, the project area has been used primarily for cattle grazing, hence the many archaeological sites obscured by grasses and lantana. If further historical documentary research is conducted for the project area, Wong suggests that a check be made for awards given out during the Kingdom of Hawaii and that the following topics be addressed: prehistoric environment and occupation in the area, as evidenced by historical documents; and local and regional cultural and residential sequences.

* References in summary are listed in Appendix C.

METHODS AND PROCEDURES

Field Work

The current field work was accomplished in five phases: preliminary field inspection, aerial (helicopter) survey, variable-intensity pedestrian survey, site recording, and limited surface collections and excavations.

Preliminary Field Inspection - PHRI Senior Archaeologist Dr. Alan E. Haun conducted a preliminary field inspection of portions of both Waiohuli and Keokea subdivisions in order to assess the project area terrain and vegetation with regard to logistical problems which might be faced by survey crews. In addition, Dr. Haun visited several previously recorded archaeological sites in each subdivision to evaluate the adequacy of existing archaeological records.

Helicopter Survey - On January 11, 1989, a low-level (30-50 ft. altitude) aerial reconnaissance survey was made of approximately 60% of both subdivisions. The areas surveyed included all portions of the project areas not obscured by black wattle forests (thus, eastern upslope portions were not examined aerially). Thirty-eight archaeological sites and/or features were identified from the air—34 in the Keokea parcel and four in the Waiohuli parcel. Each site/feature was flagged with weighted pink surveyor's tape, was labeled with a temporary aerial survey (AS) number, and was plotted on 1"=200' aerial photographs. A brief and very preliminary description of each site was recorded during the flight; these descriptions were upgraded during the subsequent variable-intensity 100% survey and recording phases of the field work.

Variable - Intensity 100% Coverage Ground Survey - The variable intensity ground survey began on January 17, 1989 and was completed on February 22, 1989. A crew of five archaeologists supervised by PHRI Supervisory Archaeologist Roderick S. Brown swept the entirety of both proposed subdivisions. Transects were spaced at 15-40 meter intervals. Transect spacing was determined exclusively by the surface integrity of the area being transected. In areas where no mechanical or erosional disturbance was evident, the survey interval was maintained at 15 meters. In disturbed areas the interval was increased to as wide as 40 meters. Surveyors were instructed to walk zigzag courses to search first for "islands" of undisturbed ground, and then to search within these "islands" for archaeological sites. The zigzagging resulted in an estimated maximum effective survey interval of 30 meters.

Locational control was maintained by plotting the course of each sweep on aerial photographs and/or 1"=200'scale topographic maps, and by marking each archaeologist's start and end points on each sweep with labeled surveyor's tape. As sites and features were encountered, each was marked with pink-and-blue surveyor's tape on which was labeled the project number (88-442), a temporary site number, and the date and name of the surveyor on whose transect the site was discovered. Each site was described in a field notebook at the time of discovery and was plotted on 1"=200' aerial photographs. Notation was made as to whether the site bore the (sometimes labeled) orange flagging with which some sites were marked by the Bishop Museum survey crew. Also noted were the direction and distance to nearby DHHL lot corner markers (where they existed) and the presence of aerial survey site markers.

Site Recording - Site recording began on February 22, 1989, immediately after the variable-intensity ground survey was completed. To facilitate the recording, two archaeologists were added to the field crew. The crew was divided into two teams of three persons each—one recorder, one mapper, and a rover, who measured, photographed, and described features and marked each site with an aluminum tag and flagging. Sites were recorded on standard PHRI site and feature forms. Scaled sketch maps were prepared of representative features and/or of the overall site configuration. Vegetation hampered visibility of, and even access to, some features, but the majority of features were adequately recorded.

During the pedestrian survey, sites and features were numbered as they were encountered. The numbering systems in each subdivision are independent. Temporary site numbers are prefixed by either "W-" (for Waiohuli) or "K-" (for Keokea). Site features were assigned letter designations (A,B,C,etc.).

During the pedestrian survey some sites of questionable nature were numbered. In some instances, subsequent examination of the questionable sites indicated they were natural or the result of recent ground disturbance; hence, the site was eliminated from site lists. Other sites were preliminarily recorded as separate entities and later were combined with other nearby sites and subsumed under a single site number. When sites were combined, the lowest site number was retained and other numbers were deleted; hence, the gaps in the numbering sequence. During the recording phase, many previously undiscovered sites were identified and were assigned numbers.

Data Management

Data management, cartography, and report production were computerized. Preliminary site and feature data gathered during the ground survey were entered from the field notebooks into formatted dBASE IV files. Output from these preliminary files included formatted listings of site and feature information and direct electronic input of site location coordinates [easting (X), northing (Y) and elevation (Z)] to the computer-aided drafting program. Output of these data allowed recording crews to return to sites with printouts containing preliminary site descriptions and with contour maps illustrating the locations of the sites to be recorded.

Soon after the recording of each site and feature, the data were entered into dBASE IV files. These data files were formatted to allow direct output of revised site and feature location maps and the extraction of selected data in tabular format for inclusion in the Interim and Final reports. In addition, report-ready site survey records and site/feature descriptions were generated from the data files.

FINDINGS

ARCHAEOLOGICAL SITES

During previous archaeological surveys of Waiohuli and Keokea subdivisions (Riford 1987), 113 sites consisting of 252 component features were identified. Three of the 113 sites, all heiau, were assigned SIHP* site numbers—Papakea Heiau (50-50-10-1036), Molohai Heiau (50-50-10-1037) and Kaumeheiwa Heiau (50-50-10-1039). The remaining 110 sites were assigned temporary numbers. As part of the present work, the work on the earlier survey was consulted. It was found that records for 77 of the previously identified sites were incomplete. In addition, when an attempt was made to relocate the earlier sites in the field, definite field identifications were often impaired by unclear locational information in the report and by the lack of site markers in the field.

The present survey resulted in the formal identification of 159 sites consisting of 274 features. During the present survey, 53 previously identified sites were relocated. These sites were reassigned PHRI temporary numbers. Table 1 correlates previously identified sites with PHRI temporary site numbers. Figures 2 and 3 depict the locations of all identified sites. Appendices A and B summarize the sites and their component features. Appendices D and E provide detailed descriptions for each site and feature.

Appendices D and E include for each site:

1. Site numbers - either State Inventory of Historic Places (SIHP) numbers, Bishop Museum temporary numbers, if previously assigned, or PHRI temporary site numbers. PHRI temporary numbers are one, two, and three-digit numbers prefixed by "K-" or "W-";

2. A site type designation - provides formal feature type for sites consisting of a single feature, or designates the site as a complex if site includes more than one feature. Also lists total number of features present;

3. A description of site topography - a brief description of the terrain in the area of the site;

4. A listing of site vegetation - lists principal components of the vegetation within and in the vicinity of the site;

5. A statement of site condition - overall state of preservation of the site (poor, fair, good, or excellent);

6. An assessment of site integrity - degree of historic modification by human agencies (unaltered, partially altered, and completely altered) and nature of modifications, if any;

7. A probable age - indicates probable/possible age of the site (i.e., historic or prehistoric);

8. A functional interpretation - probable or possible (*) functions for each site; or, if function cannot be determined, assigns indeterminate function. For sites with multiple functions, functions separated by "/";

9. Feature dimensions - maximum length, width, and maximum area. Dimensions immediately followed by a description of feature construction, associated portable remains, and other descriptive information; and

10. A site description - a brief overall description of the site listing types of constituent features, portable remains present, if any, and other site data.

Appendix F provides UTM coordinates, elevations, and proximity to water for all sites.

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* State Inventory of Historic Places (SIHP) site designation system: all four-digit site numbers prefixed by 50-50-10 or 50-50-14 (50=State of Hawaii, 50=Island of Maui, 10 or 14=USGS 7.5' series quad map ["Puu o Kali" or "Makena," respectively]).

Table 1.

CORRELATION OF SITE NUMBERS

PHRI Temporary Number	BPBM Site Number (T-)	SIHP Site Number
W- 1	—	2344
W- 2	6	2345
W- 3	7	2039
W- 4	8	2346
W- 5	—	2347
W- 6	—	2348
W- 8	—	2349
W- 10	—	2350
W- 11	5	2040
W- 12	—	2351
W- 13	—	2352
W- 14	—	2353
W- 15	—	2354
W- 17	—	2355
W- 18	—	2356
W- 20	—	2357
W- 21	—	2358
W- 27	36	~~1039~~ 2041
W- 28	—	2042
W- 30	110	2359
W- 31	—	2360
W- 32	—	2361
W- 35	105	2362
W- 36	—	2043
W- 37	104	2363
W- 42	75	2364
W- 45	72	2044
W- 46	71	2365
W- 47	107	2366
W- 48	108	2367
W- 49	—	2368
W- 55	—	2369
W- 57	—	2370
W- 58	—	2371
W- 59	81	2372
W- 60	—	2373
W- 65	—	2374
W- 67	—	2375
W- 71	101	2376
W- 73	—	2377
W- 75	86-87	2378
W- 77	—	2379
W- 80	—	2380
W- 82	—	2381

Table 1. (cont.)

PHRI Temporary Number	BPBM Site Number (T-)	SIHP Site Number
W- 83	—	2382
W- 88	—	2383
W- 90	—	2384
W- 96	—	2385
W- 97	—	2386
W- 98	69-70*	2387
W-101	—	2388
K- 1	15	2046
K- 2	16	2047
K- 3	14	2028
K- 4	19	2048
K- 5	—	2049
K- 6	—	2029
K- 7	22	2030
K- 8	—	2050
K- 9	38	2051
K- 10	—	2052
K- 11	39	2053
K- 12	—	2054
K- 13	—	2055
K- 14	—	2056
K- 16	—	2057
K- 19	—	2058
K- 20	—	2059
K- 21	—	2060
K- 25	—	2061
K- 26	64	2062
K- 27	62	2063
K- 29	63	2064
K- 30	—	1037
K- 31	13	2065
K- 32	—	2066
K- 35	—	2067
K- 36	—	2032
K- 39	—	2068
K- 40	—	2069
K- 41	—	2070
K- 42	—	2071
K- 44	—	2072
K- 45	60	2073
K- 46	60	2074
K- 48	61-17-58	2033
K- 50	—	2075
K- 51	—	2076
K- 52	31	2077

Table 1. (cont.)

PHRI Temporary Number	BPBM Site Number (T-)	SIHP Site Number
K- 53	—	2078
K- 54	30	2079
K- 55	—	2080
K- 57	—	2081
K- 59	—	2082
K- 60	—	2083
K- 62	—	2084
K- 63	—	2085
K- 64	—	2034
K- 65	—	2086
K- 69	37	2087
K- 70	27	2088
K- 71	—	2089
K- 76	—	2090
K- 78	—	2091
K- 79	—	2092
K- 80	46	2093
K- 81	—	1036
K- 84	55	2095
K- 85	—	2096
K- 87	25	2097
K- 89	—	2098
K- 90	—	2099
K- 95	—	2300
K- 96	—	2301
K- 97	—	2302
K- 98	—	2303
K- 99	3	2304
K-100	—	2305
K-101	24	2306
K-102	—	2307
K-103	56	2308
K-105	—	2035
K-106	—	2310
K-107	—	2311
K-108	—	2312
K-109	49	2313
K-110	48	2314
K-111	—	2036
K-112	43	2315
K-115	42	2316
K-116	41	2317
K-118	—	2318
K-120	40	2319
K-124	—	2037
K-127	—	2320

Table 1. (cont.)

PHRI Temporary Number	BPBM Site Number (T-)	SIHP Site Number
K-130	—	2038
K-131	—	2321
K-134	—	2322
K-135	—	2323
K-137	—	2324
K-140	—	2325
K-142	—	2326
K-143	—	2327
K-146	—	2328
K-148	—	2329
K-149	—	2330
K-152	—	2331
K-200	—	2332
K-201	—	2333
K-202	—	2334
K-203	—	2335
K-204	—	2336
K-205	—	2337
K-206	1	2338
K-207	45	2339
K-208	—	2340
K-209	—	2341
K-210	—	2342
K-211	—	2343

Of the 159 sites identified, 61 were complexes (sites consisting of more than one feature). In Waiohuli, nine complexes comprised of 21 features were identified, and in Keokea 52 complexes comprised of 156 features were identified. Ninety-eight of the identified sites consisted of single features (42 in Waiohuli and 56 in Keokea). Feature types present at sites include: wall, enclosure, terrace, mound, overhang, upright, wall, lithic scatter, alignment, cave, platform, bridge, and burial. Table 2 lists the frequencies of formal feature types recorded.

Probable functional interpretations were made for most sites. Site functions included: agricultural, habitation, religious, animal (cattle) control, burial, transportation, storage, roadway, lithic reduction, and indeterminate. The frequencies of functional site types are listed in Table 3. Sites were interpreted as habitation sites if they appeared to have been permanent or semi-permanent residences. Habitation sites are those which include archaeological features traditionally associated with dwellings. In the project area, habitation features include enclosures, platforms, terraces, and C-, L-, and U-shaped walls. No sites in the project area were interpreted as temporary habitation sites; however, several sites did include features traditionally associated with temporary habitation—such as C-, L-, and U-shaped walls and overhang shelters. Also, no habitation sites in the project area were "open" sites—habitation sites not associated with stone architecture. This was because such open sites, if they existed, would have been manifested by surface exposures of midden, artifact scatters, and soil discolorations—none of which were likely to have been seen through the dense vegetative cover which characterizes most of both subdivisions.

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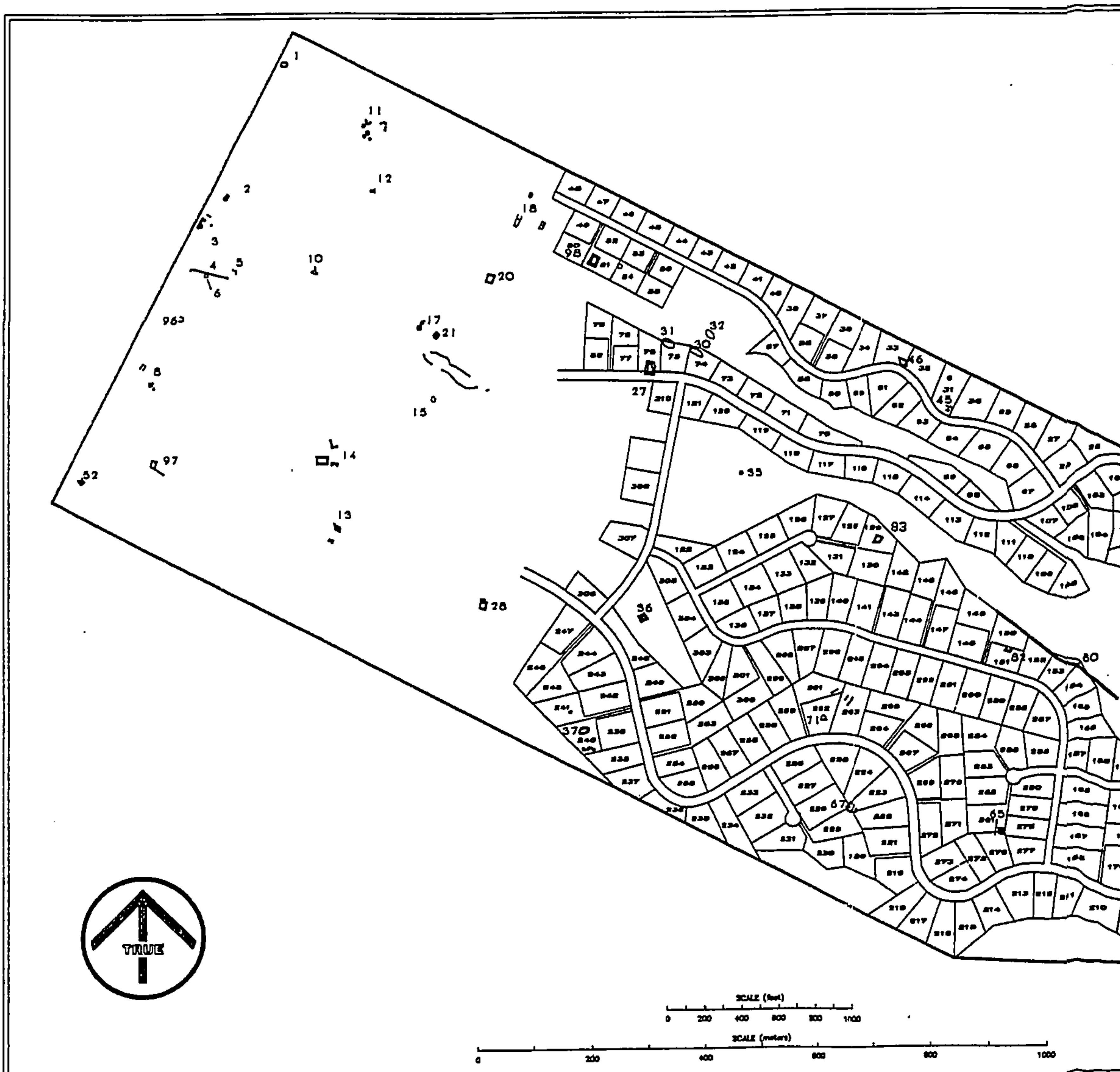

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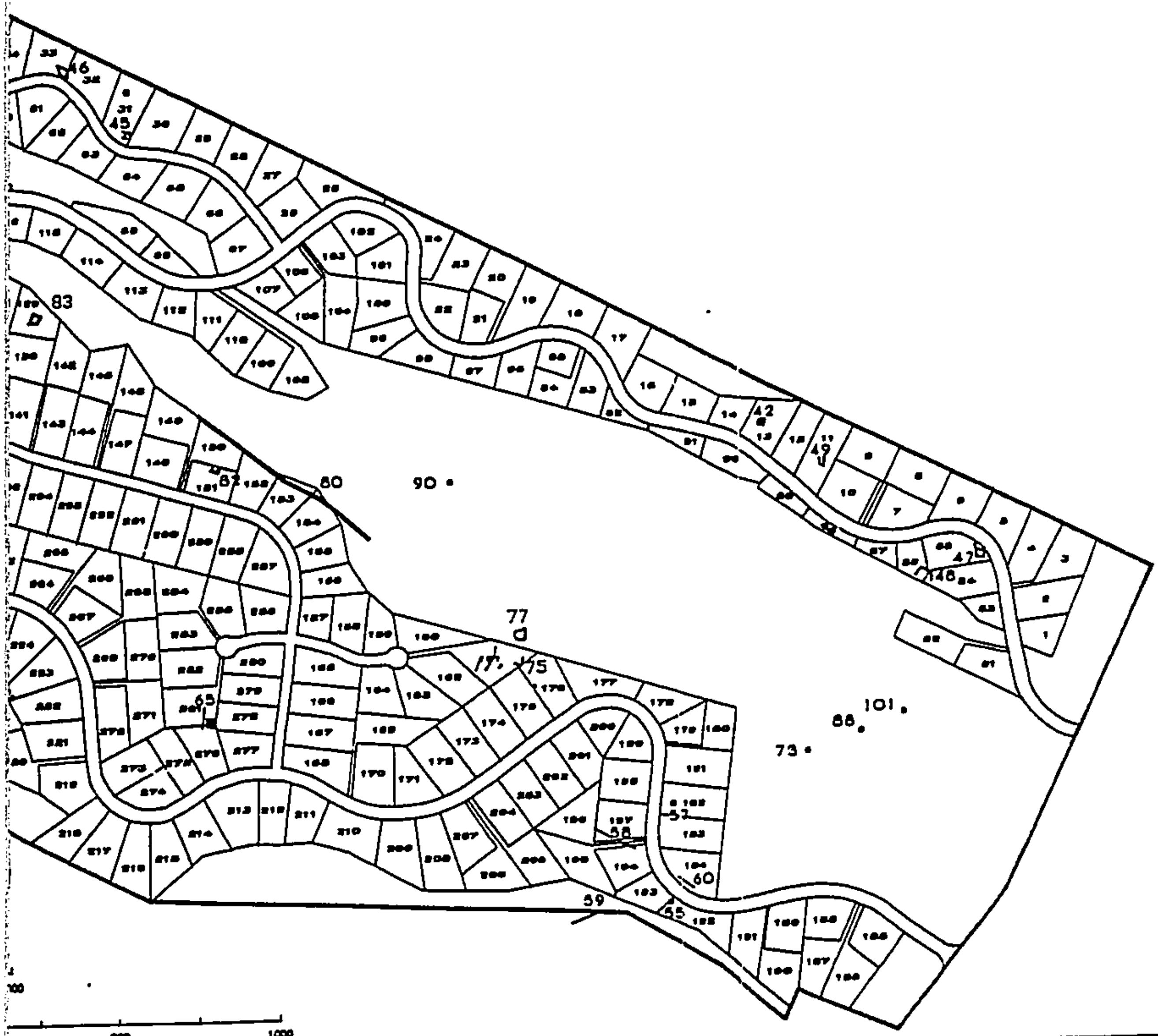
LEGEND

SITE NUMBERS - PHRI TEMPORARY SITE NUMBERS PREFIXED BY 'W-'

A
Ke

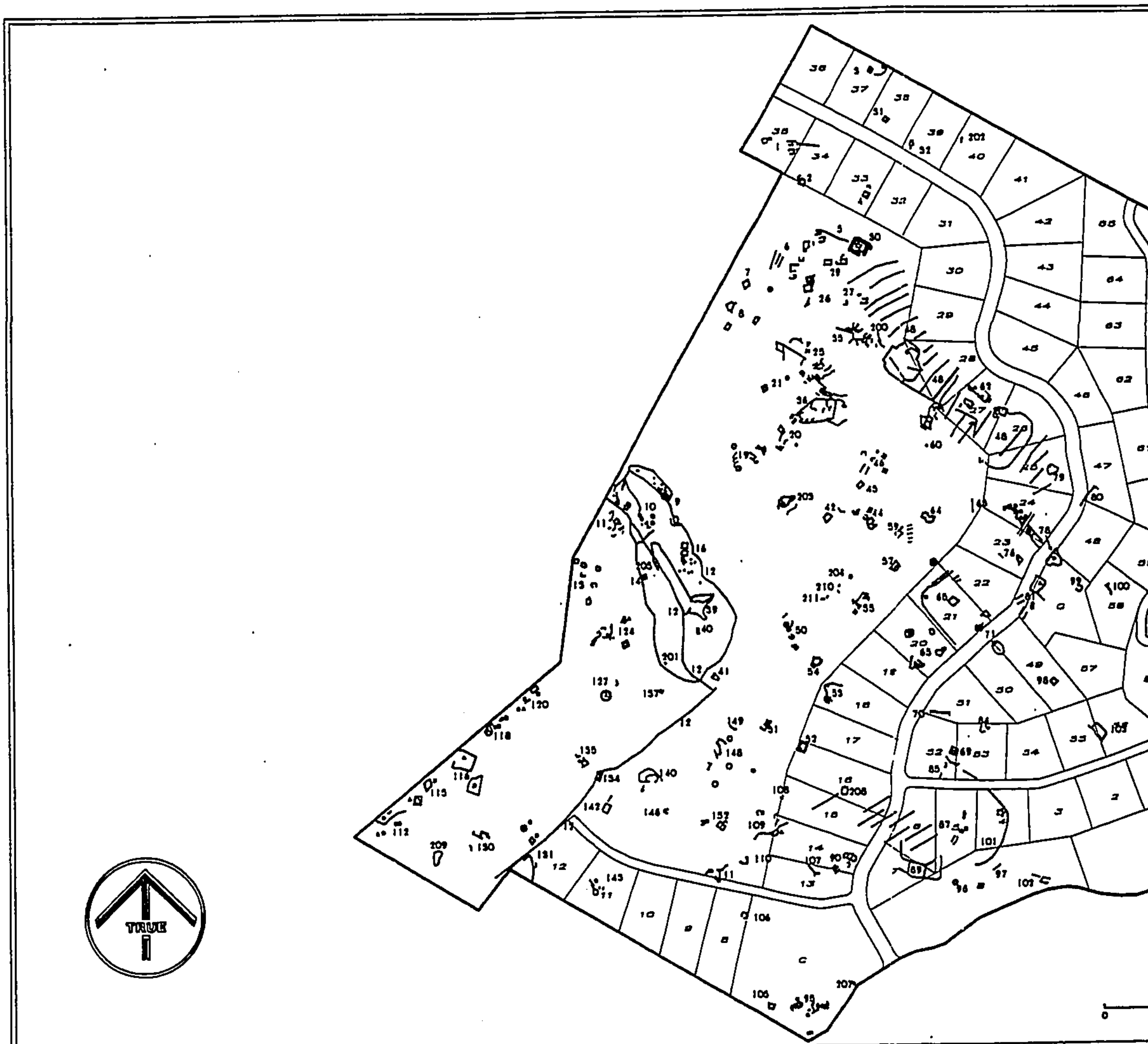


PORARY SITE NUMBERS PREFIXED BY "W"

Archaeological Inventory Survey
Keokea and Waiohuli Subdivisions
PHRI Project No. 88-442

FIGURE 2.
Site Location Map
Waiohuli Subdivision

442-050289



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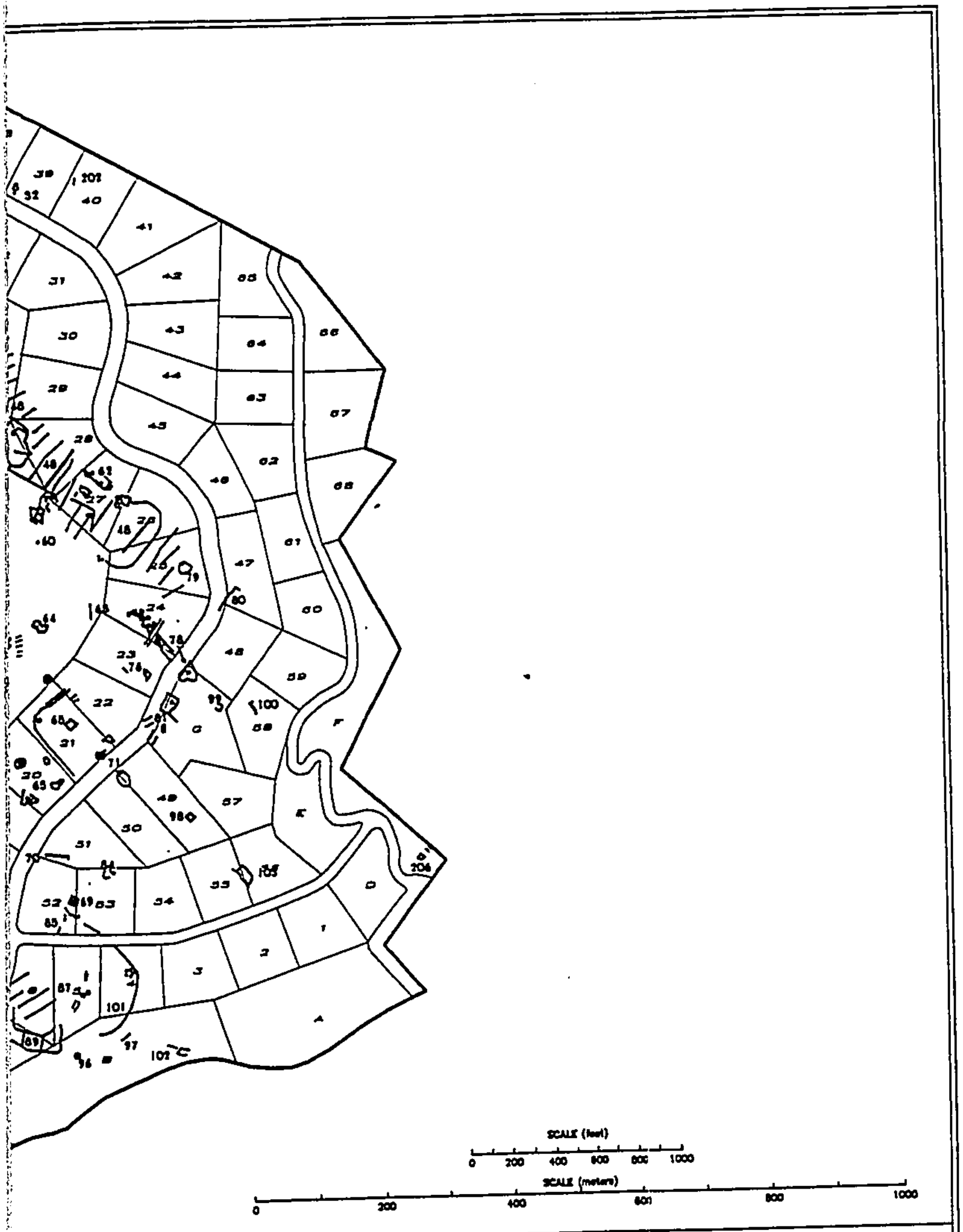
LEGEND

SITE NUMBERS • PHRI TEMPORARY SITE NUMBERS PREFIXED BY 'K'

Archaeo
Keokea
PHR



SITE NUMBERS PREFIXED BY 'K-'

Archaeological Inventory Survey
Keokea and Waiohuli Subdivisions
PHRI Project No. 88-442

FIGURE 3.
Site Location Map
Keokea Subdivision

Table 2.

FREQUENCIES OF FORMAL FEATURE TYPES

Formal Type	Number	Percent
WAIOHULI		
Alignment	1	1.59
Bridge	1	1.59
Human Bone	1	1.59
Cave	1	1.59
Enclosure	30	47.62
Lithic Scatter	1	1.59
Mound	4	6.35
Overhang	3	4.76
Platform	1	1.59
Terrace	5	7.94
Upright	2	3.17
Wall	13	20.63
WAIOHULI TOTAL:	63	100.00%
KEOKEA		
Cairn	1	0.47
Enclosure	139	65.88
Heiau	1	0.47
Lava Tube	2	0.95
Lava Tube Enclosure	1	0.47
Mound	3	1.42
Overhang	21	9.95
Paved Area	1	0.47
Platform	6	2.84
Sink	1	0.47
Stone	1	0.47
Structure	1	0.47
Terrace	17	8.05
Wall	16	7.58
KEOKEA TOTAL:	211	100.00%

Nine sites were interpreted as religious or possibly religious, and 10 were interpreted as burials or potential burials. These include the previously recorded heiau, notched-rectangular enclosures, features with free-standing uprights and/or coral, large stepped and paved terraces, and features known or suspected to contain human remains. Several sites in the vicinity of Molohai Heiau in Keokea (a likely candidate for interpretation as an ahupuaa-level heiau) include a relatively high density of features tentatively assigned a religious function. Among these are Sites K-2, -3, -6, -29, and -48. In addition, many large and probably high-status residential features, densely clustered agricultural features, and other features were found proximate to the heiau. For example, nearby Site K-78 consists of a series of stepped, paved terraces extending for more than 120 meters; the site may be a heiau (ili level?). In addition, the land between K-78 and Molohai Heiau—very much like what persists throughout the Keokea subdivision and nearby surrounding lands—is regularly terraced and includes at least six large features.

Table 3.

FREQUENCIES OF FUNCTIONAL SITE TYPES

Formal Type	Number	Percent
	WAIOHULI	
Agriculture	8	15.69
Animal Control	5	9.80
Burial*/Ag.	1	1.96
Habitation/Ag.	23	45.10
Burial	2	3.92
Indeterminate	2	3.92
Lithic Reduction	1	1.96
Religious	1	1.96
Religious*	1	1.96
Religious*/Hab.	3	5.88
Transportation	3	5.88
Habitation	1	1.96
WAIHOULI TOTAL:	51	100.00%
	KEOKEA	
Agricultural	5	4.63
Animal Control	6	5.55
Animal Control/Ag.	3	2.78
Burial*/Hab./Ag.	3	2.78
Burial	1	0.93
Burial/Habitation	2	1.85
Burial/Ag.	1	0.93
Tool Manufacturing	1	0.93
Habitation	22	20.37
Habitation*/Ag.	1	0.93
Habitation/Ag.	48	44.44
Habitation*/An. Cont.	1	0.93
Habitation/Indeterminate	1	0.93
Habitation/Ag./An. Cont.	4	3.84
Indeterminate	2	1.85
Religious*/Ag.	1	0.93
Religious/Hab./Ag.	1	0.93
Religious*/Hab./Ag.	1	0.93
Religious	1	0.93
Temp. Habitation	1	0.93
Temp. Hab./Ag.	1	0.93
Water Tank	1	0.93
KEOKEA TOTAL:	108	100.00%

* Tentative Function

One hundred thirty-nine enclosures were identified in Keokea Subdivision of which 127 were tentatively assigned a habitation function. This is a density of one major habitation feature for every 2.76 acres. Walls were found throughout both subdivisions. These varied in thickness, height, and construction. The historical documentary research for the present project suggests that most walls were built within the last century. Indeed, the majority of the walls appear to have been constructed in historic times to control ranging cattle.

During the present project, two extensive wall complexes of probable historic origin were recorded (W-4 and K-12). Site W-4 consists of a series of walls and wall segments bordering both sides of the northernmost large gulch in Waiohuli; these walls and segments apparently served to keep cattle out of portions of the gulch. Site K-12 consists of a meandering series of long and substantial walls situated in the southwest portion of Keokea subdivision. K-12 includes the long straight wall which marks the southern boundary of the Keokea project area. Aside from barbed wire and occasional posts in and associated with Site W-4, no historic artifacts were found in association with the walls.

Extensively scattered throughout both subdivisions were hundreds of minor agricultural features (mounds and terraces) which were found associated with most of the recorded sites. Most of these features were not formally recorded; instead, their distributions were plotted (Figure 4) and they were referred to in the records of formally recorded sites as being present in the site area. Recorded sites not associated with minor agricultural features were exclusively those found in areas where mechanical ground alteration had almost certainly obliterated them. This is particularly true in Waiohuli where perhaps 50% of the surface of the subdivision has been bulldozed. In the Waiohuli parcel, major residential features may have been bulldozed; this would account for the low density of sites in that subdivision, however, it is clear that the bulldozer operator made occasional attempts to avoid them.

The spatial associations between the various formal and functional feature types in Waiohuli have been so thoroughly obscured by ground disturbance that, aside from focusing on a few small locales, any attempt to analyze site and feature distributions can be expected to yield very limited and unreliable results. This does not hold true in the Keokea subdivision where recent mechanical disturbance is primarily limited to areas along the eastern subdivision boundary and along the few roads which traverse the subdivision.

In Keokea, several of the residential features showed signs of having been disassembled in order to use their stones for *building materials (Sites K-52 and K-90)*. In both Keokea (Site K-107) and Waiohuli (Site W-90), there was evidence that stone walls at the entrances to burial caves had been removed.

LIMITED SURFACE COLLECTIONS

Surface collection was limited to the recovery of four artifacts considered threatened by either collection by amateurs or displacement by natural forces. The artifacts were all indigenous Hawaiian types—a small polished basalt adze, a retouched, utilized basalt core, a retouched basalt flake tool, and a scoria abrader.

LIMITED TEST EXCAVATIONS

Limited test excavations were undertaken to recover charcoal for radiocarbon dating and to assess the depth and constituents in cultural strata at selected features. The features excavated included a sample of the major formal feature types present. Nineteen test excavations (12 in Keokea and seven in Waiohuli) were conducted. Each excavation was taken down to a maximum depth of 50 cmbs (centimeters below surface) or to sterile soil. The test excavations yielded ecofactual material and 112 artifacts, including abraders, a flaked lithic tool, and flaked lithic debitage. The ecofactual materials included medium mammal, small mammal bone, fish bone, marine shell, kukui (*Aleurites moluccana* [L.] Willd.), gourd, and floral remains. Twelve of the excavation units (at 12 separate features) yielded marine faunal remains. Nine units yielded terrestrial faunal remains. The test units also yielded radiocarbon samples, of which 17 were submitted for dating analysis.

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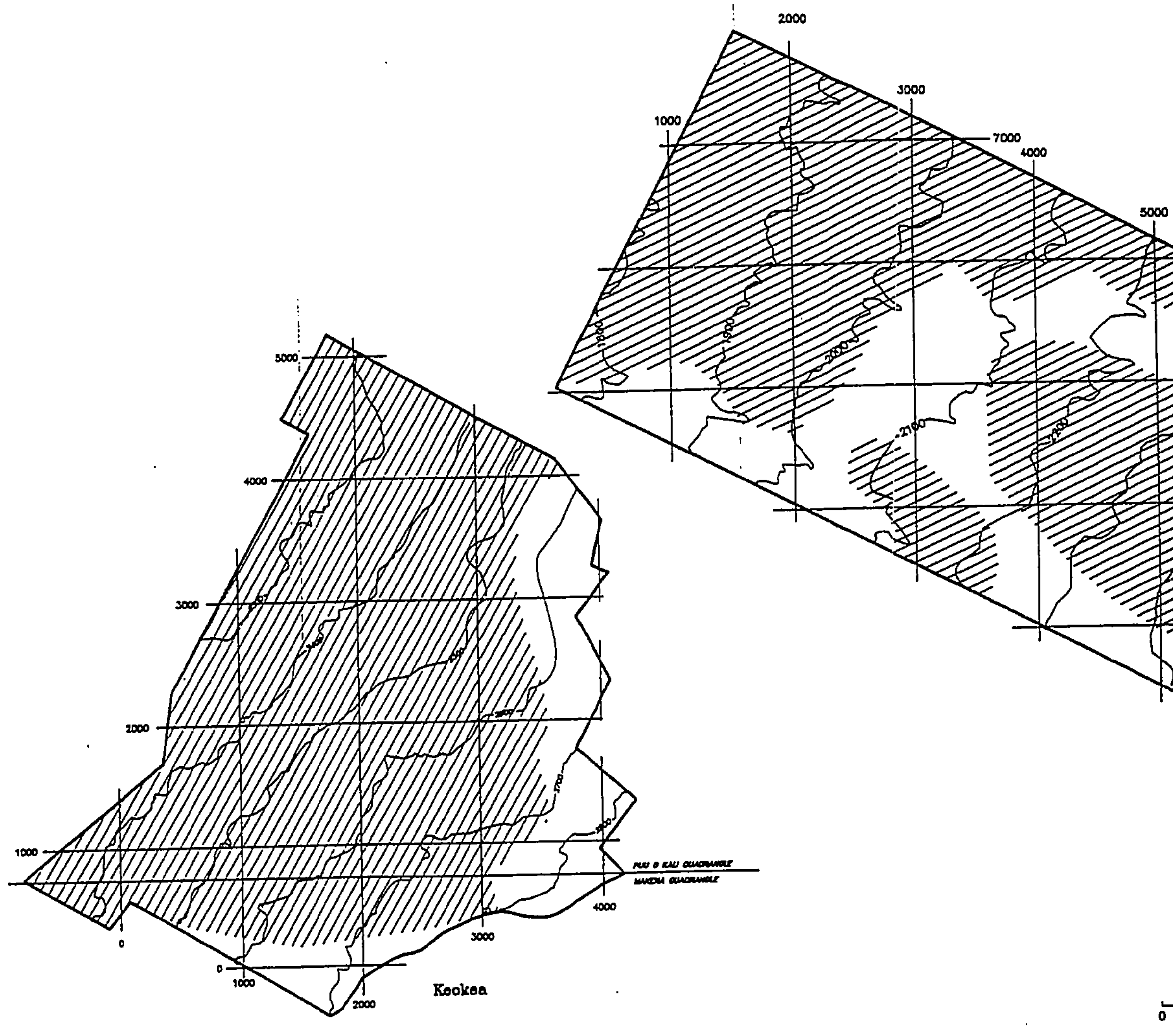

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FIGURE 4.
Distribution of Agricultu

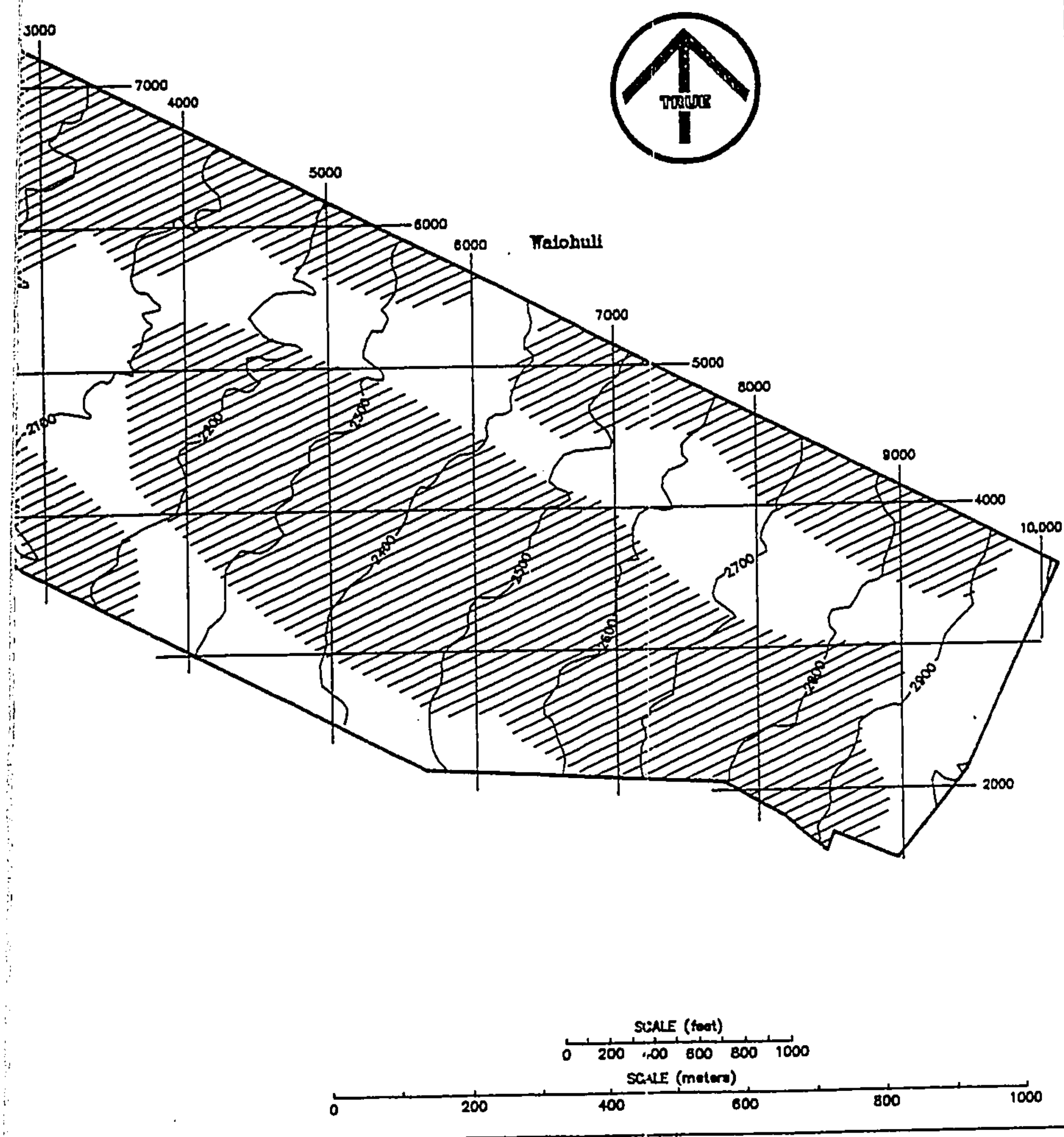

FIGURE 4.
ibution of Agricultural Features

DATA ANALYSES

CHRONOLOGY

Seventeen ash-charcoal samples from 15 sites were submitted to Beta Analytic Laboratories in Coral Gables, Florida for age determination analyses. The samples were collected from subsurface contexts within a number of feature types—including heiau, rectangular and circular enclosures, a paved platform, and a C-shaped wall—and from outside of an overhang shelter. Radiocarbon age determinations are summarized in Table 4 and are graphically illustrated in Figure 5.

One sample (from Site K-7, TP-1, 40-50 cmbs) contained insufficient carbon for dating. A sample from Site W-3 produced a modern (post AD 1950) date. The other 15 date ranges span 1,210 years (AD 680-AD 1890). Site K-7, Feature A, a rectangular enclosure tentatively assigned a permanent habitation function produced the earliest date (680-1060 AD). As insufficient carbon was recovered from the lowest level excavated at Site K-7, Feature A (40-50 cmbs), the dated sample (from 30-40 cmbs) does not represent the oldest strata in the feature. In addition, the lowest level excavated was not taken down to sterile strata. The early date for Feature A—which in structural form is similar to enclosures associated with much later dates—and other data suggests that the area of the feature has been inhabited on a fairly permanent basis for at least a millenium. Questions concerning intensity of occupation at the site and the evolution at the site of adaptive strategies over time will require further data collection and analysis and will require sound chronological determinations.

The remaining 14 date ranges span AD 1270-modern dates. Eight of these ranges were derived from samples taken from sites tentatively assigned religious functions. One of the eight ranges and three other ranges were from sites at which human remains are known to be present, or are suspected (from W-11, K-3, K-111, and K-130). The earliest of these ranges, AD 1270-1490, was derived from Feature A, Site W-11. Feature A is a C-shaped wall; however, it is unlike other C-shapes in that it opens toward the prevailing northeast winds—which indicates it most likely did not serve as a shelter. Feature A is associated with alignments and substantial mounds, some of which are tentatively interpreted as burials. Site K-3 is an enclosure and Sites K-111 and K-130 are overhang shelters.

An excavation at Site W-27 yielded two samples from separate, arbitrary strata (10cm) between 30 and 50 cmbs. The excavation was placed within the paved interior of the structure. Beneath the pavement was what appeared to be domestic midden, suggesting that the dates do not necessarily relate to the construction and use of the heiau itself but perhaps to pre-heiau occupation. This same observation pertains to the other substantial paved structures excavated and/or dated. In every case, once the paving was breached, apparent domestic deposits were encountered. One is led to deduce from this that the features tested were not as elaborate in construction early on; that the structures were either non-existent during early occupation at their location or that they were less elaborate and were added to or rebuilt over time. The relationships between the dated samples and the form of the structures from which they were taken must await more detailed study.

PORTABLE REMAINS

One hundred twelve artifacts including abraders, a flaked lithic tool and flaked lithic debitage were recovered from 19 test excavations. Thirty-seven pieces of volcanic glass from nine sites and 60 pieces of flaked basalt from eight sites were recovered during excavations. Three sites yielded polished basalt flakes and one site yielded a shark tooth. Two pieces of coral were recovered from two sites (Table 5). Four artifacts—an abrader, an adze, a flaked lithic tool, and a utilized flake—were collected from the surface of four separate sites.

Marine ecofactual remains included Gastropoda, bivalves, fish, and Echinoidea (Table 6). Terrestrial faunal remains included remains of small, medium, and large mammals, and several pieces of unidentified remains. Floral remains included unidentified charcoal, gourd, and four kukui fragments. The excavated ecofactual remains do not constitute representative site or feature samples. They were collected as a by-product of excavations aimed primarily at collecting datable materials. They are, however, informative in that they demonstrate that a wide range of activities occurred throughout the project area over perhaps 1,200 years.

Table 4.

SUMMARY OF RADIOCARBON AGE DETERMINATIONS

PHRI Lab.No. RC-	Lab. No. BETA-	Provenience	C-14 Age Yrs. B.P. (one sigma)	C-13/ C-12 Ratio	C-13 Adjusted C-14 Age Yrs. B.P.	*Calendric Range Yrs. AD
KEOKEA						
K-3						
513	30811	Fea. A, TU-1 Layer I/II 0-22 cmbs	180±50	-24.0	200±50	1640-1890 1910-1955#
K-6						
514	30812	Fea. A, TT-1 Layer II, 17-48 cmbs	260±60	-24.1	270±60	1470-1680 1739-1805 1935-1955#
K-7						
515	30813	Fea. A, TP-1 Layer I-4 30-40 cmbs	1020±100	-19.3	1110±100	680-1060 1077-1125 1135-1157
530		Fea. A, TP-1 Layer I-5 40-50 cmbs		—	—	Insufficient Carbon
K-48						
518	30815	Fea. B, TP-2 Layer I-4 30-40 cmbs	30±70	-15.0	190±70	1518-1591
K-64						
517	30814	Fea. A, TP-1 Layer II/III 6-50 cmbs	330±80	-22.9	360±70	1420-1660
K-105						
519	30816	Fea. A, TP-1 Layer III 20-40 cmbs	310±50	-26.3	290±50	1470-1670 1775-1793 1947-1953
K-111						
520	30817	Fea. A, TP-1 Layer II 6-20 cmbs	110±70	-23.2	140±70	1640-1955#

*Calibrated according to Stuiver and Pearson (1986). Range at two sigmas.

#Denotes influence of bomb C-14.

Table 4. (cont.)

PHRI Lab.No. RC-	Lab. No. BETA-	Provenience	C-14 Age Yrs. B.P. (one sigma)	C-13/ C-12 Ratio	C-13 Adjusted C-14 Age Yrs. B.P.	*Calendric Range Yrs. AD
K-124						
521	30818	Fea. A, TP-1 Layer III 13-57 cmbs	110±60	-21.7	160±60	1640-1955#
K-130						
522	30819	Fea. A, TP-1 Layer II 4-16 cmbs	100.2±0.7% Modern	-10.4	220±50	1523-1566 1629-1696 1726-1818 1859-1861 1921-1955#
WAIOHULI						
W-3						
523	30820	Fea. A, TP-1 Layer I-1 0-30 cmbs	100.5±0.8% Modern	-24.3	100.4±0.8% Modern	—
W-11						
524	30821	Fea. A, TP-1 Layer I-1 0-35 cmbs	530±90	-24.5	540±90	1270-1490
W-27						
525	30822	Fea. A, TP-1 Layer I-4 30-40 cmbs	430±70	-22.0	480±70	1305-1360 1380-1510 1598-1617
526	30823	Fea. A, TP-1 Layer I-5 40-50 cmbs	390±90	-21.4	450±90	1300-1365 1370-1650
W-28						
527	30824	Fea. A, TP-1 Layer I-2/3 10-30 cmbs	430±90	-22.5	470±90	1290-1640
W-36						
528	30825	Fea. A, TP-1 Layer I-5 40-50 cmbs	450±50	-23.9	470±50	1397-1482
W-45						
529	30826	Fea. B, TP-1 Layer II 18-30 cmbs	100±50	-11.1	330±50	1450-1660

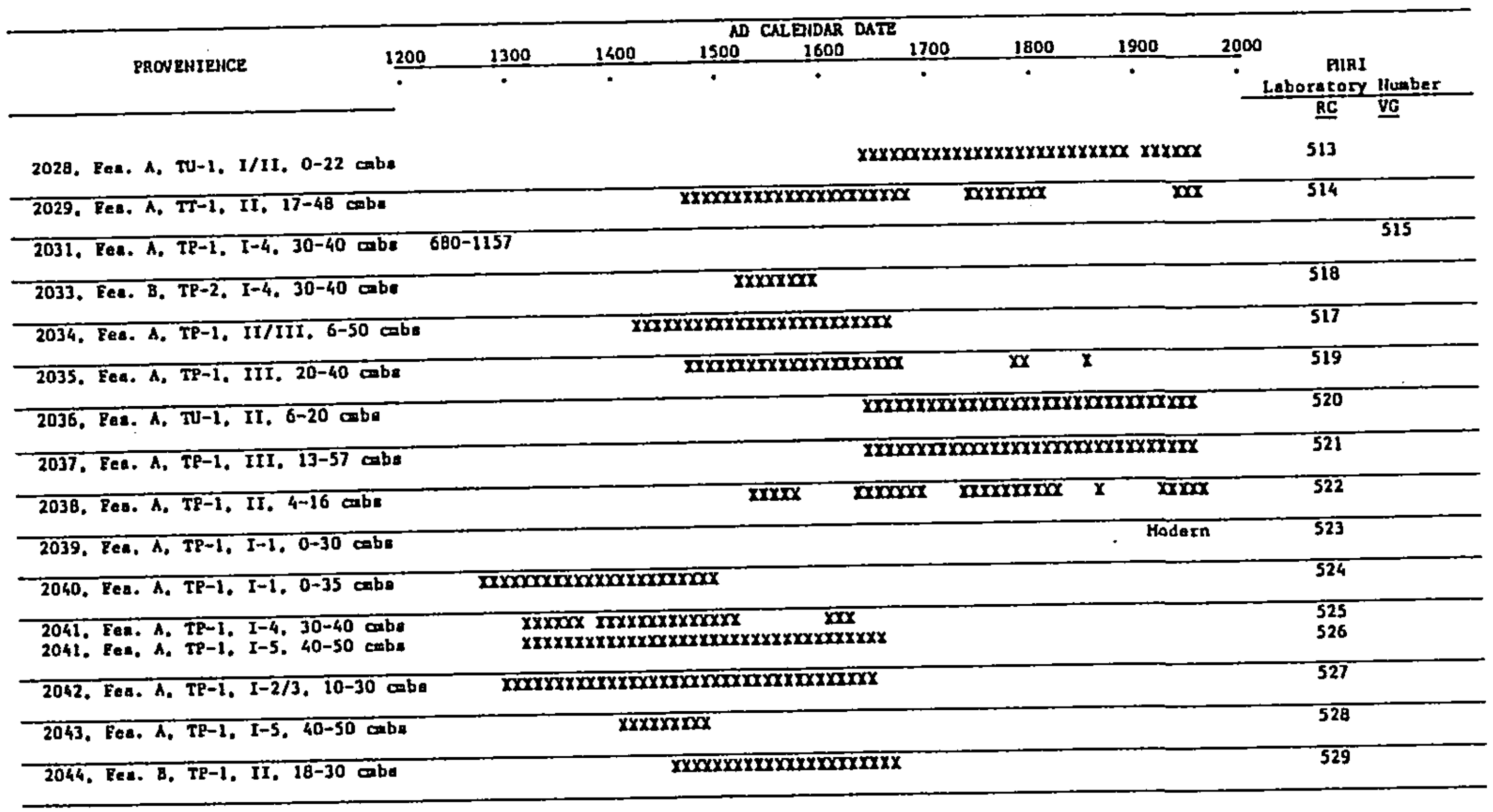

Figure 5. AGE DETERMINATION RANGES

Table 5.

SUMMARY OF PORTABLE ARTIFACT TYPES (SUBSURFACE)

Material	K-3			K-6	K-30					K-48				
	Fea. A		Total	Fea. A	Fea. A				Total	Fea. B				Total
	TP-1			TP-1	TP-1					TP-1	TP-2			
	I	II		I	I-2	I-3	I-4	I-5		I	I-1	I-2	Total	
INDIGENOUS														
FLAKED STONE														
Basalt	1	9	10	2	3	3	2	1	9	2	1	1	2	4
Volcanic Glass	1	–	1	2	–	2	2	–	4	3	1	2	3	6
SUBTOTAL FLAKED STONE	2	9	11	4	3	5	4	1	13	5	2	3	5	10
TOOLS														
Polished basalt flakes	1	1	2	–	–	–	–	–	–	–	–	–	–	–
Shark tooth	–	–	–	–	–	–	–	–	–	1	–	–	–	1
SUBTOTAL TOOLS	1	1	2	–	–	–	–	–	–	1	–	–	–	–
TOTAL INDIGENOUS	3	10	13	4	3	5	4	1	13	6	2	3	5	11

Table 5. (Cont.)

Material	K-64	K-105	K-111	K-124	W-39	W-27					Total
	Fea. A	Fea. A	Fea. A	Fea. A	Fea. A	Fea. A					
	TP-1	TP-1	TP-1	TP-1	TP-1	TP-1					
	II	II	II	II	I-1	I-1	I-2	I-3	I-4	I-5	
INDIGENOUS											
FLAKED STONE											
Basalt	1	–	–	3	–	1	3	1	–	–	5
Volcanic Glass	–	–	5	–	–	–	8	4	1	1	14
SUBTOTAL FLAKED STONE	1	–	5	3	–	1	11	5	1	1	19
TOOLS											
Polished basalt flakes	–	1	–	–	–	–	–	–	–	–	–
Shark tooth	–	–	–	–	–	–	–	–	–	–	–
SUBTOTAL TOOLS	–	1	–	–	–	–	–	–	–	–	–
TOTAL INDIGENOUS	1	1	5	3	–	1	11	5	1	1	19

Table 5. (Cont.)

Material	K-28			W-36				W-45				Grand Total
	Fea. A		Total	Fea. A			Total	Fea. B			Total	
	TP-1			TP-1				TP-1				
	I-2	I-3		I-2	I-4	I-5		I	II	III		
INDIGENOUS												
FLAKED STONE												
Basalt	1	7	8	8	2	2	12	1	3	2	6	60
Volcanic Glass	1	-	1	-	-	-	-	-	3	1	4	37
SUBTOTAL FLAKED STONE	2	7	9	8	2	2	12	1	6	3	10	97
TOOLS												
Polished basalt flakes	-	-	-	-	-	-	-	-	-	-	-	3
Shark tooth	-	-	-	-	-	-	-	-	-	-	-	1
SUBTOTAL TOOLS	-	-	-	-	-	-	-	-	-	-	-	4
TOTAL INDIGENOUS	2	7	9	8	2	2	12	1	6	3	10	101

Table 6.

DISTRIBUTION OF ECOFACTUAL REMAINS

CATEGORY	K-3 Fea. A II	K-6 Fea. A I	K-6 Fea. A Fill	K-6 Fea. A II	K-7 Fea. A I	K-32 Fea. A I-1	K-32 Fea. A I-3	K-32 II	K-36 Fea. B I-1	K-36 Fea. B I-3	K-48 I	K-48 Fea. B I-1	K-48 Fea. B I-2	K-48 Fea. B I-3	K-48 Fea. B I-4
MARINE INVERTEBRATES															
GASTROPODA															
Strombus maculatus	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cypraeidae	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Conidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nerita picea	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
BIVALVIA															
Tellinidae	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
OTHER															
Echinoidea	-	+	-	+	+	-	-	-	-	-	-	+	-	-	+
BONE															
Fish	-	+	+	+	-	-	-	-	-	+	+	+	+	-	-
Mammal	+	-	-	-	-	+	+	-	-	+	-	+	+	-	-
Large	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Medium	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Small	-	+	-	+	+	+	-	+	-	-	-	-	-	-	+
Unidentified	-	+	-	-	-	-	-	-	-	-	-	+	-	-	+
VEGETAL REMAINS															
Charcoal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gourd	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aleurites moluccana	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-
NON-ECOFACTUAL REMAINS															
Coral	-	+	-	+	-	-	-	-	-	-	-	-	-	-	

Table 6. (Cont.)

	K-64 Fea. A III	K-105 Fea. A II	K-105 Fea. A III	K-111 Fea. A I	K-111 Fea. A II	K-124 Fea. A II	K-124 Fea. A III	K-136 Fea. A II	W-27 Fea. A I-3	W-28 Fea. A I-3	W-36 Fea. A I-3	W-45 Fea. B I	W-45 Fea. B II	W-45 Fea. B III
MARINE INVERTEBRATES														
GASTROPODA														
Strombus maculatus	-	-	-	-	-	-	-	-	+	-	-	-	-	+
Cypraeidae	-	-	-	+	-	-	-	-	-	-	-	-	+	+
Conidae	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Nerita picea	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BIVALVIA														
Tellinidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OTHER														
Echinoidea	+	-	-	-	-	-	-	-	-	-	-	-	-	-
BONE														
Fish	-	+	+	-	-	-	-	-	-	+	-	-	-	-
Mammal	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Large	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Medium	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Small	-	-	-	+	+	+	+	+	-	-	-	-	-	-
Unidentified	-	-	-	-	+	-	-	-	+	+	+	-	+	-
VEGETAL REMAINS														
Charcoal	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Gourd	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Aleurites moluccana	-	+	+	-	-	-	-	-	-	-	-	-	-	+
NON-ECOFACTUAL REMAINS														
Coral	-	-	-	-	-	-	-	-	-	-	-	-	-	-

CONCLUSION

EVALUATION OF SURVEY METHODOLOGY

The archaeological inventory survey of Waiohuli and Keokea Subdivisions involved low-level aerial survey of approximately 60% of each subdivision and intensive (15-30 m interval) pedestrian survey of 100% of both subdivisions. During both aerial and pedestrian surveys, dense lantana, panini, wattle, ilima, and high grass consistently limited surface visibility to 10-20 percent of the ground surface, effectively eliminating the possibility of finding surface portable remains and minor agricultural features. As a result, the survey was focused on identifying substantial residential and agricultural features.

Even major, large-stacked boulder and cobble residential features were found to be thoroughly overgrown with panini and/or lantana, or were buried under wattle deadfalls. Because of this, the sites had to be considerably cleared and wall segments had to be probed for prior to preparing sketch maps. Nevertheless, excepting perhaps features in areas completely obscured by large, impenetrable panini thickets (areas totaling c. one acre), all major archaeological features in both subdivisions were identified during the survey.

DISCUSSION

The overall data suggests that Keokea Subdivision was intensively expoited in a variety of ways for at least two-thirds of the entirety of Hawaiian prehistory. There is evidence in the project area for change over time, spatial variety, functional (behavioral) variety, and interaction with peoples in other (coastal) areas.

The picture that the overall data for Waiohuli Subdivision presents is less clear due to the extensive historic disturbance in the area, especially in regard to the density of feature types and the temporal ranges of features. The feature types in the area (heiau to agricultural mounds) do, however, reflect a full range of activities. If the low site density in Waiohuli is not due to removal of sites by bulldozing, then prehistoric and historic occupation of the area was very different from nearby Keokea. For example, Kaumeheiwa Heiau in Waiohuli is not as densely surrounded by agricultural, habitation, and religious features as could be expected if it were in Keokea. It exists in relative isolation when compared with Molohai Heiau in Keokea. Agricultural features in Waiohuli are as widespread as those in Keokea, but they are not found in as high densities. The same goes for habitation and religous features in Waiohuli. There are other "non-archaeological" differences between the two areas. For example, three major gulches and an extensive and well-developed contributary drainage system in Waiohuli may have transported surface water out of the immediate area before much could be absorbed. Keokea has no such drainage system. This could render the Waiohuli area effectively drier than Keokea and make the area less suited for agriculture. In turn, the limited productivity of the land might have substantially limited the population.

Even if the lower feature density in Waiohuli is a direct result of surface bulldozing, it is still possible that subsurface remains are still present and are relatively intact. Unless the presense of subsurface remnants of features is demonstrated in Waiohuli, comparisons between the distributions of sites and features in Keokea and Waiohuli cannot be made with confidence, nor can the distributions within the Waiohuli Subdivision itself be addressed.

The historical documentary research suggests that the Kula region was intensively cultivated during the early historic period. Apparently, this was especially true during the gold rush years in California, when the influx of miners created a demand for food which the potato farmers in Kula in part filled. The historical documentation suggests that the farmers during this period did not make substantial modifications to the land (terraces, etc.) but instead "...followed the natural contour of the land..." Whether Keokea and Waiohuli subdivisions were under intensive cultivation during this period is open to question. The lack of historic period artifacts in association with residential and agricultural features suggests they were not.

SUGGESTED RESEARCH QUESTIONS

Future research in the Kula area should address, at a minimum, the following questions.

1. When was the Kula area and each site and feature first occupied?
2. Were the occupations brief, intermittent, continuous, or long-term?
3. Which sites and features represent contemporaneous occupation and/or use?
4. Do some formal site/feature types appear earlier in the archaeological record than others?

5. Are earlier sites functionally different from later sites?

6. How are the archaeological resources distributed with regard to environmental factors like elevation, distance from water, soil types, geomorphic features and vegetation communities?

7. How are archaeological resources distributed relative to each other? Do particular site and feature types tend to occur together?

8. What are the relationships between the archaeological resources in the Kula area and those elsewhere?

9. How do the distributions and densities of archaeological sites and features relate to the distribution and density of prehistoric people in the Kula area?

10. Can particular behaviors be associated with formal site and feature types—which behaviors with which formal types?

11. Do the archaeological data correlate well with the ethnographic and historic records?

12. Do the archaeological data from Kula support the interpretations made concerning similar sites and features in similar areas?

GENERAL SIGNIFICANCE ASSESSMENTS AND RECOMMENDED GENERAL TREATMENTS

To facilitate State and County review, general significance assessments and recommended general treatments for all identified sites are summarized in Table 1. Significance categories used in the site evaluation process are based on the National Register criteria for evaluation, outlined in the Code of Federal Regulations (36 CFR Part 60). The Hawaii State Historic Preservation Office (SHPO) uses these criteria for evaluating cultural resources. Sites determined to be potentially significant for information content (Category A, Table 1) fall under Criterion D, which defines significant resources as ones which "have yielded, or may be likely to yield, information important in prehistory or history" (36 CFR Sec. 60.4). Sites potentially significant as representative examples of site types (Category B, Table 1) are evaluated under Criterion C, which defines significant resources as those which "embody the distinctive characteristics of a type, period, or method of construction...or that represent a significant and distinguishable entity whose components may lack individual distinction." Sites with potential cultural significance (Category C) are evaluated under guidelines prepared by the Advisory Council on Historic Preservation (ACHP) entitled "Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review" (Draft Report, August 1985). The guidelines define cultural value as "...the contribution made by an historic property to an ongoing society or cultural system. A traditional cultural value is a cultural value that has historical depth" (1985:1). The guidelines further specify that "[a] property need not have been in consistent use since antiquity by a cultural system in order to have traditional cultural value" (1985:7).

Of the total 159 sites identified during the present survey, 108 are in Keokea and 51 are in Waiohuli. Of the 108 Keokea sites, 94 are assessed as significant solely for information content. Eighty-nine of the 94 sites are recommended for further data collection, and five of the 94 sites are recommended for no further work. Four of the remaining 14 sites are assessed as significant for information content, as an excellent example of a site type, and for cultural; value. Further data collection and preservation with interpretive development are recommended for these four sites. Three of the remaining 14 sites are assessed as significant for information content and as an excellent example of a site type. For these three sites, further data collection and preservation with interpretive development are recommended. Another three sites are assessed as significant for information content and for cultural value; these three sites are recommended for further data collection and preservation as is. Three other sites are assessed as significant for information content and are tentatively assessed as significant for cultural value. These three sites are recommended for further data collection and are provisionally recommended for preservation as is. The last site is assessed as significant for information content and as having cultural value. For this site, preservation "as is" is recommended.

Of the 51 sites in Waiohuli Subdivision, 42 are assessed as significant solely for information content. Thirty-three of these 42 sites are recommended for further data collection, and nine of the 42 sites require no further work. Of the remaining nine sites, three are assessed as significant for information content, as excellent examples of a site type, and as culturally significant. Further data collection and preservation with interpretive development are recommended for these three sites. Two of the remaining six sites are assessed as significant for information content and are provisionally assessed as having cultural value. For these two sites, further data collection is recommended and preservation with interpretive development is provisionally recommended. The final four sites are assessed variously and require various recommended treatments (see Table 7 for specific recommendations).

Table 8 lists lots which contain or appear to contain sites or portions of sites that are tentatively recommended for preservation. The uncertainty as to whether lots contain or do not contain sites is due to problems concerning lot boundaries. These problems are due to (a) possible inaccurate boundaries/locations on maps and aerial photographs provided by DHHL, (b) problems of determining precise boundaries and locations in the field due to vegetation and terrain changes that have occurred since preparation of the photographs and maps, and (c) missing DHHL lot corner markers. In all, 19 lots in Keokea and 5 lots in Waiohuli contain or appear to contain sites recommended for preservation. In order to accurately determine exactly which lots contain sites or portions of sites, the sites must first be individually staked out in the field. Following this, the DHHL will have to restake the boundaries in question.

Table 7.

SUMMARY OF GENERAL SIGNIFICANCE ASSESSMENTS AND RECOMMENDED GENERAL TREATMENTS
WAIOHULI PARCEL

Site or Feature No.	Significance Category				Recommended Treatment			
	A	X	B	C	FDC	NFW	PID	PAI
W-1	+	-	-	-	+	-	-	-
W-2	+	-	-	-	+	-	-	-
W-3	+	-	-	-	+	-	-	-
W-5	+	-	-	-	+	-	-	-
W-6	+	-	-	-	+	-	-	-
W-8	+	-	-	-	+	-	-	-
W-10	+	-	-	-	+	-	-	-
W-12	+	-	-	-	+	-	-	-
W-13	+	-	-	-	+	-	-	-
W-14	+	-	-	-	+	-	-	-
W-15	+	-	-	-	+	-	-	-
W-17	+	-	-	-	+	-	-	-
W-18	+	-	-	-	+	-	-	-
W-20	+	-	-	-	+	-	-	-
W-21	+	-	-	-	+	-	-	-
W-31	+	-	-	-	+	-	-	-

General Significance Categories:

A = Important for information content, further data collection necessary (PHRI=research value);
X = Important for information content, no further data collection necessary (PHRI=research value, SHPO=not significant);
B = Excellent example of site type at local, region, island, State, or National level (PHRI=interpretive value); and
C = Culturally significant (PHRI=cultural value).

Recommended General Treatments:

FDC = Further data collection necessary (further survey and testing, and possibly subsequent data recovery/mitigation excavations);
NFW = No further work of any kind necessary, sufficient data collected, archaeological clearance recommended, no preservation potential (possible inclusion into landscaping suggested for consideration);
PID = Preservation with some level of interpretive development recommended (including appropriate related data recovery work); and
PAI = Preservation "as is," with no further work (and possible inclusion into landscaping), or minimal further data collection necessary.

* Provisional assessment; definite assessment pending results of further data collection.

Table 7. (cont.)

WAIOHULI PARCEL

Site or Feature No.	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
W-37	+	-	-	-	+	-	-	-
W-42	+	-	-	-	+	-	-	-
W-46	+	-	-	-	+	-	-	-
W-48	+	-	-	-	+	-	-	-
W-49	+	-	-	-	+	-	-	-
W-55	+	-	-	-	+	-	-	-
W-65	+	-	-	-	+	-	-	-
W-67	+	-	-	-	+	-	-	-
W-71	+	-	-	-	+	-	-	-
W-73	+	-	-	-	+	-	-	-
W-75	+	-	-	-	+	-	-	-
W-77	+	-	-	-	+	-	-	-
W-82	+	-	-	-	+	-	-	-
W-83	+	-	-	-	+	-	-	-
W-96	+	-	-	-	+	-	-	-
W-97	+	-	-	-	+	-	-	-
W-98	+	-	-	-	+	-	-	-
Subtotal: 33	33	-	-	-	33	-	-	-
W-4	-	+	-	-	-	+	-	-
W-47	-	+	-	-	-	+	-	-
W-57	-	+	-	-	-	+	-	-
W-58	-	+	-	-	-	+	-	-
W-59	-	+	-	-	-	+	-	-
W-60	-	+	-	-	-	+	-	-
W-80	-	+	-	-	-	+	-	-
W-88	-	+	-	-	-	+	-	-
W-101	-	+	-	-	-	+	-	-
Subtotal: 9	-	9	-	-	-	9	-	-
W-27	+	-	+	+	+	-	+	-
W-28	+	-	+	+	+	-	+	-
W-36	+	-	+	+	+	-	+	-
Subtotal: 3	3	-	3	3	3	-	3	-
W-45	+	-	+	-	+	-	+	-
Subtotal: 1	1	-	1	-	1	-	1	-

Table 7. (cont.)

WAIOHULI PARCEL

Site or Feature No.		Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
W-11		+	-	-	*	+	-	-	*
Subtotal:	1	1	-	-	1	1	-	-	1
W-30		+	-	-	*	+	-	*	-
W-32		+	-	-	*	+	-	*	-
Subtotal:	2	2	-	-	2	2	-	2	-
W-90		+	-	-	+	+	-	-	+
Subtotal:	1	1	-	-	1	1	-	-	1
W-35		+	-	-	+	+	-	-	-
Subtotal:	1	1	-	-	1	1	-	-	-
Waiohuli Total:	51	42	9	4	8	42	9	6	2

KEOKEA PARCEL

Site or Feature No.	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
K- 1	+	-	-	-	+	-	-	-
K- 2	+	-	-	-	+	-	-	-
K- 4	+	-	-	-	+	-	-	-
K- 5	+	-	-	-	+	-	-	-
K- 7	+	-	-	-	+	-	-	-
K- 8	+	-	-	-	+	-	-	-
K- 10	+	-	-	-	+	-	-	-
K- 11	+	-	-	-	+	-	-	-
K- 13	+	-	-	-	+	-	-	-
K- 14	+	-	-	-	+	-	-	-
K- 16	+	-	-	-	+	-	-	-
K- 19	+	-	-	-	+	-	-	-
K- 21	+	-	-	-	+	-	-	-
K- 20	+	-	-	-	+	-	-	-
K- 25	+	-	-	-	+	-	-	-
K- 26	+	-	-	-	+	-	-	-
K- 27	+	-	-	-	+	-	-	-
K- 31	+	-	-	-	+	-	-	-
K- 32	+	-	-	-	+	-	-	-

Table 7. (cont.)

KEOKEA PARCEL

Site or Feature No.	Significance Category				Recommended Treatment			
	A	X	B	C	FDC	NFW	PID	PAI
K-35	+	-	-	-	+	-	-	-
K-42	+	-	-	-	+	-	-	-
K-52	+	-	-	-	+	-	-	-
K-53	+	-	-	-	+	-	-	-
K-203	+	-	-	-	+	-	-	-
K- 9	+	-	-	-	+	-	-	-
K-65	+	-	-	-	+	-	-	-
K-76	+	-	-	-	+	-	-	-
K-85	+	-	-	-	+	-	-	-
K-120	+	-	-	-	+	-	-	-
K-124	+	-	-	-	+	-	-	-
K-140	+	-	-	-	+	-	-	-
K-143	+	-	-	-	+	-	-	-
K-36	+	-	-	-	+	-	-	-
K-39	+	-	-	-	+	-	-	-
K-41	+	-	-	-	+	-	-	-
K-44	+	-	-	-	+	-	-	-
K-45	+	-	-	-	+	-	-	-
K-46	+	-	-	-	+	-	-	-
K-50	+	-	-	-	+	-	-	-
K-51	+	-	-	-	+	-	-	-
K-54	+	-	-	-	+	-	-	-
K-55	+	-	-	-	+	-	-	-
K-57	+	-	-	-	+	-	-	-
K-59	+	-	-	-	+	-	-	-
K-64	+	-	-	-	+	-	-	-
K-69	+	-	-	-	+	-	-	-
K-70	+	-	-	-	+	-	-	-
K-79	+	-	-	-	+	-	-	-
K-90	+	-	-	-	+	-	-	-
K-81	+	-	-	-	+	-	-	-
K-84	+	-	-	-	+	-	-	-
K-89	+	-	-	-	+	-	-	-
K-95	+	-	-	-	+	-	-	-
K-96	+	-	-	-	+	-	-	-
K-97	+	-	-	-	+	-	-	-
K-98	+	-	-	-	+	-	-	-
K-99	+	-	-	-	+	-	-	-
K-101	+	-	-	-	+	-	-	-
K-102	+	-	-	-	+	-	-	-
K-103	+	-	-	-	+	-	-	-
K-105	+	-	-	-	+	-	-	-
K-106	+	-	-	-	+	-	-	-
K-108	+	-	-	-	+	-	-	-

Table 7. (cont.)

KEOKEA PARCEL

Site or Feature No.	Significance Category				Recommended Treatment			
	A	X	B	C	FDC	NFW	PID	PAI
K-109	+	-	-	-	+	-	-	-
K-110	+	-	-	-	+	-	-	-
K-111	+	-	-	-	+	-	-	-
K-112	+	-	-	-	+	-	-	-
K-116	+	-	-	-	+	-	-	-
K-118	+	-	-	-	+	-	-	-
K-127	+	-	-	-	+	-	-	-
K-130	+	-	-	-	+	-	-	-
K-131	+	-	-	-	+	-	-	-
K-135	+	-	-	-	+	-	-	-
K-137	+	-	-	-	+	-	-	-
K-142	+	-	-	-	+	-	-	-
K-146	+	-	-	-	+	-	-	-
K-148	+	-	-	-	+	-	-	-
K-149	+	-	-	-	+	-	-	-
K-152	+	-	-	-	+	-	-	-
K-200	+	-	-	-	+	-	-	-
K-201	+	-	-	-	+	-	-	-
K-202	+	-	-	-	+	-	-	-
K-204	+	-	-	-	+	-	-	-
K-205	+	-	-	-	+	-	-	-
K-206	+	-	-	-	+	-	-	-
K-208	+	-	-	-	+	-	-	-
K-209	+	-	-	-	+	-	-	-
K-210	+	-	-	-	+	-	-	-
K-211	+	-	-	-	+	-	-	-
Subtotal: 89	89	-	-	-	89	-	-	-
K- 30	+	-	+	+	+	-	+	-
K- 62	+	-	+	+	+	-	+	-
K- 78	+	-	+	+	+	-	+	-
K-115	+	-	+	+	+	-	+	-
Subtotal: 4	4	-	4	4	4	-	4	-
K- 12	-	+	-	-	-	+	-	-
K- 60	-	+	-	-	-	+	-	-
K- 63	-	+	-	-	-	+	-	-
K- 80	-	+	-	-	-	+	-	-
K-100	-	+	-	-	-	+	-	-
Subtotal: 5	0	5	-	-	-	5	-	-

Table 7. (cont.)

KEOKEA PARCEL

Site or	Significance Category				Recommended Treatment			
Feature No.	A	X	B	C	FDC	NFW	PID	PAI
K- 29	+	-	+	-	+	-	+	-
K- 40	+	-	+	-	+	-	+	-
K- 48	+	-	+	-	+	-	+	-
Subtotal: 3	3	-	3	-	3	-	3	-
K- 87	+	-	-	+	+	-	-	+
K-107	+	-	-	+	+	-	-	+
K-207	+	-	-	+	+	-	-	+
Subtotal: 3	3	-	-	3	3	-	-	3
K- 3	+	-	-	*	+	-	-	*
K- 6	+	-	-	*	+	-	-	*
K- 71	+	-	-	*	+	-	-	*
Subtotal: 3	3	-	-	3	3	-	-	3
K-134	+	-	-	+	-	-	-	+
Subtotal: 1	1	-	-	1	-	-	-	1
Keokea Total: 108	103	5	7	11	102	5	7	7
Waiohuli Total: 51	51	9	4	8	42	9	6	2
Grand Total: 159	154	14	11	19	144	14	13	9

Table 8.

LOTS WHICH APPEAR TO CONTAIN SITES OR PORTIONS OF SITES RECOMMENDED FOR PRESERVATION*

Keokea Subdivision		Waiohuli Subdivision	
Lot No.	Site No.	Lot No.	Site No.
5	87	30	45
13	107	31	45
14	107	74	30
21	71	75	30
22	71	76	27
23	78		
24	48,78		
25	48		
26	48,62		
27	48,62		
28	48		
29	48		
37	3		
48	78		
49	71		
50	71		
58	78		
A	78		
C	207		

* See page 29 for explanation of uncertainty regarding boundaries of lots in relation to sites.

Table 9.

RESIDENCE LOTS CONTAINING SITES

Keokea Subdivision		Waiohuli Subdivision	
Lot No.	Site No.	Lot No.	Site No.
11	143 A	11	49
12	12, 131	13	42
12	131, 131 A-C	2-33	46
13-14	90, 107	51-54	98
14	109, 109 A	74	30
15	108	75	31
16	208	76	27
16-17	52, 52 A-B	84-85	47
18	53	84-85-86	48
19-20-21-22	65	129	83
20	65 D-G	149-150-152-153-154	80
21	65 C, 71 B	150-151	82
21-22	65 A-B, 71 A	161-175-176	75
21-49-50	71	182-183	57
23	76, 76 A-B	184	60
23-24	63, 78 A	192	55
23-24-48-49	78	194-196-197	58
24	78 B-E	222-223-224-228-229	67
25	79		
26-27	48 C	240-241	37
27	48 D	262	71
27-28	62, 62 A-C	276-277-278-281	65
29-28	48 A	31	45
29-28-27-26-25	48		
33	4, 4 A-B		
34	2, 2 A-B		
34-35	1 B		
35	1 A		
4	K-101		
5-6-7	K-87, 89		
8	K-106		
20	K-71B		
24	K-48		
37	K-3		
38	K-31		
39	K-32		
40	K-202		
49	K-98		
51	K-70		
52	K-69, 85		
53	K-69, 84		
55-56	K-103		

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APPENDIX A

SUMMARY OF IDENTIFIED SITES AND FEATURES - WAIOHULI

*Site/ Feature Number	Formal Site/Feature Type	Tentative Functional Interpretation	#CRM Value Mode Assess. R	I	C	+Field Work Tasks DR	SC	EX
1	Enclosure	Habitation/Ag.	M	L	L	+	+	+
2	Enclosure	Habitation/Ag.	M	L	L	+	+	+
3	Terrace	Habitation/Ag.	H	L	L	+	+	+
4	Wall	Animal Control	L	L	L	-	-	-
5	Overhang	Indeterminate	M	L	L	-	-	+
6	Lithic Scatter	Lithic Reduction	M	L	L	+	+	-
8	Enclosure	Habitation/Ag.	M	L	L	+	+	+
10	Terrace	Agriculture	M	L	L	+	-	+
11	Complex (6+)	Burial**/Ag.	M/H	L	L/H	+	-	+
A	Wall							
B	Mound							
C	Mounds							
D	Mound							
E	Platform							
F	Mound							
12	Terraces	Agriculture	M	L	L	+	-	+
13	Complex (2)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Enclosure							

* PHRI temporary site numbers.

Cultural Resource Management -Value Mode Assessment—

Nature: R = scientific research
I = interpretive
C = cultural

Degree: H = high
M = moderate
L = low

+ Field Work Tasks:
DR = detailed recording (scaled drawings, photographs, and written descriptions)
SC = surface collections
EX = test excavations

**Possible functional interpretation

SUMMARY OF IDENTIFIED SITES AND FEATURES - WAIOHULI (cont.)

Site/ Feature Number	Formal Site/Feature Type	Tentative Functional Interpretation	CRM Value Mode Assess.			Field Work Tasks		
			R	I	C	DR	SC	EX
14	Complex	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Enclosure							
C	Wall,L-shaped							
15	Enclosure	Habitation/Ag.	M	L	L	+	-	+
17	Complex (2)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Enclosure							
18	Complex (2)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Enclosure							
20	Enclosure	Habitation/Ag.	M	L	L	+	+	+
21	Enclosure	Habitation/Ag.	M	L	L	+	-	+
27	Enclosure	Relig.(Heiau/Hab.)	H	H	H	+	-	+
28	Enclosure	Religious**/Hab.	H	H	H	+	-	+
30	Alignment	Religious**	L/H	L/H	L/H	+	-	+
31	Overhang	Habitation/Ag.	M	L	L	+	-	+
32	Upright	Religious**	L/H	L/H	L/H	+	+	+
35	Human Bone	Burial	L	L	H	+	+	-
36	Enclosure	Religious**/Hab.	H	H	H	+	+	+
37	Complex (2)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Wall, U-shaped							
42	Enclosure	Habitation/Ag.	M	L	L	+	-	+
45	Complex (2)	Habitation/Ag.	H	H	L	+	-	+
A	Enclosure							
B	Enclosure							
46	Enclosure	Habitation/Ag.	M	L	L	+	-	+

SUMMARY OF IDENTIFIED SITES AND FEATURES - WAIOHULI (cont.)

Site/ Feature Number	Formal Site/Feature Type	Tentative Functional Interpretation	CRM Value Mode Assess. R	I	C	Field Work Tasks DR	SC	EX
47	Enclosure	Animal Control	L	L	L	-	-	-
48	Wall	Agriculture	M	L	L	+	+	+
49	Terraces	Agriculture	M	L	L	+	-	+
55	Overhang	Temp. Habitation	M	L	L	+	+	+
57	Upright Slab	Indeterminate	L	L	L	-	-	-
58	Walls	Animal Control	L	L	L	-	-	-
59	Wall	Transportation	L	L	L	-	-	-
60	Wall	Animal Control	L	L	L	-	-	-
65	Enclosure	Habitation/Ag.	M	L	L	+	-	+
67	Complex (2)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Enclosure							
71	Enclosure	Agriculture	M	L	L	+	-	+
73	Walls	Agriculture	M	L	L	+	-	+
75	Wall	Habitation/Ag.	M	L	L	+	+	+
77	Enclosure	Agriculture	M	L	L	+	-	+
80	Wall	Animal Control	L	L	L	-	-	-
82	Terrace	Habitation/Ag.	M	L	L	+	-	+
83	Enclosure	Habitation/Ag.	M	L	L	+	-	+
88	Wall	Transportation	L	L	L	-	-	-
90	Cave	Burial	H	L/H	H	+	+	+
96	Wall	Agricultural	M	L	L	+	+	+
97	Enclosure	Habitation/Ag.	M	L	L	+	+	+
98	Enclosure	Habitation/Ag.	M	L	L	+	+	+
101	Bridge	Transportation	L	L	L	-	-	-

APPENDIX B

SUMMARY OF IDENTIFIED SITES AND FEATURES — KEOKEA

*Site/ Feature Number	Formal Site/Feature Type	Tentative Functional Interpretation	#CRM Value Mode Assess.			+Field Work Tasks		
			R	I	C	DR	SC	EX
1	Complex (2)	Habitation/Ag	M	L	L	+	-	+
A	Platform							
B	Terrace							
2	Complex (2)	Habitation/Ag	M	L	L	+	-	+
A	Enclosure							
B	Enclosure							
3	Complex (2)	Burial**/Hab./Ag	M/H	L	L/H	+	-	+
A	Enclosure							
B	Enclosure							
4	Complex (2)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Enclosure							
5	Complex (2)	Temp. Habitation/ Agriculture	M	L	L	+	-	+
A	Platform							
B	Enclosure							
6	Complex (4)	Burial/Hab./Ag.	M/H	L	L/H	+	-	+
A	Enclosure							
B	Mound							
C	Enclosure							
D	Enclosure							

* PHRI temporary site numbers.

Cultural Resource Management - Value Mode Assessment—

Nature: R = scientific research
I = interpretive
C = cultural
Degree: H = high
M = moderate
L = low

+ Field Work Tasks:
DR = detailed recording (scaled drawings, photographs, and written descriptions)
SC = surface collections
EX = test excavations

**Possible functional interpretation

SUMMARY OF IDENTIFIED SITES AND FEATURES — KEOKEA (cont.)

Site/ Feature Number	Formal Site/Feature Type	Tentative Functional Interpretation	CRM Value Mode Assess. R	I	C	Field Work Tasks DR	SC	EX
7	Complex (2)	Habitation/Ag.	H	L	L	+	-	+
A	Enclosure							
B	Enclosure							
8	Complex (3)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Enclosure							
C	Enclosure							
9	Complex (3)	Habitation/Ag.	M	L	L	+	-	+
A	Overhang							
B	Enclosure							
C	Enclosure							
10	Complex (7)	Habitation/Ag.	H	L	L	+	-	+
A	Enclosure							
B	Enclosure							
C	Enclosure							
D	Enclosure							
E	Enclosure							
F	Enclosure							
G	Platform							
11	Terrace	Habitation/Ag.	M	L	L	+	-	+
12	Wall	Animal Control	L	L	L	-	-	-
13	Complex (6)	Habitation/Ag.	H	L	L	+	-	+
A	Enclosure							
B	Enclosure							
C	Enclosure							
D	Enclosure							
E	Enclosure							
F	Enclosure							
14	Enclosure	Habitation	M	L	L	+	-	+
16	Complex (3)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Enclosure							
C	Enclosure							
19	Complex (4)	Habitation/Ag.	H	L	L	+	+	+
A	Enclosure							
B	Enclosure							
C	Enclosure							

SUMMARY OF IDENTIFIED SITES AND FEATURES — KEOKEA (cont.)

Site/ Feature Number	Formal Site/Feature Type	Tentative Functional Interpretation	CRM Value Mode Assess. R	I	C	Field Work Tasks DR	SC	EX
20	Complex (3)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Terrace							
C	Enclosure							
21	Complex (2)	Habitation/Ag.	H	L	L	+	-	+
A	Enclosure							
B	Enclosure							
25	Complex (6)	Habitation/Ag./ Animal Control	H	L	L	+	-	+
A	Enclosure							
B	Wall							
C	Enclosure							
D	Enclosure							
E	Enclosure							
F	Wall							
26	Complex (2)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Platform							
27	Complex (2)	Habitation/Ag.	M	M	L	+	-	+
A	Overhang							
B	Enclosure							
29	Complex (2)	Habitation/Ag.	H	M	M	+	-	+
A	Enclosure							
B	Enclosure							
30	Heiau	Religious/Heiau	H	H	H	+	-	+
31	Enclosure	Habitation	M	L	L	+	-	+
32	Terrace	Habitation	M	L	L	+	-	+
35	Complex (2)	Habitation/Ag.	H	L	L	+	-	+
A	Enclosure							
B	Overhang							
36	Complex (5)	Habitation/Ag.	H	L	L	+	-	+
A	Enclosure							
B	Enclosure							
C	Enclosure							
D	Enclosure							
E	Enclosures							

SUMMARY OF IDENTIFIED SITES AND FEATURES — KEOKEA (cont.)

Site/ Feature Number	Formal Site/Feature Type	Tentative Functional Interpretation	CRM Value Mode Assess.			Field Work Tasks		
			R	I	C	DR	SC	EX
39	Overhang	Habitation	M	L	L	+	+	+
40	Complex (2)	Habitation	H	M	L	+	-	+
A	Enclosure							
B	Overhang							
41	Overhang	Temp. Habitation	M	L	L	+	-	+
42	Enclosure	Habitation	H	L	L	+	-	+
44	Complex (4)	Habitation/Ag.	H	L	L	+	-	+
A	Enclosure							
B	Enclosure							
C	Enclosure							
D	Enclosure							
45	Enclosure	Habitation/Ag.	M	L	L	+	-	+
46	Complex (4)	Habitation/Ag.	M	L	L	+	-	+
A	Structure							
B	Enclosure							
C	Enclosure							
D	Enclosure							
48	Complex (4)	Habitation/Ag.	H	H	H	+	-	+
A	Enclosure							
B	Enclosure							
C	Enclosure							
D	Enclosure							
50	Complex (3)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Enclosure							
C	Enclosure							
51	Enclosure	Habitation/Ag.	M	L	L	+	-	+
52	Complex (2)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Paved Area							
53	Complex (2)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Terrace							
54	Enclosure	Habitation/Ag.	M	L	L	+	-	+

SUMMARY OF IDENTIFIED SITES AND FEATURES — KEOKEA (cont.)

Site/ Feature Number	Formal Site/Feature Type	Tentative Functional Interpretation	CRM Value Mode Assess. R	I	C	Field Work Tasks DR	SC	EX
55	Complex (3)	Habitation/Ag.	H	L	L	+	-	+
A	Enclosure							
B	Overhang							
C	Enclosure							
57	Enclosure	Habitation/Ag.	M	L	L	+	-	+
59	Enclosure	Habitation/Ag.	M	L	L	+	-	+
60	Wall	Animal Control	L	L	L	-	-	-
62	Complex (3)	Relig./Habit. Ag./Burial	H	H	H	+	-	+
A	Enclosure							
B	Enclosure							
C	Enclosure							
63	Wall	Animal Control	L	L	L	-	-	-
64	Enclosure	Habitation/Ag.	M	L	L	+	-	+
65	Complex (7)	Habitation/Ag.	H	L	L	+	-	+
A	Enclosure							
B	Walls							
C	Enclosure							
D	Enclosure							
E	Enclosure							
F	Enclosures							
G	Enclosure							
69	Enclosure	Water Tank	M	L	L	+	+	-
70	Terrace	Agricultural	M	L	L	+	+	+
71	Complex (3)	Burial**/Habit.	M/H	L	L/H	+	-	+
A	Enclosure							
B	Enclosure							
C	Mound							
76	Complex (2)	Habitation/Ag.	M	L	L	+	-	+
A	Terrace							
B	Wall							

SUMMARY OF IDENTIFIED SITES AND FEATURES — KEOKEA (cont.)

Site/ Feature Number	Formal Site/Feature Type	Tentative Functional Interpretation	CRM Value Mode Assess. R	I	C	Field Work Tasks DR	SC	EX
78	Complex (6)	Rel.**/Hab./Ag.	H	H	H	+	+	+
A	Terraces							
B	Terrace							
C	Platform							
D	Complex							
E	Enclosure							
F	Enclosure							
79	Enclosure	Agriculture	M	L	L	+	-	+
80	Wall	Animal Control	L	L	L	-	-	-
81	Complex (2)	An. Contr./Ag.	M	L	L	+	-	+
A	Enclosure							
B	Enclosure							
84	Wall	Indeterminate	M	L	L	+	-	+
85	Walls & Terraces	An. Contr./Ag.	M	L	L	+	-	+
87	Complex (2)	Burial	H	L	H	+	-	+
A	Platform							
B	Mound							
89	Terrace	Habitation	M	L	L	+	-	+
90	Enclosure	Habitation	H	L	L	+	-	+
95	Complex (3)	Habit./Ag.	M	L	L	+	-	+
A	Enclosure							
B	Terrace							
C	Wall							
96	Enclosure	Habitation	M	L	L	+	-	+
97	Wall	Agricultural	M	L	L	+	-	+
98	Enclosure	Habitation/Ag.	M	L	L	+	-	+
99	Enclosure	Habitation	M	L	L	+	-	+
100	Wall	Animal/Control	L	L	L	-	-	-

SUMMARY OF IDENTIFIED SITES AND FEATURES — KEOKEA (cont.)

Site/ Feature Number	Formal Site/Feature Type	Tentative Functional Interpretation	CRM Value Mode Assess.			Field Work Tasks		
			R	I	C	DR	SC	EX
101	Mounds & Wall	An. Control/Ag.	M	L	L	+	-	+
102	Terrace & Wall	Habitation/Ag.	M	L	L	+	-	+
103	Overhang	Habitation/Ag.	M	L	L	+	-	+
105	Enclosure	Habitation/Ag.	H	L	L	+	-	+
106	Stone	Tool Manufac.	M	L	L	+	+	+
107	Overhang	Burial/Ag.	H	L	H	+	+	+
108	Enclosure	Habitation	M	L	L	+	-	+
109	Complex (2)	Agriculture	M	L	L	+	-	+
A	Overhang							
B	Terrace							
110	Wall	Agricultural	M	L	L	+	-	+
111	Complex (3)	Habitation	M	L	L	+	-	+
A	Overhang							
B	Terrace							
C	Overhang							
112	Complex (3)	Habitation/Ag.	M	L	L	+	-	+
A	Overhang	Animal Control						
B	Enclosure							
C	Wall							
115	Complex (2)	Habitation	H	H	M	+	-	+
A	Enclosure							
B	Enclosure							
116	Complex (2)	Animal Control	M	L	L	+	-	+
A	Enclosure							
B	Enclosure							
118	Complex (3)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure	Animal Control						
B	Enclosure							
C	Enclosure							

SUMMARY OF IDENTIFIED SITES AND FEATURES — KEOKEA (cont.)

Site/ Feature Number	Formal Site/Feature Type	Tentative Functional Interpretation	CRM Value Mode Assess. R	I	C	Field Work Tasks DR	SC	EX
120	Complex	Habitation/Ag.	M	L	L	+	-	+
A	Paved Terrace							
B	Lava Tube							
C	Enclosure							
124	Complex (3)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Overhang							
C	Enclosure							
127	Complex (2)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Overhang							
130	Enclosure	Habitation/Ag.	M	L	L	+	-	+
131	Complex (3)	Habitation/Ag. Animal Control	M	L	L	+	-	+
A	Overhang							
B	Enclosure							
C	Enclosure							
134	Enclosure	Religious"/ Habitation	H	L	M	+	-	+
135	Complex (2)	Habitation/Ag.	M	L	L	+	-	+
A	Lava Tube							
B	Wall							
137	Enclosure	Habitation/Ag.	M	L	L	+	-	+
140	Complex (2)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Enclosure							
142	Enclosure	Habitation/Ag.	H	L	L	+	-	+
143	Complex (2)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Overhang							
146	Enclosure	Habitation	M	L	L	+	-	+
148	Complex (4)	Habitation/Ag.	M	L	L	+	-	+
A	Enclosure							
B	Enclosure							
C	Enclosure							
D	Enclosure							

SUMMARY OF IDENTIFIED SITES AND FEATURES — KEOKEA (cont.)

Site/ Feature Number	Formal Site/Feature Type	Tentative Functional Interpretation	CRM Value Mode Assess.			Field Work Tasks		
			R	I	C	DR	SC	EX
149	Overhang	Habitation	M	L	L	+	-	+
152	Complex (2)	Habitation/Ag.	H	L	L	+	-	+
A	Platform							
B	Enclosure							
200	Overhang	Habitation	M	L	L	+	-	+
201	Enclosure	Habitation	M	L	L	+	-	+
202	Enclosure	Habitation	M	L	L	+	-	+
203	Enclosure	Habitation/Ag.	H	L	L	+	-	+
204	Enclosure	Habitation	M	L	L	+	-	+
205	Overhang	Habitation	M	L	L	+	-	+
206	Lava Tube Enclosure	Habit.**/Ag.	M	L	L	+	-	+
207	Sink	Burial/Habitation	H	L	L	+	+	+
208	Enclosure	Habitation	M	L	L	+	-	+
209	Enclosure	Agricultural	M	L	L	+	-	+
210	Overhang	Habitation	M	L	L	+	-	+
211	Terrace	Habitation	M	L	L	+	-	+

APPENDIX C

LIMITED HISTORICAL DOCUMENTARY RESEARCH KEOKEA AND WAIOHULI SUBDIVISIONS INVENTORY SURVEY

by Helen Wong Smith, B.A.

Keokea and Waiohuli Subdivisions are situated in the ahupua'a of Keokea and Waiohuli, Makawao District (Kula), Island of Maui. Makawao can be translated: "Watchful eyes of Wa-o" (timeless or eternity). Sterling (n.d.) notes that "Makawao includes the ancient districts of Hamakualoa and Hamakauapoko..." For this reason, historical citations regarding Hamakuapoko and Hamakualoa are included within this report.

This report includes information obtained from the usual historical sources found in libraries, and information from other sources such as land and tax records, archaeological reports, maps, and various other manuscripts. Much information was obtained from the files of the Maui Historical Society, which houses the personal notes of E. Sterling and I. Ashdown. The information in this report is organized into five sections: Early Historical Accounts, Heiau in the Project Area, Land Commission Award (LCA) Information, Land Use and Tenure Information, and Informant Interviews.

EARLY HISTORICAL ACCOUNTS

Early accounts concerning the Makawao District generally either describe the area or relate early historical events. Areal descriptions usually concern the atmosphere or weather. Ashdown (n.d.) writes, "kula-o-ka-ma'o-ma'o or Land of Mirages, where lost souls wandered until they could find their way to rest." The rain of Makawao is described by Mrs. Miverva Kalama to Sterling (n.d.) in this way: "'ukiu rain = a soft drizzle (the ua Kama'aina of Makawao) when the kiu rain cloud from Makawao meets the Naulu rain cloud from Kula then the rain comes, the typical Makawao rain."

A passage in Edward G. Beckwith's Journal of a Tour on Maui, also speaks of the unusual Makawao rain (Sterling n.d.):

> We noticed a peculiar meteorological phenomen through the whole ride. The trade wind which blows from the ocean across the Northwestern slope of Haleakala, is highly charged with vapor, which is condensed by the cool mountain air, and falls in abundant rains over the region of Makawao. Along the west side of the mountains about half way to the summit, lay a long line of cumulo stratus clouds, and between this and the nimbus there was but little space. The former lay along side of the mountain, apparently immovable, while the latter would advance and recede, now coming very near and coquettishly scattering its shining rain-drops beneath the very head of immovable cumulus, and now retreating as though afraid of its more dignified companion. While mentioning this latter peculiarity to a gentleman this evening, he remarked that it was this feature of the clouds which gave the place its name - Makawao, Mako=to be afraid, wao=a cloud (HMCS June 5, 1854). [Sterling notes that this is incorrect, that "afraid translates maka'u and ao is cloud. Pukui et al (1974) indicates the literal translation of Makawao is "forest beginning."

The Sterling and Ashdown manuscripts also provide these two descriptions of Makawao. Sterling's description is somewhat poetic; Ashdown's description is curiously intermixed with what may be a legend:

> "O native sons of those sections, the ones who watch for the dancing (haa) of the naked ones (olohe) on the plains of Kama'oma'o, where the iwa birds dwell in the ukiuku rain of Makawao..." S. W. Nailiili "E noho ana oe e oe ehoolono iki mai ana" Ke Au Okoa, Nov. 6, 1865. Hamakuapoko and Hamakualoa (Sterling n.d.).

In the area of Wahine'oma'o (now called the "Baseball Park" above the modern Poli-Poli camp) and nearby Lua-ma-ma-ne, was a structure said to be for bird catching ceremonies because that region was full of birds. The 'Oma'o bird is known as the Hawaiian Thrush, and they were plentiful and provided green feathers. The Woman of 'Omao' dwelt at Mamane and she was called Mamao because she was of such very high rank. She was so sacred that others must keep their distance. A handsome lesser chief fell in love with her beauty and tried to win her. Of course this was kapu. Her heart was heavy with the knowledge that because he came near to her shadow he had to be punished. A high priest conducted ceremonies of purification at the temple there and revived happiness. Today the Mamane trees are stunted and soon the foreign trees such as California Redwood, Norfolk Pines and others will be replacing the former green verdure (Ashdown 1971:46).

In 1873, Isabella Bird toured the Hawaiian Islands and wrote of her experiences to her sister back home in Edinburgh. These are her impressions of Makawao:

> It is very pretty here, and I wish all invalids could revel in the sweet, changeless air. The name signifies "ripe bread-fruit of the gods." The plantation is 2000' above the sea, and is one of the finest on the islands; and owing to the slow maturity of the cane at so great a height, the yield is from 5 to 6 tons an acre. Water is very scarce; all that is used in the boiling-house and elsewhere has been carefully led into concrete tanks for storage, and even the walks in the proprietor's beautiful garden are laid with cement for the same purpose. He has planted many thousand Australian eucalyptus trees on the hill-side in the hope of procuring a larger rainfall, so that the neighbourhood has quite an exotic appearance. Below, the coast is black and volcanic-looking jutting into the sea in naked lava promontories, which nature has done nothing to drape (Bird 1974:228).

Early accounts which mention Makawao in relation to early historical events include those by historians Kamakau and Fornander:

> When Kekaulike heard that Alapa'i, the ruling chief of Hawaii was at Kohala on his way to war against Maui, he was afraid and fled to Wailuku in his double war canoe named Ke-aka-milo. He sailed with his wives and children..., his officers, war leaders, chiefs, and fighting men, including warriors, spearmen, and counselors. Some went by canoe and some overload, and the fleet landed at Kapa'ahu at the pit of 'Aihako'ko in Kula [old name for Makawao]. Here on the shore the chiefs prepared a litter for Kekaulike and bore him upland to Haleki'i in Kukahua (Kamakau 1961:69).
>
> Ke-a-ulu-moku was another celebrated man of Kalaniopu'u's day. His father was the great chief Kau-ua-kahi-akua-nui, son of Lono-maka'i-honua and Kaha-po'ohiwi, but his mother belonged to Naohaku in Kohala. He was celebrated as a composer of war chants, chants of praise, love chants, prophetic chants, and genealogical chants. When he went back to Hawaii with Kalaniopu'u he was homesick for the two Hamakua districts of Maui [Hamakua is within Makawao District] here he had lived with Kamehameha-nui and Kahekili. His love for the place found expression in a chant he composed, of which the following is an excerpt:

Aloha, Aloha	Affectionate longing, ibid
Aloha wale o'u maku-a la	Affection for my (foster) parents,
e o'u makua,	my parents,
Aloha wale o'u makua	Affection for my parents
Mai na 'aina	Who belong to
Hamakua,	Hamakua,
He mau 'aina Hamakua elua,	The two districts of Hamakua
No'u mua kaikua'ana i naho ai.	Where my elder brothers live.
He ala pali na'u he mau ali'i ia	My hillside trails are theirs to rule

(Kamakau 1961:112).

During the fleeing of Kekaulike, Kahekili was carrying on the war on Oahu and suppressing the revolt of the Oahu chiefs, (Kamakau dates this 1785) a serious disturbance on Maui had occurred which gave him much uneasiness. It appears that he had given the charge of his herds of hogs that were running in the Kula district and on the slopes of Haleakala to a petty chief named Kukeawe. This gentleman, not satisfied with whatever he could embezzle from his master's herds, made raids upon the farmers and country people of Kula, Honuaula, Kahikinui, and even as far as Kaupo, robbing them of their hogs, under pretext that they belonged to Kahekili. Indignant at this tyranny and oppression, the country people rose in arms and a civil war commenced. Kukeawe called the military forces left by Kahekili at Wailuku to his assistance; a series of battles were fought, and finally Kukeawe was killed at Kamaole-i-kai, near Palauea, and the revolted farmers remained masters of the situation (Fornander 1969:228).

This uprising of the country people was called the "Battle of the pig-eating Ku-keawe" ('Aipua'a-a-Ku-keawe) (Kamakau 1961:142).

HEAIU IN THE PROJECT AREA

Three heiau are present in Keokea project area—Molohai, Papakea, and Kaumiumimua heiau. Molohai heiau, situated at an elevation of 2,275 feet above sea level, was initially described by Walker (n.d.), who described 26 heiau in the Kula region of which Molohai is the fourth largest. Walker about 1930 listed Molohai heiau as being 65 by 90 ft and constructed of rough a'a. Walker surmised that the heiau was probably originally L-shaped; however, this could not be determined definitely, as the heiau had deteriorated and portions of it had been rebuilt as a modern wall. According to Walker, the front of the heiau was double terraced, and within it were a large court and a platform, set off by a low wall. In 1973, the Historic Sites office recorded the heiau as including narrow, terraced platform steps along the walls, three stone mounds, an alignment of stones, and a rectangular platform. Due to its size and good condition, Molohai heiau has been placed on the State Register of Historic Places.

Papakea heiau is situated mauka of Molohai at an elevation of 2,300 ft above sea level. Walker (1931) describes the heiau as "an open platform of a'a construction 45'x88'...the front double-terraced to a height of 4'...some coral seen but no pebbles." While surveying the heiau in 1973, a Historic Sites office archaeologist was told by a local informant that a house and cistern once stood on the site. The archaeologist and informant surmised that rocks from the heiau were utilized in constructing the cistern and that Walker's measurement of the heiau excluded the property line of the house. Ashdown (1971:46) cites this heiau as a fishing shrine.

Kaumiumimua heiau, according to M. Riford (1987), is situated makai of Papakea, on a large gully overlooking Ma'alaea Bay. In 1931, Walker commented that the heiau had been much disturbed and that the remains of a platform were present in the northern corner and near the entrance. A survey of the heiau by the Historic Sites office in 1973 indicated that the east and south walls evidence two and possibly three separate construction periods.

Ashdown (1971:46) mentions other heiau in Keokea and Waiohuli—Ho'ola and Ho'oula Ua heiau in Keokea and Kaimupeelua heiau in Waiohuli. Ho'ola heiau (Health temple) is situated just behind the Kula Sanatorium. Ashdown writes, "Ho'oula Ua heiau," a place for praying and offering gifts to bring rain." She also writes, "long before the forest was denuded...near Polipoli Spring area, there was farm where 'awa was cultivated and there stood a temple to Lono." Kaimupeelua heiau is located in the Waiohuli project area. Although the heiau originally measured 17 by 25 meters, much of it has been reduced to rubble by cattle (Historic Sites Register 1973).

Other heiau mentioned by historic writers in the Makawao district include Kailua heiau (Thrum 1909:44), and Pa'uhu, Mahea, Kaumuopahu (or Kaunuopahu), Po'onahoehoe and Mana heiau. The latter heiau is now part of a modern cemetery (Ashdown 1971:57).

LAND COMMISSION AWARDS

Although there were many small parcels granted in Keokea and Waiohuli, the Indices states that Keokea was Crown Land from the beginning and that Waiohuli was approved as such in 1890 by Kalakaua. The numerous parcels may be a result of an experiment conducted by the Kamehameha III's administration prior the Greaty Mahele concerning trial fee ownership runs. Kuykendall (1968:283) recounts the reasons for such trial fee ownership runs:

> It will be remembered that the year 1845, during which the new land law was written and in part enacted, was disturbed by an anti-foreign agitation, accompanied by a rather pointed suggestion that lands be given or sold to the common people and that the legislative committee, in its reply to the petitions of the people, approved the idea of selling land to Hawaiian subjects. This was directly in line with suggestions contained in Dr. Judd's report as minister of the interior, and there were frequent allusions to the subject in the proceedings of the legislature. The agitation among the people probably hastened the decision of the goverment to make an experimental beginning without waiting for the new law to go into operation. The places selected for the experiment were the Makawao district of Maui and Manoa valley on Oahu.
>
> During the King's tour of Maui in December, 1845, and January 1846, the party visited Makawao and it was announced that the entire district, with the exception of McLane's plantation, was to be offered for sale to the people in fee simple. Rev. J.S. Green, pastor of the Hawaiian church at Makawao, undertook to manage the business of selling the land. In afterwards relating his experience in connection with the project, Green said he called the people together, showed them his instructions from the goverment, and explained the plan to them.
>
> A few of them purchased at once, others had less confidence that lands thus purchased would be secure, but soon abandoned their scruples, while others still could not for a long time, be persuaded that there was not some catch about it—some design to enrich the chiefs at their expense. But nearly all of these were finally talked out of their suspicions & took up each a small piece of land.
>
> * Letter in Polynesian, July 14, 1849.

Another missionary, Rev. Richard Armstrong, assisted the enterprise by making surveys. The land was sold at $1 per acre, and nearly a 100 parcels were taken up, most of them ranging from 5 to 10 acres. Altogether about 900 acres were purchased by the people of the district.

In a report by Riford (1987), 11 Land Commission Awards (LCA) either within or bordering the Keokea parcel and eight LCAs within the Waiohuli parcel are listed. The bulk of the parcels is designated as kula land and houselots (1987). Kula land is described by Handy and Handy (1972:510) as "open country, or plain, as distinct from valley...and has often been used as a term to distinguish between dry, or 'kula land' and 'wet-taro land'". As indicated in Kuykendall's account, kula plots were cultivated for personal use, but many tenants were involved in ranching and cash crops. A map of the project area showing LCA locations was obtained from the Tax Map Bureau in Honolulu (Figure A-1; "Portion of Kula, Makawao, Maui TMK 2-2-02"). The map shows nine LCAs within or abutting Keokea and Waiohuli. LCA 8452:19, in the ahupuaa of Koheo 1 and 2, abuts the Waiohuli project area on the northern side.

LAND USE AND TENURE

In their discussion of Hawaiian sweet potato planting techniques, Handy and Handy (1972) mention the Kula area of Maui and describe it as "[w]here potatoes are planted in crumbling lava with humus, as on eastern Maui and in Kona, [in] Hawaii the soil is softened and heaped carelessly in little pockets and patches using favorable spots on slopes...[r]ocky lands in the olden days were walled up all around with the big and small stones of the patch until there was wall (kuaiwi) about 2' high" (Handy and Handy 1972:131).

Handy (1940:161) also mentions Kula in his early work entitled The Hawaiian Planter:

> KULA was always an arid region, throughout its long, low seashore vast stony kula lands, and broad uplands. Both on the coast, where fishing was good, and on the lower westward slopes of Haleakala a considerable population existed. So far as I can learn Kula supported no Hawaiian taro, and the fisherman in this section must have depended for vegetable food mainly on poi brought from Waikapu and Wailuku across the plain to supplement their sweet potato staple diet.

Kuykendall (1968:313) writes of the time when Kula crops turned from subsistence crops to commodities:

...Before that time the whalers had created a limited market for fresh vegetables, fresh meat, and fruit; the great increase in the number of whaleships after 1840 caused a corresponding increase in the demand for such products of the soil. In bulk and value, potatoes (sweet and Irish) ranked first in this traffic. In the early days only sweet potatoes had been obtainable at the islands, but after 1830, if not sooner, cultivation of the Irish potato was taken up and during the 1840s and 1850s became of great importance. It was shortly before 1840 that Irish potatoes were first raised in the Kula district, which proved to be so well adapted to them that it soon came to be called the "potato district." Jarves describes the region as it appeared to him in July 1846:

> It ranges along the mountain (Haleakala) between 2000 and 5000 feet elevation, for the distance of 12 miles. The forest is but partially cleared, and the seed put into the rich virgin soil. The crop now in the ground is immense. The fields being all in blossom have a fine appearance, spreading as they do, over the broad surface of the mountain.

From this upland region the potatoes were carried down to the shore and taken to Lahaina or were sold directly to ships which called at Kalepolepo. In the spring of 1847 it was estimated that the crop would amount to 20,000 barrels...In 1854, G.D. Gilman estimated that the local Hawaiian market, including whaleships, could be depended on to consume about 20,000 barrels of Irish potatoes.

The influx of gold seekers together with the comparative neglect of agriculture in California created a demand for potatoes and other vegetables, as well as for sugar, molasses, and coffee, which began to be felt strongly in 1847, but the potato "boom" commenced in the fall of 1849. At the beginning of November a correspondent wrote from Maui to the Polynesian:

> The call for [potatoes] is loud and pressing, as some vessels bound for California have taken as many as 1,000 barrels each. The price is high, and the probablity is that the market can not be supplied this autumn. Kula, however, is full of people. Strangers from Wailuku, Hakamakua, and Lahaina are there

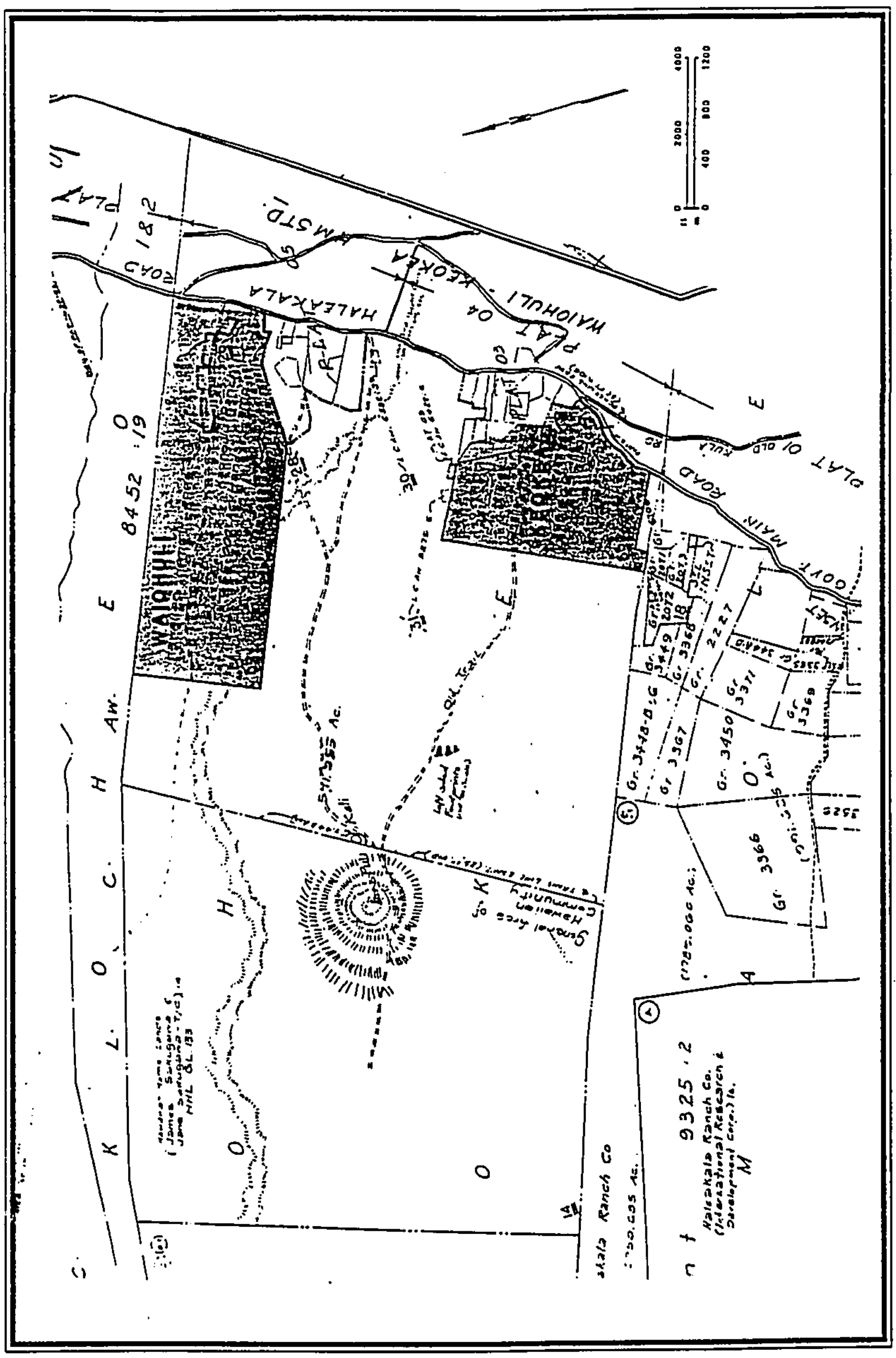

Figure C-1. 1938 MAP SHOWING PROJECT AREA AND LCA LOCATIONS

> preparing the ground and planting, so that if the demand from California shall be as urgent next spring as it is now the people will reap a rich harvest...They often repeat the saying of a foreigner, who after visiting the mines of California, came back to Maui quite satisfied, and said to his neighbors at Waikapu, "California is yonder in Kula. There is the gold without the fatigue and sickness of the mining country."

The foreigner's remark caught the fancy of the Hawaiians and they were soon referring to Kula as "Kalifonia" or "Nu Kalifonia" and working with great diligence to extract the wealth from the rich pay dirt on the slopes of Haleakala. To encourage the spirit of enterprise which had been thus awakened among the native people, the privy council voted to have the government lands in Kula surveyed and divided into small lots of from 1 to 10 acres and offered for sale to the natives at a price of $3/acre (see page 5 of this report) (1968:321).

C. Speakman, in his book entitled MOWEE also mentions the fervor of cash-cropping:

> During the gold rush, hundreds of Hawaiians were going into business for themselves on Maui-growing potatoes and hauling them to the port where they were snapped up and shipped to San Francisco. The Maui fields were called Nu Caliponi, or New California; potatoes were gold, and a fortune could be dug out of the ground by one man. The potato boom was short lived, and, when the prices dropped, the Hawaiians lost interest. Perhaps the problem was that Hawaiians did not share the white man's concept of time (1978:116).

The Chinese were among those who took advantage of this agricultural opportunity. During the 1840s, Chinese farmers leased lands in Kula. Their initial success motivated many Chinese to move to that region and lease land for farming. They moved from places such as Makawao, Paia, and Wailuku on Maui, Kohala on the Big Isle, and from Honolulu. Some went to Kula directly from China. The vast majority of Chinese, about 95%, were Hakkas from Kwangtung Province. During the 1840s, most Kula Chinese acquired their farmland by lease or deed from the haole ranchers or Hawaiian homesteaders. Much of this land was owned by the Hawaiian government, which leased it to the ranchers, who in turn subleased it to the Chinese. In some cases, the farmers made their lease payments in farm produce, in lieu of monetary transaction. One family which leased land from Ulupalakua Ranch paid five bags of corn for every acre of land they farmed (Interview, Willie Fong IN Mark 1975). Although by the mid-1850s, the demand for Kula potatoes had diminished, the Chinese population continued to grow. By between 1880 and 1910 approximately 80 Chinese families had moved to Kula; by 1900 there were some 700 Chinese living there. For a period of 30 to 40 years, Kula supported a thriving community which included Chinese and English schools, Christian churches, a Hung Men society, gambling joints and opium dens, general stores, and dozens of operating farms and cattle ranches (Mark 1975).

In addition to Irish potatoes, the Kula farmers planted corn, beans, onions, Chinese cabbage, round cabbage, sweet potatoes, wheat and other grains, and even cotton. When the Hawaiian market showed no demand for corn, the farmers used the corn to raise pigs, ducks and chickens, and marketed the animals instead. When the corn, potatoes, and other crops were harvested, they were packed and transported on mule teams or wagons to Kahului and Makena harbors, and were then shipped to Honolulu. Those who lived in the southern districts of Keokea and Kamaole usually brought their produce to the Makena landing. Most of Kula's produce, poultry, and beef was sent to two or three markets in Honolulu Chinatown, including Wing Hong Yuen and Sing Loy. The two stores, in turn, supplied Kula's general stores with Chinese dry goods and staples such as rice, flour, sugar, and canned milk (Mark 1975).

Early farming in Kula was adapted to the topography. In planting crops, rather than terracing the land, the farmers followed the natural contour of the land and depended on moist air and rainfall rather than irrigation. Until 1905, there was little water piped into the area, and during droughts—which occurred every several years—the farmers had to pack barrels of water on mules from Polipoli Springs, or from the beach or Olinda, both about 8 miles away (Mark 1975). An article in newspaper The Honolulu Advertiser points out the changes in the topography in Kula and its affect on the water supply:

> Before 1850 Kula was supplied with moisture naturally through the existence of a large forest. "That forest was cut down when land was cleared in Kula to open farm plots in 1850. This was in answer to the demand for food in California during the gold rush....by ranchers clearing for pasture." Secondary result of clearing forests was destruction of existing fresh water ponds in Kihei on the Maaloaea (sic) Bay coast below Kula. When forest was cleared, water was free to rush down the mountains carrying soil from Kula and filling with

> mud, the ponds for which Kihei was once famous. Meanwhile Kula is dependent on pipe from Waikamoi watershed (Korte 1962 A:15).

In 1905 the Kula Pipeline was built during perhaps the worst drought in Kula history. The water source for the pipeline was discovered in Olinda, northeast of Kula. The contractor who built the pipeline was a prominent Kula resident named Shim Mook, and labor was supplied by the men and women of the area (Mark 1975).

In 1911 the Hawaiian government released a large amount of public land, and it became possible for citizens to purchase property in Kula. The sale of the land was advertised in English and Hawaiian newspapers, but word was somehow not communicated to the Chinese, whose lives these land sales would most affect. According to the Hawaiian Church Chronicle (Oct. 1911:12), the Kula Chinese "were not aware of what was taking place until the land was sold and the Hawaiians came and told them that the property belonged to them. They (Chinese) had relied on the information which they had received that the disposal of the land would not take place for a considerable time." Faced with eviction, the Kula Chinese decided determinately to remain on the land and organize themselves. Ninety-eight young residents signed a petition expressing the desire of the Chinese to be allowed to reside on certain lots their families had farmed for many years. In a letter to the Commissioner of Public Lands dated September 27, 1911, Governor Frear suggested that leases be made to occupants of unsold lots for approximately 10 years, subject to withdrawal for homestead purposes. Then, as the older children of those families reached 18 years of age, they would be able to apply for the lots as homesteads. In October 1911 the Hawaiian Church Chronicle reported that the government had promised to do so under these terms. Chinese who applied for homesteads and were granted them were given three years to improve their lot...after that period, they could apply for a "right of purchase" lease, and then buy the land outright from the government. Before this special arrangment was arrived at, however, a number of Kula farmers saw their land divided into homesteads and leased to others. These farmers, with the loss of their farmland, were forced to move out of Kula and change their livelihoods.

During the 1910s and 1920s many families left Kula for various reasons: severe drought which ruined crops and killed livestock, soil which was reaching depletion level after years of harvesting and tilling, lack of educational opportunities for children, and loss of land due to parceling homesteads. In 1918 another mass exodus occurred—some 40 families left Kula because the land they were leasing was sold to a man named Harold Rice, who intended to use the land for ranching. In the book Mowee, the author writes regarding the sale of farms to Rice: "The leases to the land had not expired, but the farmers were unaware of their right to challenge the eviction" (Speakman 1978:143). It is some of this land that Rice acquired from the farmers that made up Kaonoulu Ranch, in which the project area resides.

In the early 1970s, 35% of Hawaii's vegetables were grown in Kula, including a large percentage of the state's head lettuce, dry onions, and tomatoes. Much of the remaining land was devoted to livestock breeding by about 20 full and part-time ranchers (Project Measure Work Plan - Lower Kula Irrigation Project," Board of Water Supply, Maui County, Sept. 1971) The cash crops in Kula were no longer corn and potatoes, but a variety of vegetable and flowers produced by some 35 family-operated farms ranging in size from five to 50 acres. As of 1975, the agricultural yield of the irrigated soil was still very high (Mark 1975).

Sugar cultivation has played a major role in Honuaula and Makawao. In the spring of 1846 there were six establishments on the western slope of Mt. Haleakala manufacturing sugar and molasses (Kukendall 1968:316). Since the general vicinity of the present project area has been used historically for small farms and ranching, Kula sugar cultivation will not be discussed here.

A report on Kula would not be complete without some mention of Kula Sanatorium, founded for the care of tuberculosis sufferers. The sanitorium is located mauka of the project area at an elevation of 3,000 feet (The Honolulu Advertiser 9/20/85 B:3). Land for the sanatorium was requested by Bill Pogue in 1909. Initially the sanitorium consisted of two tent-houses which accomodated 12 patients. The tent-houses, which included kitchen and dining facilities, was financed by the County and Territory and cost $500.00. The first permanent ward was built by W.E. Foster, former patient and Superintendent. Around 1932, the Hawaiian Homes Commission granted 100 acres to the sanitorium, and in 1937 a new sanatorium was constructed (Jones 1940).

The following general information relevant to Keokea and Waiohuli ahupua'a is from The Maui News:

> ***3-26-04*** - P. Cockett has been appointed manager of Waiohuli Cattle Ranch.
>
> ***4-27-07*** - On last Sunday morning, J.P. Inaina was installed pastor of the Keokea Hawaiian church in Kula. A large audience was present. Rev. I. D. Iaea preached the sermon and Rev. M. Lutero gave the right hand of fellowship. The charge to people and pastor was given by Rev. R.B. Dodge. Rev. D.N. Opunui offered the installing prayer.

12-16-32 - Formal approval of the newly acquired land in Keokea which is now being turned into a baseball park for the people of Kula, was given by the Board of Supervisors on Thursday. A resolution requesting the Commissioner of Public Lands to effect the exchange of lands between the territory and the owner was adopted by the Board. Slightly over two acres are involved in the transaction.

INFORMANT INTERVIEWS

On April 20, 1989 the author, accompanied by Mr. Dan Auwai, Department of Hawaiian Homes Lands - Maui Manager, conducted oral history interviews with two former employees of Kaonoulu Ranch—William Poepoe and Henry Kekiwi. William Poepoe was employed by the ranch for some 46 years and retired in 1983. Mr. Poepoe was born on Ulapalakua Ranch and started working for Kaonoulu Ranch at the age of nine, at which age he planted molasses grass (scattering seeds) for the cattle to feed on. By age 11, he was working full-time for Kaonoulu Ranch. Mr. Poepoe said that Harold W. Rice, the founder of the ranch, owned, in addition to lands leased, over 18,000 acres. After Mr. Rice's death, his son, Oskie Rice, took over. Oskie Rick employed 15 full-time ranch hands. Mr. Poepoe said that the cattle raised on the ranch were taken to Makawao for slaughter. In addition to beef cattle, there were also dairy cattle.

Mr. Poepoe also provided additional information on the general Kula area. According to him, near Pu'u Kali (Red Hill) they grew corn, and within the caldera of Pu'u Kali is a fence that the Army erected during WWII for target practice. On the Kamaole-Keokea border there was once a Hawaiian settlement. Mr. Poepoe said there were paved sidewalks and gravesites there. He once took a tombstone from there, until the foreman asked where he got it and pointed out what it was. He then returned it.

Mr. Henry Kekiwi was the last foreman for Kanoulu Ranch (under Rice ownership). He presently lives in the Foreman's house, which the ranch provided along with five other houses for ranch hands. According to Mr. Kekiwi, when he retired after 42 years with the ranch, the ranch had 2,500 head of cattle. Mr. Kekiwi provided general information on the area of the ranch. According to him, stone walls throughout the ahupua'a were built in the 1800s. On ranching practices, Mr. Kekiwi said that the cattle would graze in the lower lands near Pu'u Kali during the winter months, then around June, they would be taken mauka. Mr. Kekiwi noted that Hawaiian Homes Land wraps around the land of a Mr. George Tanji, who has lived on the land many years growing cabbages and pigs. Mr. Kekiwi also noted that Rice sold kuleana land in the area to a Dupont and that Hawaiians and Chinese would move from Pu'u Kali area to further up Keokea during summer. Mr. Dan Auwai said the name Kaonoulu is derived from Cornwell who originally owned the land. A check with the Hawaii State Archives, however, shows Kaonoulu listed as an 'ili, so the name is most likely traditional.

Driving down the old Haleakala Road starting at Keokea gate, where the agricultural parcels that Hawaiian Homes is allocating are located, Mr. Kekiwi noted that the heiau from second gate left of Haleakala Road had ti leaves growing on its side, which indicates a fresh water supply in the area. He also pointed out many heiau in the general vicinity of Molohai and Papakea in Keokea, and in Waiohuli. He was not privy to the names of any of them nor was he aware of any stories about them. Mr. Kekiwi pointed out that when ranching, one is busy looking for cattle, not for heiau. Along Haleakala Trail, which was used by Kaonoulu Ranch extensively during its ownership by the Rice family, he pointed out "footprints" imprinted in the lava rock. These footprints are outside the project area, on the way to Pu'u o Kali, also known as Red Hill (see Figure A-1 for location of footprints and locations of other sites mentioned in the interviews). The footprints numbered three, were of various sizes, and were all of the left foot. During an interview with William Poepoe, he said the right sides to the footprints were somewhere on Molokai. Mr. Kekiwi noted that before the ranch, the land was (probably) inhabited by Chinese; the Chinese used the walls but they were not necessarily built by them. Mr. Kekiwi said that the barbed wire fences along the walls were put up by the ranch hands, especially when parts of a wall would fall off, to prevent the cattle from crossing over. When asked by Mr. Auwai about a barbed wire fence that surrounded a small area outside the project area, Mr. Kekiwi said that it was probably put up by pakalolo growers and not the ranch hands.

CONCLUSION

During this century, the project area has been used primarily for cattle grazing, hence the many archaeological sites obscured by grasses and lantana. For the purposes of this report, a general overview of agricultural activities was given. If further historical documentary research is conducted for the project area, it is suggested that a check be made for awards given out during the Kingdom of Hawaii and that the following topics be addressed: prehistoric environment and occupation in the area, as evidenced by historical documents; local and regional cultural (including residential sequences.

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APPENDIX D

WAIOHULI SITE AND FEATURE DESCRIPTIONS

SITE NOS.: STATE: 2344 **PHRI:** W-1 **BPBM:**—
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 7.8 m long by 10.0 m wide; c. 78 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: This feature is a rectangular enclosure. *Facing in places on both the inside and outside of the walls.* Upright facing stones are present in the northeast and southwest corners. North wall is an alignment. All walls curve outwards. Walls range in height from 10 to 90 cm. Agricultural features, mounds and crude terraces surround the enclosure.

SITE NOS.: STATE: 2345 **PHRI:** W-2 **BPBM:** T-6
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 8.0 m long by 3.6 m wide; c. 29 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: This is a long, narrow enclosure. The walls show no signs of having been faced. Near the center of the west wall a short wall segment extends westward for 1.5 meters. Scattered mounds, modified outcrops, and crude terraces surround the feature.

SITE NOS.: STATE: 2039 **PHRI:** W-3 **BPBM:** T-7
FORMAL TYPE: Terrace
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, kiawe and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 19.6 m long by 10 m wide; c. 196 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: This is a complex, rectangular paved terrace with a 1.0 m high faced wall on the northwest. The west wall extends southward beyond the terrace and retains a lower earthen terrace. The paved surface of the terrace overlies 25 cm thick cultural deposit. Alignments border the south and east sides of the earthen terrace. Agricultural features; crude terraces, mounds and modified outcrops are scattered around the site.

SITE NOS.: STATE: 2346 **PHRI:** W-4 **BPBM:** T-8
FORMAL TYPE: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 78.0 m long by 1.0 m wide; c. 78 sq m
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Animal Control
DESCRIPTION: This site is part of a complex of historic stone walls all of which are associated with a major east-west drainage. The wall is constructed of stacked boulders and cobbles. It follows the bottom of a narrow drainage. A barbed wire fence begins at the east end of the wall.

SITE NOS.: STATE: 2347 **PHRI:** W-5 **BPBM:** —
FORMAL TYPE: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 3.0 m long by 3.8 m wide; c. 11 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Indeterminate
DESCRIPTION: This overhang was possibly utilized. The evidence for use consists of a single boulder which appears to have been placed on the dripline in the center of the entrance. The interior is 1.0 m high.

SITE NOS.: STATE: 2348 **PHRI:** W-6 **BPBM:** —
FORMAL TYPE: Lithic Scatter
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 7.3 m long by 2.8 m wide; c. 20 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Lithic Reduction
DESCRIPTION: Basalt flakes are on a small bedrock outcrop. The bedrock has scars on it which suggest that a cobble was smashed against it. There are c. 12 flakes (5-10 cm) and numerous smaller flakes on the bedrock.

SITE NOS.: STATE: 2349 **PHRI:** W-8 **BPBM:** —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, kiawe, and grasses

CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 5.5 m long by 8.1 m wide; c. 45 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Semi-rectangular structure with some internal facing on the east wall. The walls of the enclosure are collapsed and have been altered both by cattle and bulldozer cuts on the south and SE sides. A wing wall extends SW 2.8 m from the SW corner. The structure walls are compiled of stacked boulders and cobbles up to 70 cm in height. Mounds and modified outcrops are present south of the site.

SITE NOS.: STATE: 2350 PHRI: W-10 BPBM: —
FORMAL TYPE: Terrace
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, kiawe and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 6.6 m long by 5.3 m wide; c. 35 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Agriculture
DESCRIPTION: T-shaped terrace; at the SW corner of the terrace is an outcrop. The terrace wall is composed of stacked boulders, cobbles and pebbles. It retains a c. 10 sq m area of soil.

SITE NOS.: STATE: 2040 PHRI: W-11 BPBM: T-5
FORMAL TYPE: Complex
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 23.0 m long by 18.0 m wide; c. 414 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Burial*/Agriculture
DESCRIPTION: This complex includes a C-shaped enclosure, a wall, mounds, and a platform. Some mounds are possible burials; the largest (Feature E) is faced on one side. The C-shaped enclosure is unusual in that it opens to the northeast. Rough terraces, small mounds and modified outcrops, all probable agricultural features, surround the site.

FEATURE: A
FORMAL TYPE: C-shaped enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, kiawe and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 3.6 m long by by 2.4 m wide; c. 9 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: C-shaped enclosure open to the NE. Feature is comprised of stacked cobbles up to 40 cm high. A test pit in this feature produced only a few scattered pieces of charcoal, potentially indicating it is not a habitation feature as it's orientation also suggests. The charcoal produced a calendric age range of AD 1270-1490.

FEATURE: B
FORMAL TYPE: Mound
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 2.0 m long by 1.2 m wide; c. 2 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Mound is roughly circular and rounded in profile. It is comprised of basalt cobbles and boulders stacked 40 cm high. The feature is more substantial than most of the agricultural mounds in the vicinity.

FEATURE: C
FORMAL TYPE: Mounds
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, panini, kiawe
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 8.0 m long by 6.6 m wide; c. 53 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Four small mounds and one associated rubble wall. This portion of the site appears to be agricultural in nature. The mounds are too small for burials, and the wall appears to be a portion of a collapsed terrace situated along the edge of the drainage. The mounds average 6.5 cm in diameter and 40 cm in height.

FEATURE: D
FORMAL TYPE: Mound
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, panini, kiawe
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 1.9 m long by 1.9 m wide; c. 4 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: This is a large mound comprised of stacked basalt cobbles and boulders. It is roughly rectangular in plan and rounded in profile. The mound is 60 cm in height. It is more substantial than most of the agricultural mounds in the vicinity.

* Tentative, temporary, or provisional.

FEATURE: E
FORMAL TYPE: Platform
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 3.0 m long by 3.0 m wide; c. 9 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: This feature appears to be a mostly collapsed platform which probably contains a burial. The 90 cm high structure is comprised of stacked boulders and cobbles. A c. 2 m long segment of the exterior facing remains intact along the west side. The remaining sides are collapsed. A small piece of decomposing coral is present on the surface of the feature.

FEATURE: F
FORMAL TYPE: Mound
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, panini, kiawe
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 1.8 m long by 1.4 m wide; c. 3 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: The is a large mound comprised of stacked basalt cobbles and boulders. It is roughly rectangular in plan and rounded in profile. The mound is 60 cm in height. It is more substantial than most agricultural mounds in the vicinity.

SITE NOS.: STATE: 2351 PHRI: W-12 BPBM: —
FORMAL TYPE: Terraces
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Panini, lantana and 'ilima
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 7.0 m long by 13.2 m wide; c. 92 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Agriculture
DESCRIPTION: Three rock-retained terraces arranged in a stepped series. The terraces average 0.4 m in height, 7.0 m long by and 4.6 m wide. Terrace walls incorporate bedrock outcrops. Additional agricultural features, mostly mounds and modified outcrops are present to the southeast.

SITE NOS.: STATE: 2352 PHRI: W-13 BPBM: — *(Figure D-1)*
FORMAL TYPE: Complex
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, wiliwili, 'ilima, kiawe and grasses
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 25.0 m long by 20.0 m wide; c. 500 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Two enclosures; one square and the other trapezoidal. Associated agricultural mounds and terraces surround these features and extend c. 40 m to the northeast.

FEATURE: A *(Figure D-1)*
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 8.0 m long by 6.0 m wide; c. 48 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Trapezoidal enclosure; possible wall extension off NW corner. Small terrace at NW corner. Most of the west wall is collapsed. The SE corner is faced externally. The walls average 40 cm in height, are core-filled (filled portion is narrow), and are comprised of stacked boulders and cobbles.

FEATURE: B *(Figure D-1)*
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 6.1 m long by 6.0 m wide; c. 37 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Square enclosure with core-filled walls. The southwest wall consists of a ridge of bedrock. The walls average 40 cm in height. The wall faces are comprised of stacked basalt cobbles and boulders. The core-fill is comprised of cobbles.

SITE NOS.: STATE: 2353 PHRI: W-14 BPBM: —
FORMAL TYPE: Complex
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 42.0 m long by 28.0 m wide; c. 1176 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: This site includes two enclosures, an L-shaped wall, and associated agricultural features.

FEATURE: A
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses

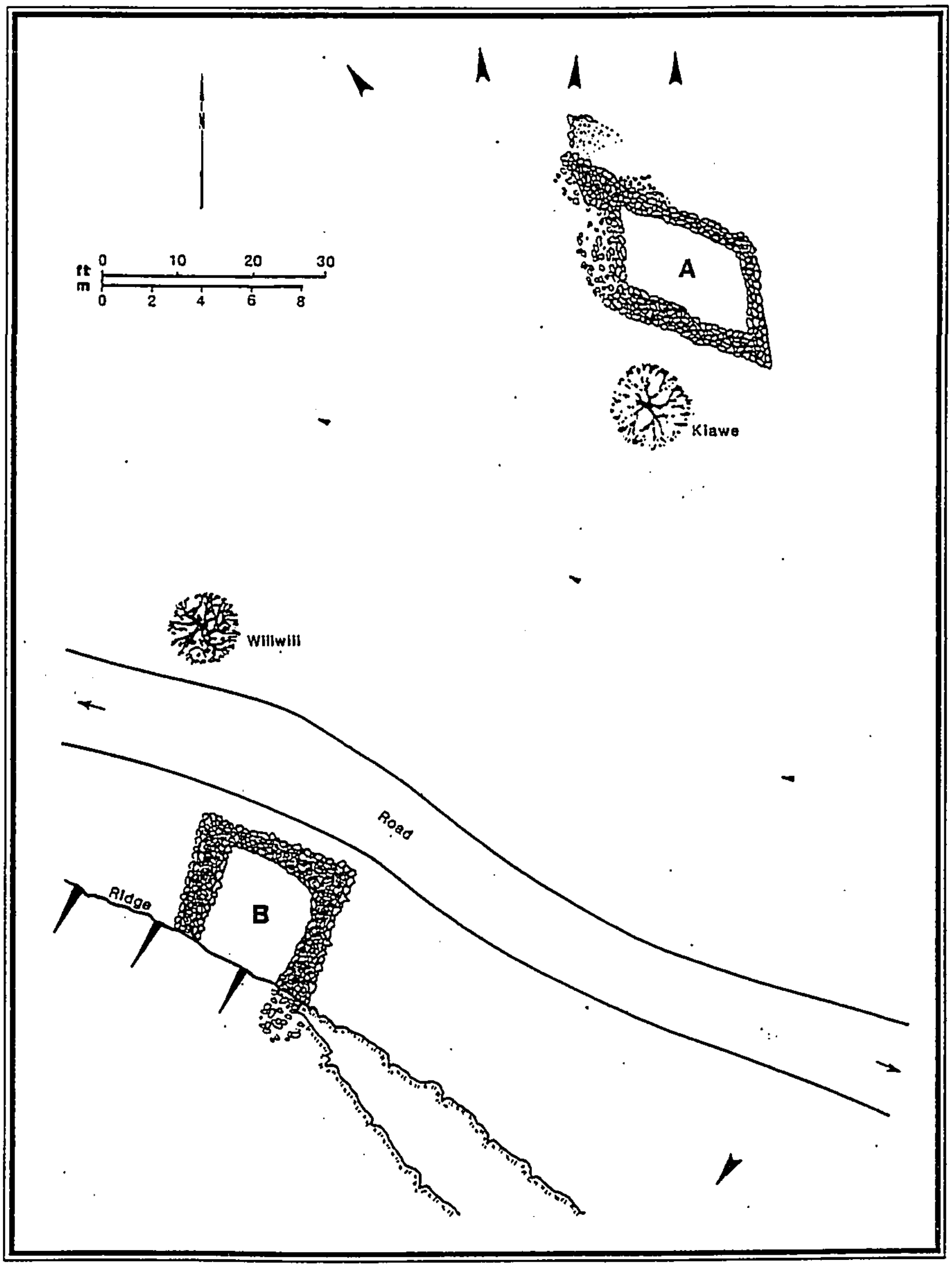

Figure D-1. SITE W-13, FEATURES A AND B.

CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 8.1 m long by 6.0 m wide; c. 49 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure with internal facing on the NE corner. Two large flat slabs located atop walls of structure. Internal wall extends off south wall. The walls range from 20 to 60 cm in height and are comprised of stacked basalt boulders and cobbles.

FEATURE: B
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 3.0 m long by 2.5 m wide; c. 8 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: C-shaped; very crude. One end of the structure sits on bedrock. Feature is open to the south. It is comprised of basalt boulders and cobbles stacked/piled up to 50 cm in height. Feature probably is agricultural in function.

FEATURE: C
FORMAL TYPE: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 10.0 m long by 9.0 m wide; c. 90 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: L-shaped; west portion of feature consists of an alignment of boulders and cobbles; south wall consists of stacked boulders and cobbles. The walls border a roughly rectangular area of level soil.

SITE NOS.: STATE: 2354 PHRI: W-15 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Poor
INTEGRITY: Unaltered
DIMENSIONS: 5.0 m long by 4.8 m wide; c. 24 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: This is an oval enclosure constructed of large stones (averaging 60 cm in diameter). The inside of the NE wall is faced. Agricultural features, mounds and modified outcrops, are present to the southeast.

SITE NOS.: STATE: 2355 PHRI: W-17 BPBM: —
FORMAL TYPE: Complex
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 13.0 m long by 9.0 m wide; c. 117 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Consists of a two-chambered enclosure and an oval enclosure; both are small and incorporate bedrock in their construction. Scattered agricultural features surround the site.

FEATURE: A
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 6.0 m long by 4.0 m wide; c. 24 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Two chambered enclosure; incorporates bedrock on south side. The north wall is faced on both the inside and the outside up to 60 cm in height. Walls are comprised of stacked boulders and cobbles. A cowrie shell fragment is present on the surface inside the feature.

FEATURE: B
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 4.2 m long by 4.2 m wide; c. 18 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Circular enclosure with the walls well faced on the inside. The southern wall is 1.0 m high and the north wall is 0.7 m high. The walls are comprised of stacked basalt boulders and cobbles.

SITE NOS.: STATE: 2356 PHRI: W-18 BPBM: —
FORMAL TYPE: Complex
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 100.0 m long by 80.0 m wide; c. 8,000 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture

DESCRIPTION: This site includes one rectangular enclosure, one irregular enclosure, and numerous agricultural terraces and mounds.

FEATURE: A
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, wattle, kiawe, and grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 6.3 m long by 5.4 m wide; c. 34 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Medium-sized rectangular enclosure which appears to have a doorway on the northwest corner. The walls are comprised of stacked basalt boulders and cobbles and range from 15 to 50 cm in height.

FEATURE: B
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 12.0 m long by 11.0 m wide; c. 132 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Complex irregular enclosure. The larger (southern) enclosed area is large (9 x 7.5 cm) and U-shaped. The northern enclosed area consists of an attached C-shape. The larger enclosed area opens to the west portion of the U-shaped area. The walls are comprised of stacked basalt boulders and cobbles. The walls range in height from 30 to 40 cm.

SITE NOS.: STATE: 2357 PHRI: W-20 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 7.1 m long by 6.9 m wide; c. 49 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Rectangular enclosure; upslope walls retain a terrace. The west wall consists of an alignment on an outcrop. The walls are comprised of basalt boulders and cobbles stacked up to 70 cm in height. A probable hammerstone is present on the surface. Scattered agricultural features surround the site.

SITE NOS.: STATE: 2358 PHRI: W-21 BPBM: —
(Figure D-2)
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 9.9 m long by 9.2 m wide; c. 91 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: This is a rectangular enclosure open to the NW which is situated on a partially paved terrace. The walls of the enclosure are faced on both sides. The enclosure is 5 m long by 4.5 wide by 1.2 m high. Both the terrace and enclosure are comprised of stacked basalt cobble and boulders. Scattered agricultural features surround the site.

SITE NOS.: STATE: 2041 PHRI: W-27 BPBM: T-36
(Figures D-3, D-4)
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 22.0 m long by 12.5 m wide; c. 275 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Religious/ Habitation
DESCRIPTION: May be Kaumeheiwa Heiau. L-shaped enclosure; includes an internal platform or wall segment, paving, and cupboard and step along the inner north wall. The northeast corner is notched. The south wall is paved with flat well-rounded boulders. The walls are well-faced and average 1.2 to 2 m in thickness and 90 cm in height. A test unit excavated in the interior of the enclosure revealed a subsurface cultural deposit containing charcoal, basalt and volcanic glass flakes, coral, marine shell and bone. A radiocarbon sample from the deposit yielded three possible age ranges between AD 1305 and 1617.

SITE NOS.: STATE: 2042 PHRI: W-28 BPBM: —
(Figure D-5)
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 12.1 m long by 11.1 m wide; c. 134 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Religious* /Habitation
DESCRIPTION: This is a notched, paved enclosure. The paving lies over a rich cultural (habitation) layer. This feature may be a heiau or high status residence. Formally it resembles site 27. The walls average 2m in thickness and are up to 90 cm in height. The walls are faced on the interior and exterior. The walls are constructed of stacked boulders

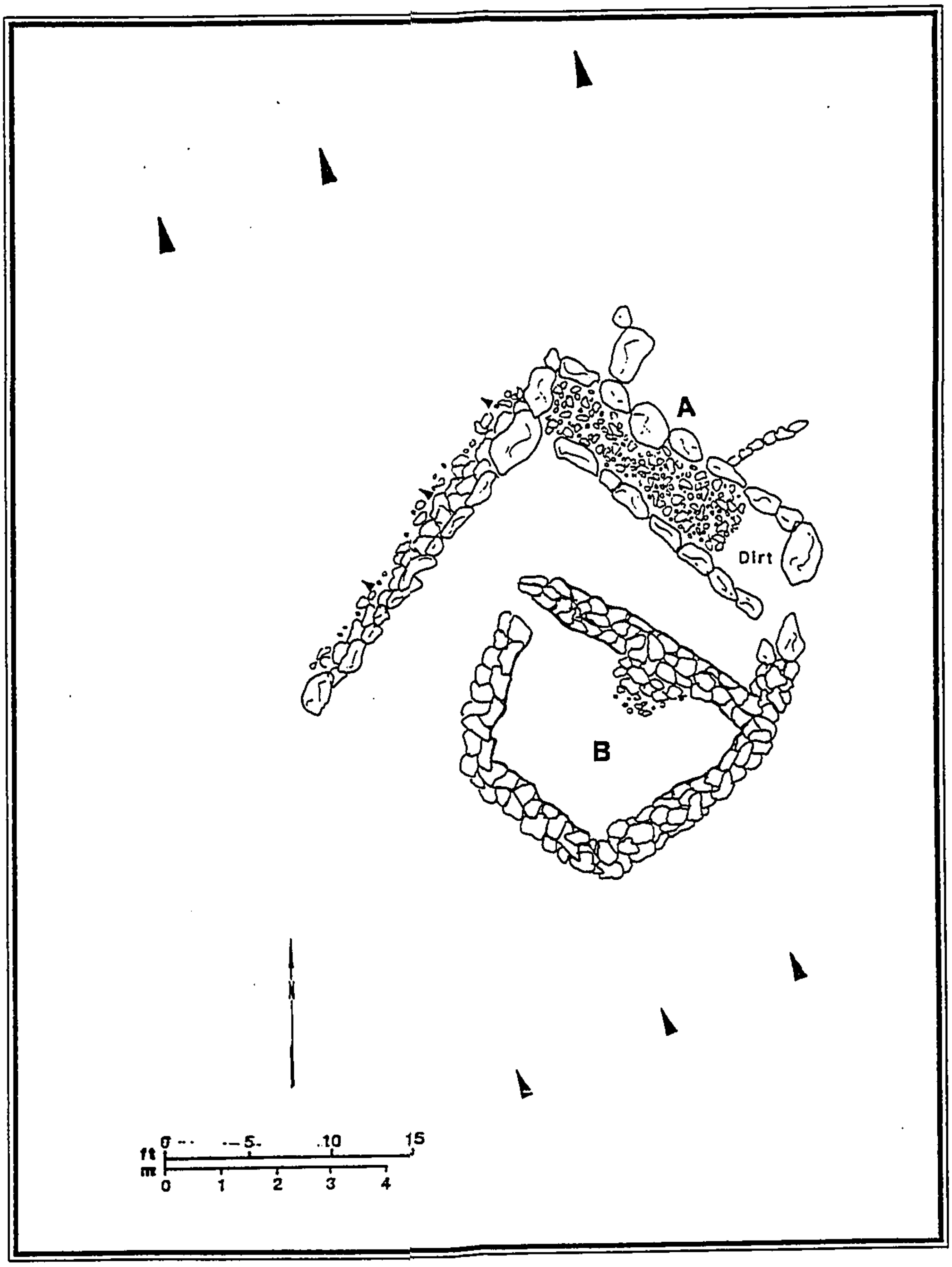

Figure D-2. SITE W-21

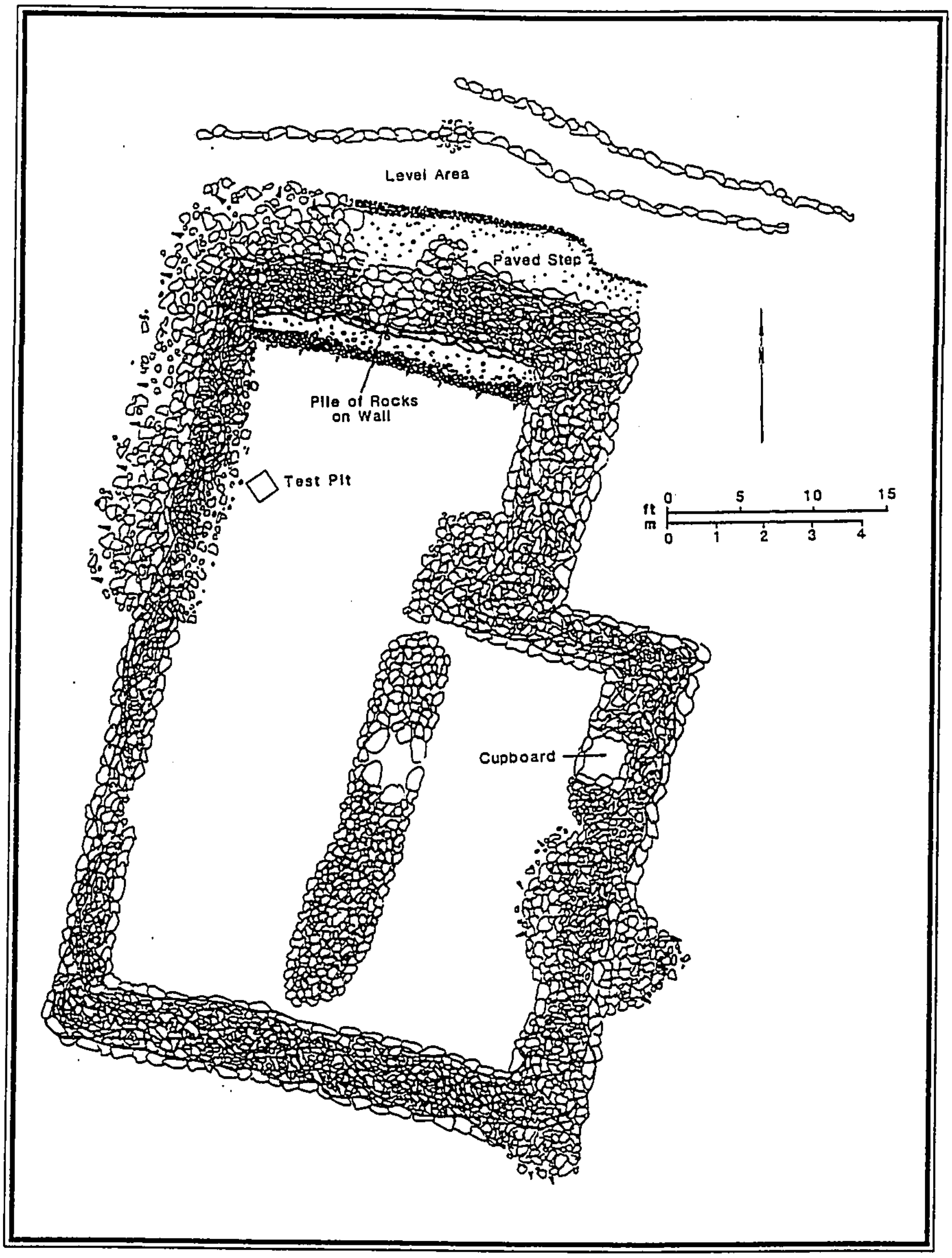

Figure D-3. SITE W-27

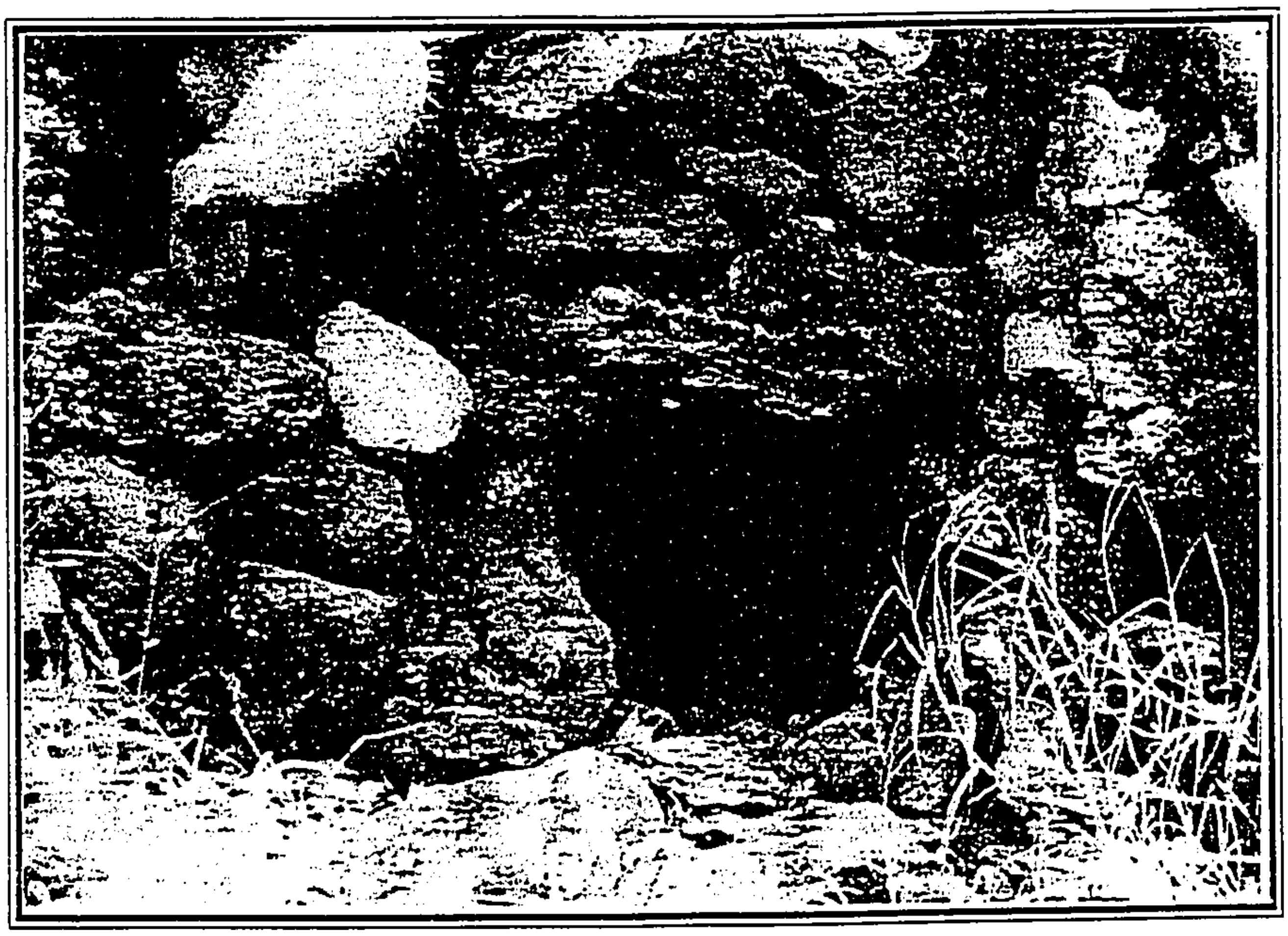

Figure D-4. SITE W-27, CUPBOARD.
VIEW TO EAST-SOUTHEAST
(PHRI Neg. 1143-3)

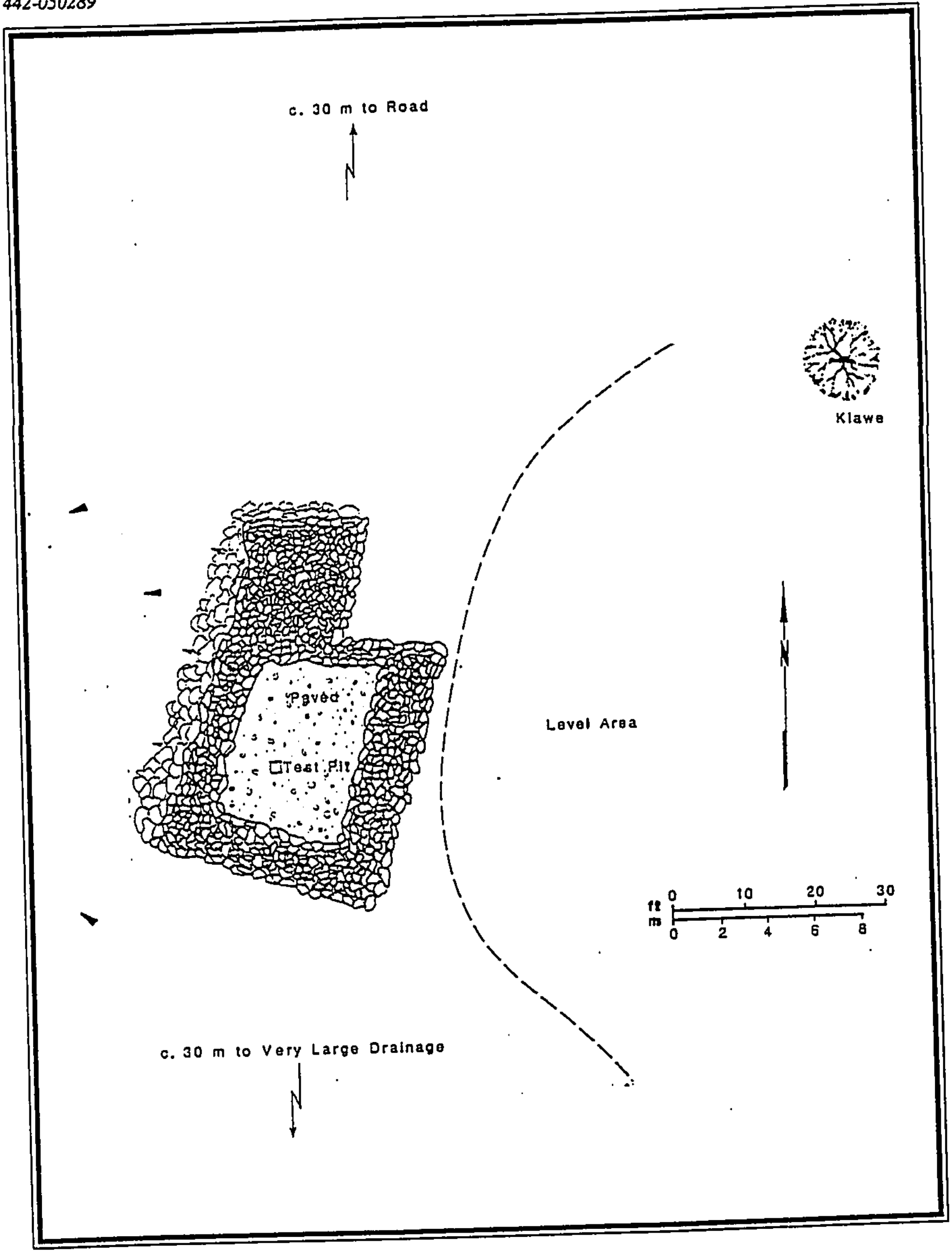

Figure D-5. SITE W-28

and cobbles. A test unit in the interior of the enclosure revealed a subsurface cultural deposit containing coral, basalt and volcanic glass flakes, bone and charcoal. The deposit was capped by a pavement of basalt pebbles and cobbles. A radiocarbon sample obtained from the deposit yielded a age range of AD 1290- 1640.

SITE NOS.: STATE: 2359 PHRI: W-30 BPBM: T-110
FORMAL TYPE: Alignment
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 23.0 m long by 1.0 m wide; c. 23 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Religious*
DESCRIPTION: Alignment of uprights and boulders situated on the edge of a basalt outcrop overlooking a gulch and another possible ceremonial site (W-32). Site W-27 lies c. 75.0 m to the southwest. The site's proximity to at least one religious/ceremonial site and its form suggest a possible religious function.

SITE NOS.: STATE: 2360 PHRI: W-31 BPBM: —
FORMAL TYPE: Overhangs
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 13.0 m long by 3.0 m wide; c. 39 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Two overhangs; includes a bedrock outcrop and a free standing wall. The wall connects with the outcrop c. 5.5 m east of the easternmost overhang and extends west for about 7.0 m. The overhangs are each c. 1.0 m deep by 3.0 m wide by 2.0 m high. Agricultural features surround the site.

SITE NOS.: STATE: 2361 PHRI: W-32 BPBM: —
(Figure D-6)
FORMAL TYPE: Upright
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 6.2 m long by 6.0 m wide; c. 55 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Religious*
DESCRIPTION: Natural upright with orifice. The upright is part of an outcrop. The upright projects well above the outcrop and is 2m high measured from the surface of the rough terrace. The orifice is .15 m in diameter and .55 m deep. Beneath the boulder wall is a crude terrace retained by a single-course of rocks. This unusual, and apparently modified natural upright is interpreted as a possible shrine; however, excavation of the terrace would be necessary to confirm this interpretation.

SITE NOS.: STATE: 2362 PHRI: W-35 BPBM: T-105*
FORMAL TYPE: Human bone
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle, lantana, and 'ilima
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 4.8 m long by 4.5 m wide; c. 22 sq m
PROBABLE AGE: Unknown
FUNCTIONAL INTERPRETATION: Burial
DESCRIPTION: A slightly waterworn human skull fragment was discovered in the bottom of a gulch. Anterior portions of the occipital and both parietals were still articulated. The isolated fragment probably originated from an eroded burial situated somewhere upslope.

SITE NOS.: STATE: 2043 PHRI: W-36 BPBM: —
(Figure D-7)
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 15.6 m long by 7.6 m wide; c. 119 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Religious* /Habitation
DESCRIPTION: A complex, paved rectangular enclosure with internal features. In the northeast corner is a slightly elevated paved platform. A fallen upright is present at the interior edge of the platform. One decomposing piece of coral is present near the platform. Overall the feature appears to be divided longitudinally into an upper paved half which has the platform and a lower half which has a soil covered surface. The walls of the feature are well-faced along much of their extent. The walls are comprised of basalt cobbles and boulders stacked up to 1.0 cm in height. The walls average 2 m in thickness. A test unit excavated in the lower soil-covered half of the feature revealed a pavement of large flat stones beneath which is a subsurface cultural deposit containing charcoal, coral, basalt flakes and numberous pebbles and cobbles, many of which are waterwon. A radiocarbon sample from the deposit yielded a calendric age range from AD 1397-1482.

SITE NOS.: STATE: 2363 PHRI: W-37 BPBM: T-104*
FORMAL TYPE: Complex

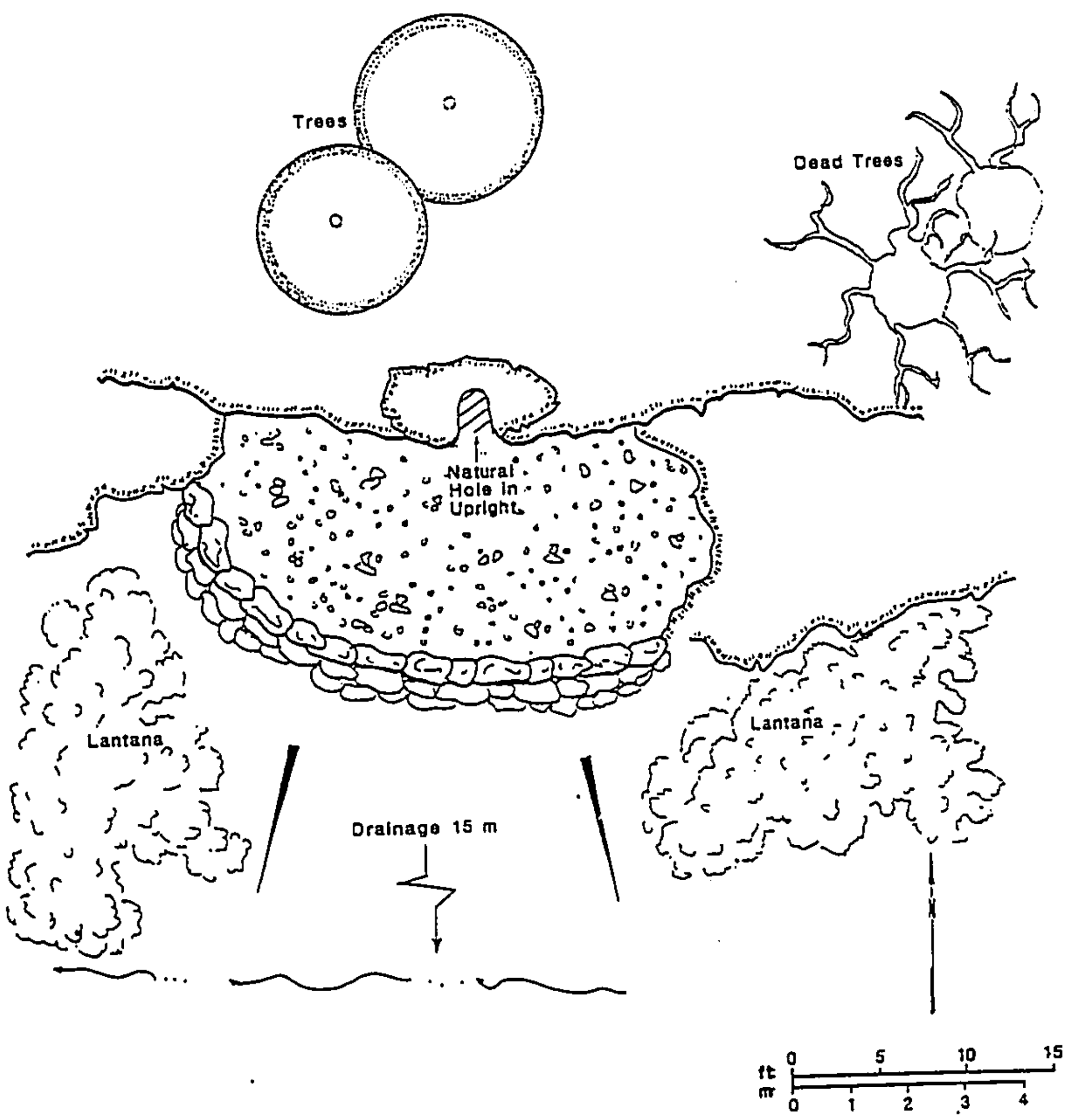

Figure D-6. SITE W-32

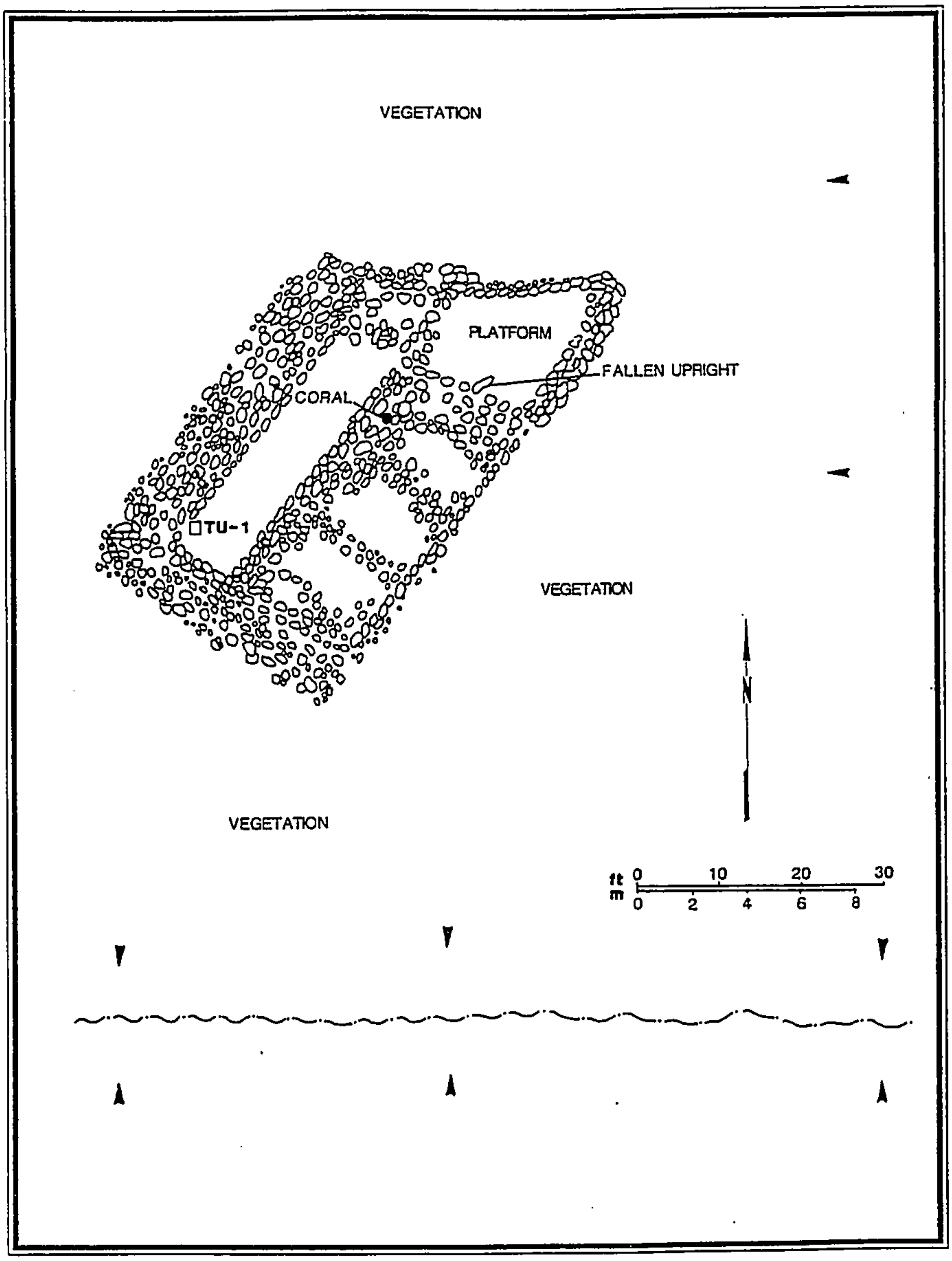

Figure D-7. SITE W-36

TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 5.0 m long by 4.0 m wide; c. 20 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Circular enclosure with some facing on inside of NE wall, and a U-shaped enclosure. Agricultural features surround this site for distances exceeding 100.0 m.

FEATURE: A
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, and 'ilima
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 5.0 m long by 4.0 m wide; c. 20 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Circular enclosure c. 25 m north of Waiohuli Gulch. Enclosure is thoroughly obscured by lantana and panini. No signs of paving within enclosure. Walls average 75 cm in thickness and 30 cm in height. They are comprised of stacked basalt boulders and cobbles.

FEATURE: B
FORMAL TYPE: U-shaped wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle Forest
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 20.0 m long by 17.0 m wide; c. 340 sq m
PROBABLE AGE: Unknown
DESCRIPTION: Discontinuous U-shaped wall faces the south, perpendicular to the slope. The wall consists of one to two courses of large stacked cobbles and boulders.

SITE NOS.: STATE: 2364 PHRI: W-42 BPBM: T-75*
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle, grasses, 'ilima
CONDITION: Poor
INTEGRITY: Unaltered
DIMENSIONS: 5.5 m long by 5.2 m wide; c. 29 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Oval enclosure and surrounding agricultural terraces. The highest density of terraces is to the east and the south of the enclosure. The enclosure is either poorly constructed or in poor condition. The walls are comprised of stacked basalt cobbles and boulders. Walls average 90 cm in thickness and 20-40 cm in height.

SITE NOS.: STATE: 2044 PHRI: W-45 BPBM: T-72 *(Figure D-8)*
FORMAL TYPE: Complex
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 90.0 m long by 65.0 m wide; c. 5,850 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: This complex includes a rectangular enclosure and an oval enclosure amidst extensive agricultural terraces and mounds.

FEATURE: A
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Panini, Lantana, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 12.0 m long by 12.0 m wide; c. 144 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure with an adjoining western terrace. The western edge of the enclosure is defined by a large bedrock outcrop. Walls are comprised of basalt boulders and cobbles stacked to a maximum height of 40 cm.

FEATURE: B
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses.
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 8.0 m long by 7.0 m wide; c. 56 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Oval enclosure with high, wide, faced walls. On the inside of the northwest wall there is a step-like feature which averages 1 m in width and is c. 30 cm above the interior surface. The walls of the structure range between 1 and 2 m in thickness and .50 to 1.40 in height. The walls are comprised of stacked boulders and cobbles. A test unit excavated in the interior of the feature revealed a subsurface cultural deposit containing charcoal, marine shell, basalt and volcanic glass flakes an kukui nut shell. A radiocarbon sample from the deposit yielded a calendric age range of AD 1450-1660.

SITE NOS.: STATE: 2365 PHRI: W-46 BPBM: T-71
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, wattle, 'ilima, and grasses

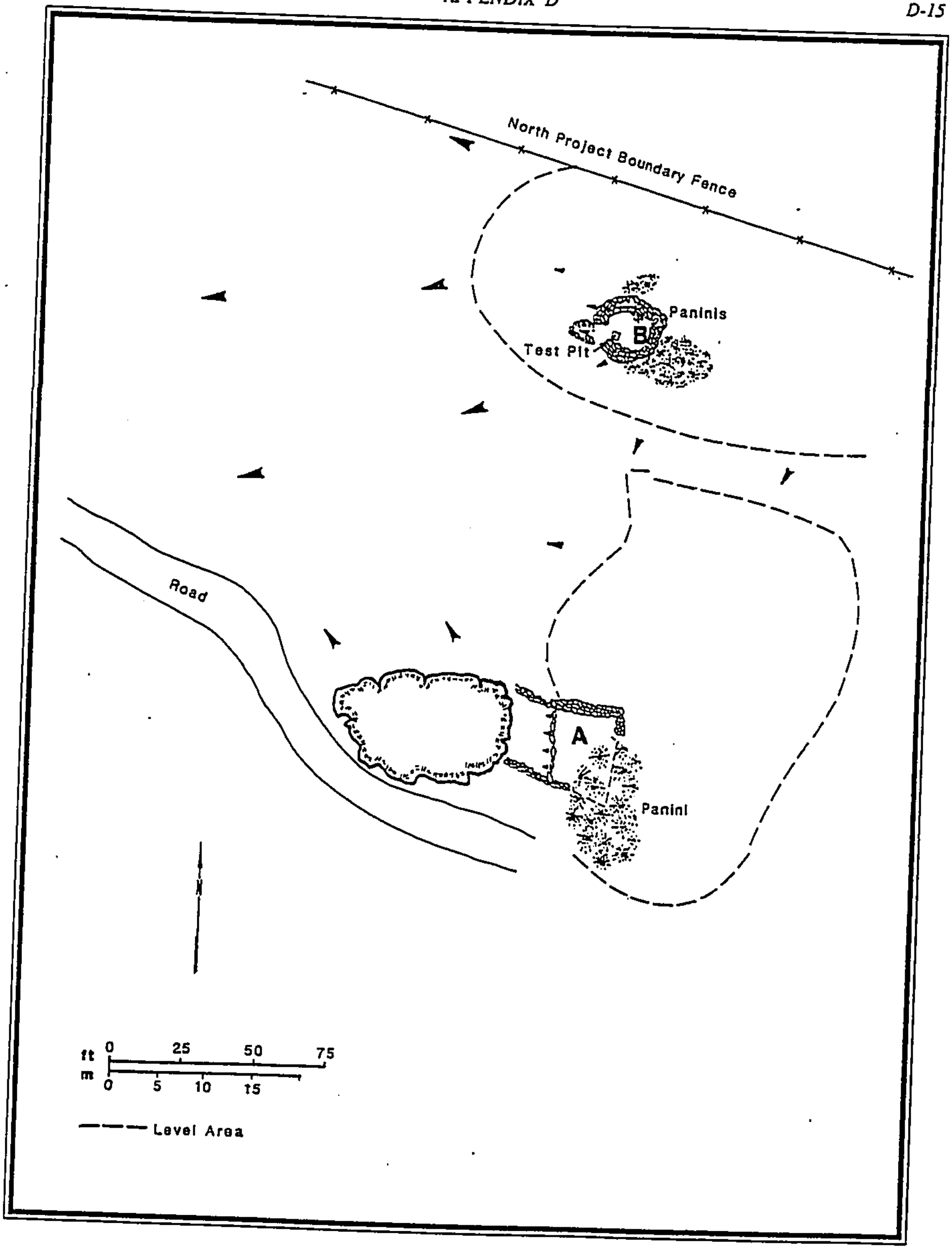

Figure D-8. SITE W-45

CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 14.5 m long by 9.5 m wide; c. 138 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Trapezoidal enclosure surrounded by agricultural features. There is an opening in the northwest corner of the structure. The walls, comprised of stacked basalt boulders and cobble, average 1.0 m in thickness and 50 cm in height.

SITE NOS.: STATE: 2366 PHRI: W-47 BPBM: T-107
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle, 'ilima and grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 39.0 m long by 25.0 m wide; c.975 sq m
PROBABLE AGE: Historic*
FUNCTIONAL INTERPRETATION: Animal Control
DESCRIPTION: Large rectangular enclosure. Wing walls extend off NE and NW corners. Some facing on the south and north sides and on the east wing wall. Walls are comprised of stacked boulders and cobbles. The walls average 80 cm in thickness and 1.0 m in height.

SITE NOS.: STATE: 2367 PHRI: W-48 BPBM: T-108
FORMAL TYPE: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle, 'ilima, and grasses
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 20.0 m long by 38.0 m wide; c. 760 sq m
PROBABLE AGE: Prehistoric*
FUNCTIONAL INTERPRETATION: Agriculture
DESCRIPTION: Large U-shaped wall; western wall retains a terrace. Wall is comprised of stacked basalt boulders and cobbles. Wall ranges in height from 40 to 100 cm.

SITE NOS.: STATE: 2368 PHRI: W-49 BPBM: —
FORMAL TYPE: Terraces
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 13.0 m long by 12.0 m wide; c. 156 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Agriculture
DESCRIPTION: Alignment connecting two parallel agricultural terraces. Agricultural terraces are extensive in this area, extending c. 150.0 m east to the edge of the project area.

SITE NOS.: STATE: 2369 PHRI: W-55 BPBM: —
FORMAL TYPE: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle, grasses, lantana, and Silky Oak
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 4.0 m long by 3.5 m wide; c. 14 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary Habitation*
DESCRIPTION: Site is an overhang with a wall in front partially blocking the entrance. The enclosed area measures 4.0 m wide by 3.5 m deep 2.0 m high. The wall covers 1.4 m of the entrance. The overhang is filled with historic trash. The wall is composed of stacked basalt boulders.

SITE NOS.: STATE: 2370 PHRI: W-57 BPBM: —
FORMAL TYPE: Upright slab
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle, lantana, and grasses.
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 0.03 m long by 0.10 m wide; c. 300 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Indeterminate
DESCRIPTION: Single upright slab with a few possibly associated boulders. Possible remnant of a wall or terrace because evidence of bulldozer disturbance surrounds.

SITE NOS.: STATE: 2371 PHRI: W-58 BPBM: —
FORMAL TYPE: Walls
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle, 'ilima, and grasses
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 30.0 m long by 1.0 m wide; c. 30 sq m
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Animal Control
DESCRIPTION: Two wall segments which were probably connected before bulldozing of area. Walls run perpendicular to slope segments comprised of stacked basalt boulders and cobbles averaging 60 cm high. Probable remnant of cattle wall..

SITE NOS.: STATE: 2372 PHRI: W-59 BPBM: T-81
FORMAL TYPE: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle, 'ilima, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 24.0 m long by 1.0 m wide; c. 24 sq m
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Transportation

DESCRIPTION: Historic road retaining wall. The wall is in good condition and well-faced. It retains an abandoned road overlooking a drainage.

SITE NOS.: STATE: 2373 PHRI: W-60 BPBM: —
FORMAL TYPE: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle and grasses
CONDITION: Poor
INTEGRITY: Altered
DIMENSIONS: 25.0 m long by 0.4 m wide; c. 10 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Animal Control
DESCRIPTION: Intermittent wall with some facing on the south side of the east end. The wall runs mauka-makai perpendicular to slope. Wall id 25 m long, 40 cm thick, and 1.0 m high. It is constructed of stacked basalt boulders and cobbles. Probably part of some wall represented at site 58.

SITE NOS.: STATE: 2374 PHRI: W-65 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Silky Oak, wattle, lantana, and grasses
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 26.0 m long by 12.0 m wide; c. 312 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Semi-rectangular enclosure and terraces. The NE and NW walls of this enclosure consist of modified bedrock. Facing is in the SE interior corner. A 10.0 m long terrace alignment situated just upslope from the structure. Enclosed walls average 75 cm in thickness and 40 cm in height. The enclosure is 8.4. m long and 5.6 m wide.

SITE NOS.: STATE: 2375 PHRI: W-67 BPBM: — *(Figure D-9)*
FORMAL TYPE: Complex
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, panini, 'ilima
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 18.0 m long by 12.0 m wide; c. 216 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Consists of one trapezoidal enclosure and two close parallel walls. Walls may represent a collapsed structure or two adjacent terraces. Several agricultural mounds noted in the vicinity.

FEATURE: A
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, panini, 'ilima
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 12.0 m long by 11.0 m wide; c. 132 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Trapezoidal enclosure. The east wall has been built around bedrock. The south wall is faced with eight upright slabs. There are also upright slabs in the NE and NW corners. A wing wall extends off the southwest corner. The wall averages 40 cm in height and is composed of stacked basalt boulders and cobbles.

FEATURE: B
FORMAL TYPE: Enclosure (?)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, panini, 'ilima
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 9.0 m long by 4.0 m wide; c. 36 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Two parallel walls two meters apart extending for c. 7.8 m. Walls are joined at NW end by relatively large rocks. The other end is partially enclosed by larger rocks but they do not completely close off the structure. Formally the walls resemble terraces; however' it is likely they represent the disturbed remnants of a smaller enclosed rectangular terrace.

SITE NOS.: STATE: 2376 PHRI: W-71 BPBM: T-101
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, panini, wattle, and grasses
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 22.0 m long by 18.0 m wide; c. 396 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Agriculture
DESCRIPTION: Triangular enclosure with associated agricultural features. The structure has a small wall in the eastern end. Agricultural features extend west for c. 120.0 m along the side of a hill. Enclosure walls average 25 cm in height and are comprised of stacked boulders and cobbles.

SITE NOS.: STATE: 2377 PHRI: W-73 BPBM: —
FORMAL TYPE: Walls
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle and grasses
CONDITION: Fair
INTEGRITY: Altered

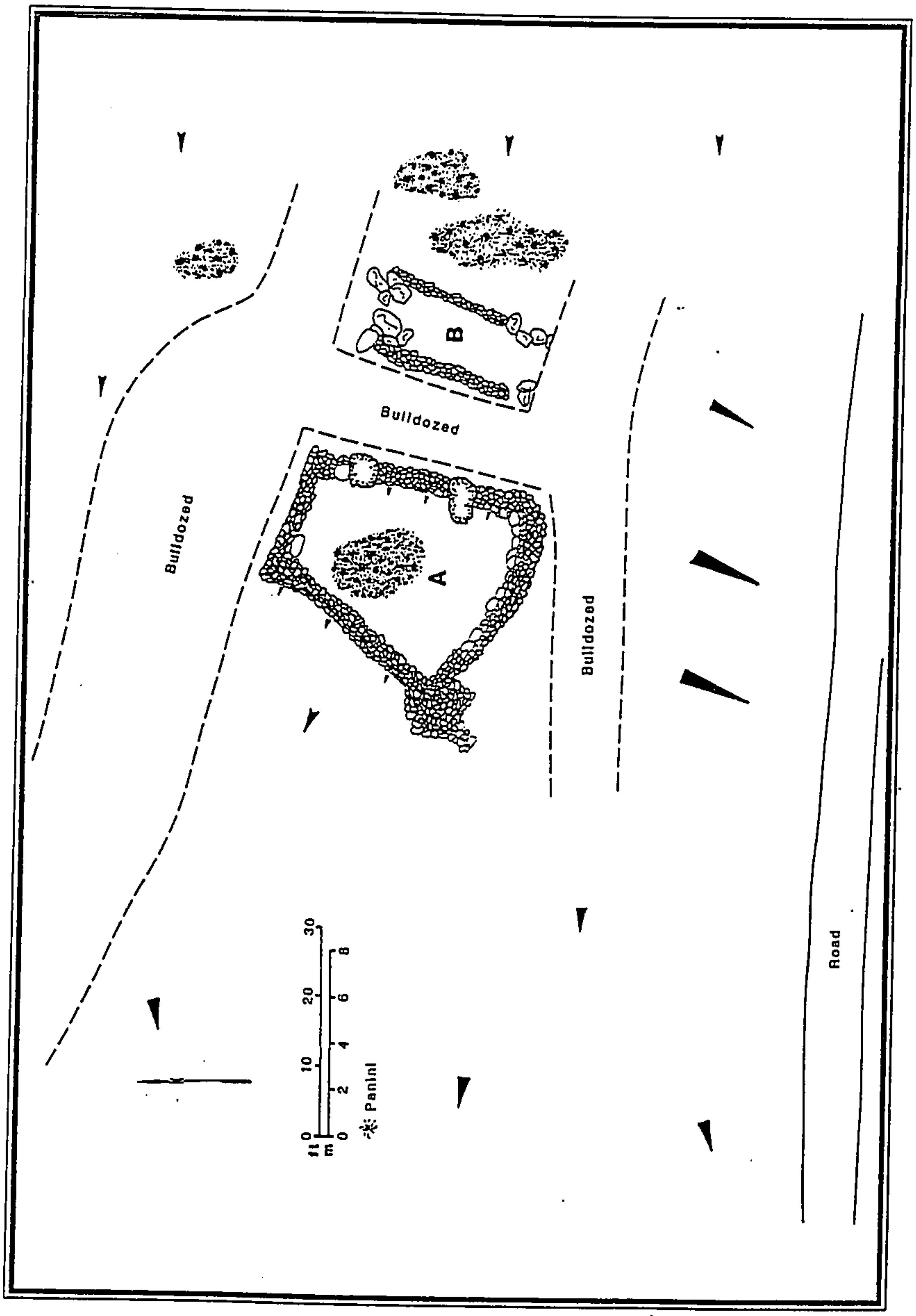

Figure D-9. SITE W-67

DIMENSIONS: 170.0 m long by 75.0 m wide; c. 12,750 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Agriculture
DESCRIPTION: Terraces and walls. In this area there are two larger terraces and numerous smaller ones. The wall runs perpendicular to the slope. Terraces are retained by either short retaining walls or alignments.

SITE NOS.: STATE: 2378 PHRI: W-75 BPBM: T-87-86
FORMAL TYPE: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle and grasses
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 100.0 m long by 0.5 m wide; c. 50 sq m
PROBABLE AGE: Prehistoric/Historic
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: L-shaped wall, the north-south wall of which retains a terrace. The east-west wall is short and free standing. There are terraces in the area. There is also a water trough made from a cut half-boiler. The L-shaped wall appears to be the disturbed remnant of a rectangular enclosure. The wall has a maximum height of 50 cm and is composed of stacked basalt boulders and cobbles.

SITE NOS.: STATE: 2379 PHRI: W-77 BPBM: —
(Figures D-10, D-11)
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle, lantana, koa haole, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 30.0 m long by 20.0 m wide; c. 600 sq m
PROBABLE AGE: Prehistoric*
FUNCTIONAL INTERPRETATION: Agriculture
DESCRIPTION: Irregular-shaped enclosure; uses a bedrock outcrop. Very low wall on NW side. The enclosure is situated in a swale. Wall is poorly preserved composed of stacked basalt boulders and cobbles. A test unit of this feature did not reveal any cultural remains.

SITE NOS.: STATE: 2380 PHRI: W-80 BPBM: —
FORMAL TYPE: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle, Silky Oak, lantana, 'ilima, panini, grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 400.0 m long by 1.0 m wide; c. 400 sq m
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Animal Control
DESCRIPTION: Long wall runs perpendicular to the slope. The wall runs parallel to and close to the south side of a deep ravine and as such may be part of the system of walls at Site W-4. Some segments of the wall are collapsed or have been destroyed by cows and bulldozers.

SITE NOS.: STATE: 2381 PHRI: W-82 BPBM: —
FORMAL TYPE: Terrace
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 9.3 m long by 5.5 m wide; c. 51 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Possible rectangle habitation terrace in a large area of many scattered agricultural terraces. Consists of a U-shaped alignment of boulders and cobbles, the interior of which is relatively level compared to the adjacent slope.

SITE NOS.: STATE: 2382 PHRI: W-83 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 5.0 m long by 3.5 m wide; c. 18 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Small rectangular enclosure; NW corner faced on interior and exterior; also facing on the interior of the SW corner. Walls have a maximum height of 30 cm and are composed of stacked cobbles and boulders. Agricultural features are present in the vicinity.

SITE NOS.: STATE: 2383 PHRI: W-88 BPBM: —
FORMAL TYPE: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 15.0 m long by 1.1 m wide; c. 17 sq m
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Road retaining wall. This wall is in good condition and is faced. The wall holds up a bend in an old road situated on the edge of a drainage. The road is almost certainly the same road that crosses the bridge (Site W-101) just up stream.

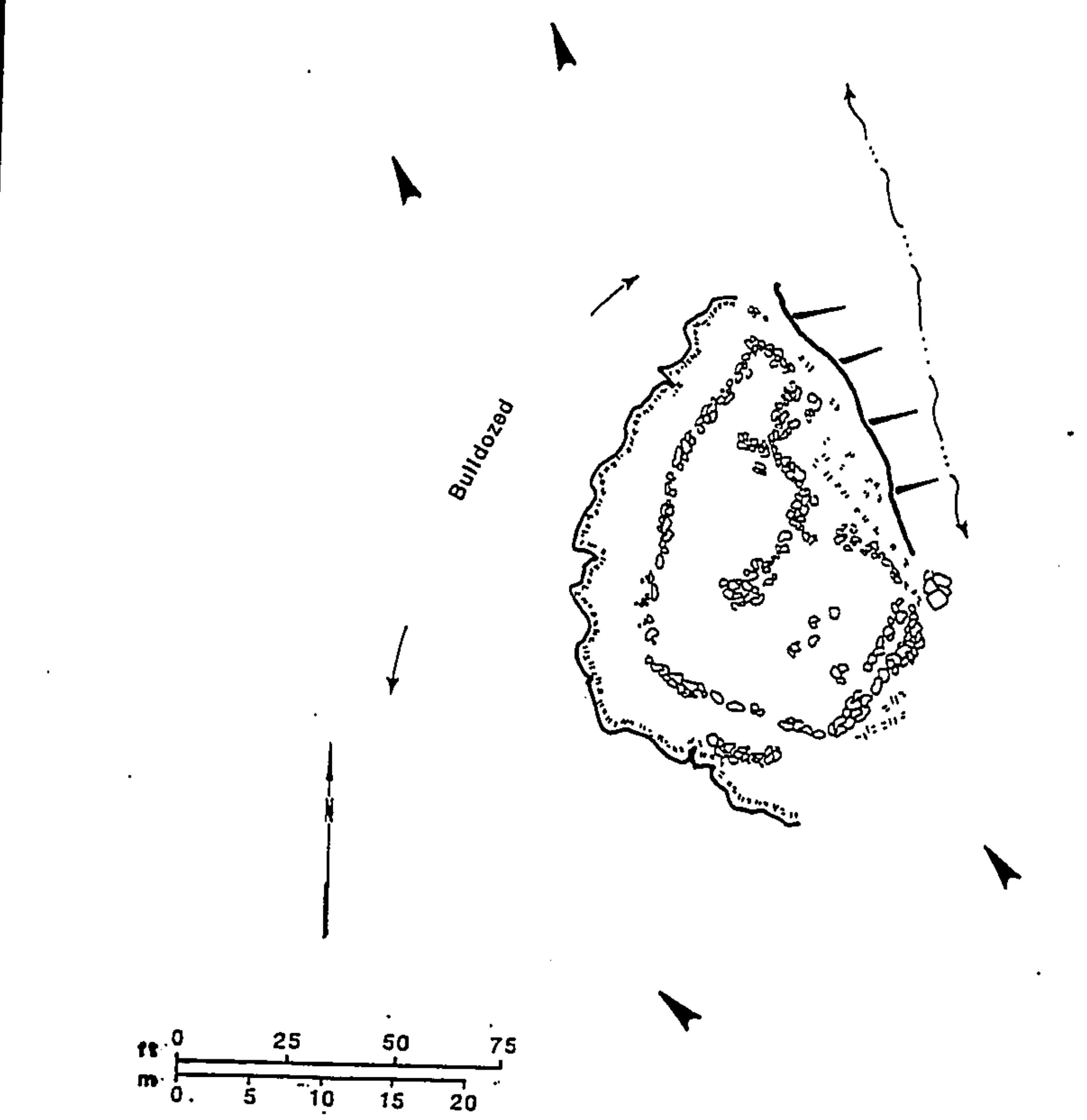

Figure D-10. SITE W-77

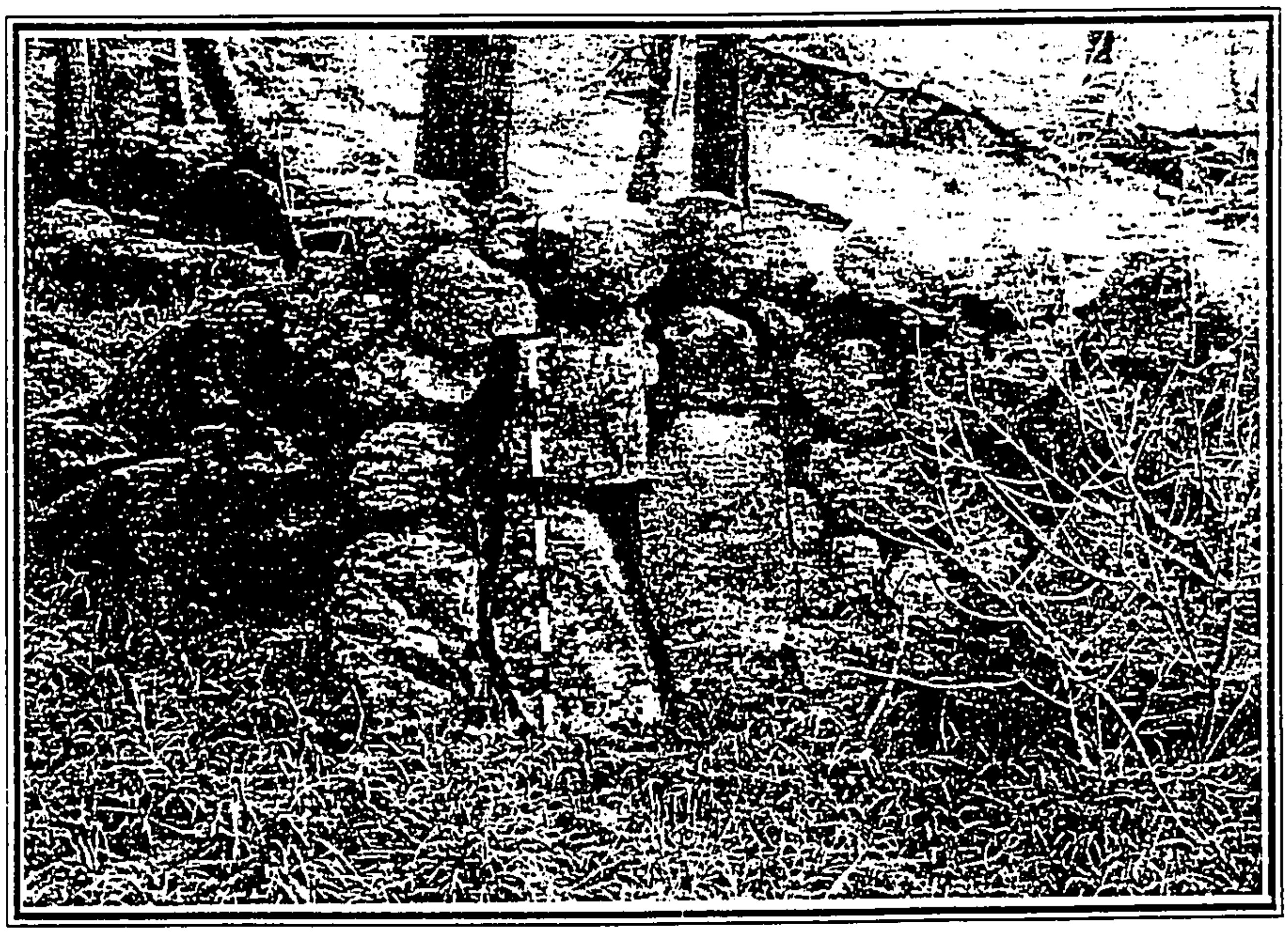

Figure D-11. SITE W-77, WALL WITH UPRIGHTS. View to South. (PHRI Neg.1143-36)

SITE NOS.: STATE: 2384 PHRI: W-90 BPBM: —
(Figure D-12)
FORMAL TYPE: Cave
TOPOGRAPHY: Stream-cut basalt cliff
VEGETATION: Wattle, lantana, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 8.0 m long by 0.8 m wide; c. 6 sq m
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Burial
DESCRIPTION: Small lava tube which extends into the face of a tall cliff face; at least two burials present in tube. The tube extends inward for more than 8.0 m; bends slightly to left. Bones are scattered throughout the tube; a concentration of bones is situated c. 6.0 m from the opening. Entrance to tube is partially walled. Elements present include rib, long bones, possible skull fragment and other post-cranial remains. A glass bead and shell button noted among the bones.

SITE NOS.: STATE: 2385 PHRI: W-96 BPBM: —
FORMAL TYPE: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 10.0 m long by 9.2 m wide; c. 92 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Agriculture
DESCRIPTION: U-shaped wall with an internal mound. Site is situated in a large agricultural area. The mound is c. 1.5 m in diameter and 0.5 m high. U-shape opens to the NW. Wall ranges from 35 to 60 cm in height and is comprised of stacked cobbles and boulders. Sub-surface probes indicate that no cultural remains are present in fill, thus probably the feature is agricultural in nature.

SITE NOS.: STATE: 2386 PHRI: W-97 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 12.0 m long by 10.0 m wide; c. 120 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Rectangular enclosure with short internal wall parallel to the east wall. The walls are very thick (c. 2 m). All walls have large flat boulders on top. There is a 15.0 m long wall extending northeast to the gulch. The 70 cm high enclosed wall is comprised of stacked basalt boulders and cobbles. Agricultural features are present in the vicinity.

SITE NOS.: STATE: 2387 PHRI: W-98
BPBM: T-69-70*
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, and grasses
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 7.7 m long by 5.0 m wide; c. 39 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Rectangular enclosure with associated agricultural features. The enclosure is higher on the west side to accommodate the slope. Walls are 1-2 m thick and range from 30-60 cm in height. Walls are composed of stacked basalt boulders and cobbles.

SITE NOS.: STATE: 2388 PHRI: W-101 BPBM: —
FORMAL TYPE: Bridge
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle
CONDITION: Poor
INTEGRITY: Unaltered
DIMENSIONS: 9.0 m long by 4.0 m wide; c. 36 sq m
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Transportation
DESCRIPTION: Historic wooden bridge. The bridge is collapsed. The south side still has some of the lower supports in place; "X" braces nailed to supports. Most of the cross members are missing. Supports consist of chemically treated piles.

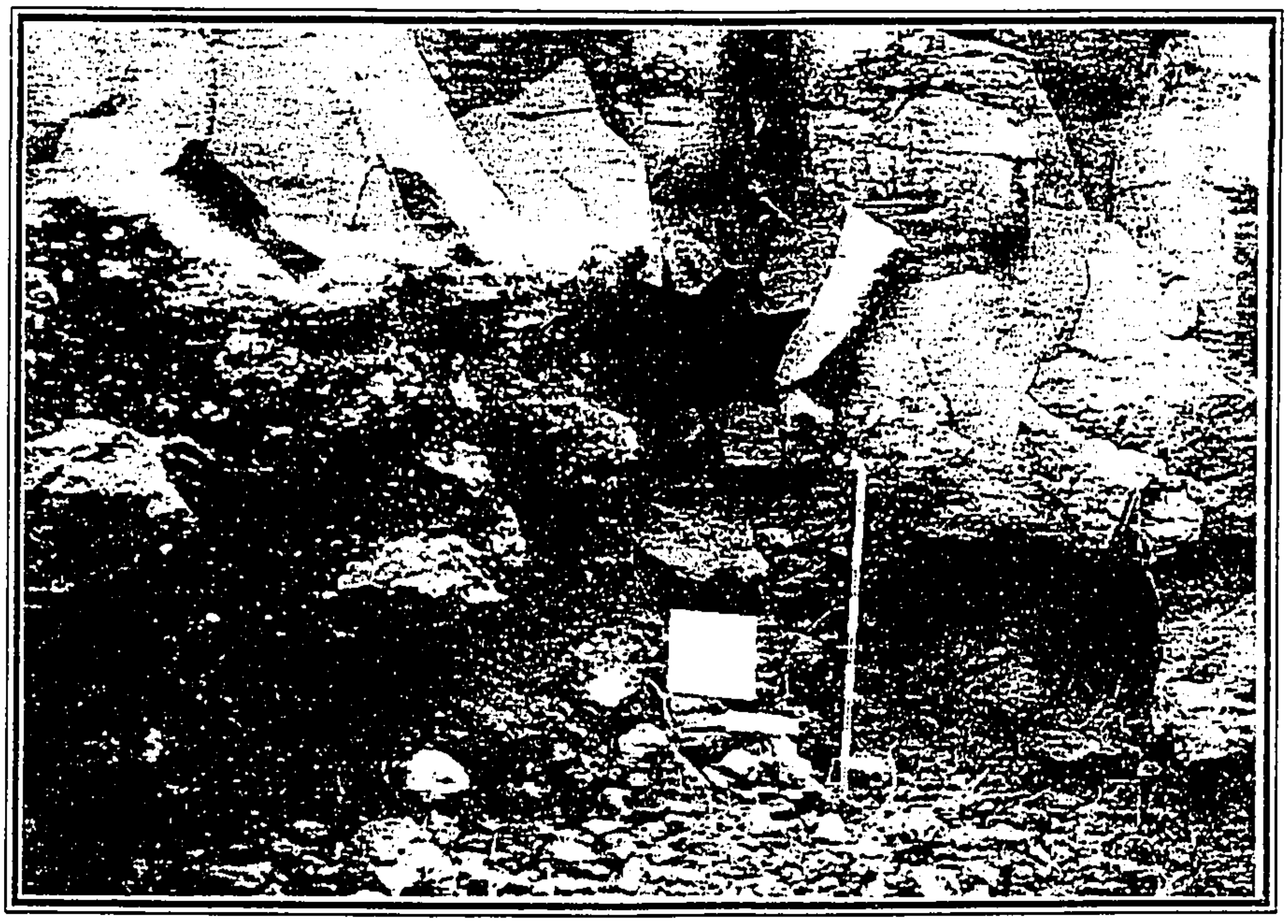

Figure D-12. SITE W-90, ENTRANCE TO HISTORIC BURIAL. VIEW TO SOUTHEAST. (PHRI Neg.1145-3)

APPENDIX E

KEOKEA SITE AND FEATURE DESCRIPTIONS

SITE NOS.: State: 2046 PHRI: K-1 BPBM: T-15
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, wattle, panini, and 'ilima
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 80.0 m long by 40.0 m wide; c. 3,200.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Platform (Fea. A), terrace (Fea. B), mounds, paved areas, walls, and possible trails. There are a large number of agricultural features in this area including terraces, mounds, and modified outcrops .

FEATURE A: Platform
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, morning glory, 'ilima, panini
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 7.0 m long by 7.0 m wide; c. 49.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: An irregular paved platform with two possible bedrock cupboards on the north side. Feature is constructed aganist a bedrock outcropp. It is constructed of stacked cobbles and boulders. The upper surfeace is irregularly paved with cobbles. The north half of the feature is partially collapsed.

FEATURE B: Terrace
TOPOGRAPHY: Dissected alluvial slope
DIMENSIONS: 5.8 m long by 6.4 m wide; c. 37 sq m
VEGETATION: Lantana, grasses, morning glory, 'ilima, panini
CONDITION: Fair
INTEGRITY: Unaltered
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular terrace. The tops of the south and west walls are even with the inside ground surface. The east wall consists of modified bedrock. The terrace wall has a maximum height of 50 cm and is composed of stacked basalt boulders and cobbles.

SITE NOS.: State: 2047 PHRI: K-2 BPBM: T-16
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: 'Ilima, lantana, and grass
CONDITION: Fair to Good
INTEGRITY: Altered*
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Site consists of two adjacents enclosures. *There are a large number of agricultural features in this area* including terraces, mounds, and modified outcrops.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana and grass
CONDITION: Fair
INTEGRITY: Altered*
DIMENSIONS: 12.0 m long by 10.0 m wide; c. 120.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure with a 5.0m by 6.0 m paved platform in the southeast corner and a possible firepit inside. The northwest wall sits on the edge of a drop and consists of an alignment. The walls range from 1.o to 2.0 m in thickness and average 50 cm in height. The walls are constructed of stacked cobbles and boulders. The south corner of Fea. B abuts the north corner of Fea. A.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: lantana, grass, and 'ilima
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 10.0 m long by 7.0 m wide; c. 70.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Irregular enclosure, the east wall of which consists of a bedrock outcrop. Facing present on both sides of the north and east walls. The south corner abuts the north corner of Fea. A. Walls are comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2028 PHRI: K-3 BPBM: T-14
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 120.0 m long by 100.0 m wide; c. 12,000.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Burial*/ Habitation/Agriculture

* Tentative, temporary, or provisional

DESCRIPTION: Two rectangular enclosures with wide walls, one with an internal L-shaped wall. Agricultural terraces and mounds surround the enclosure.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: 'Ilima, lantana, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 14.0 m long by 14.0 m wide; c. 196.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure with wide walls, especially in the northwest corner. The west and south walls are faced externally and the east wall is faced internally. The walls average 80 cm in height and are copmrised of stacked boulders and cobbles. A curved, rock-retained terrace curves southward and then west away from the southeast corner of the enclosure. A test unit excavated in the interior of this feature revealed the presence of a subsurface deposit containing charcoal, marine shell, bone, and basalt flakes. The bone includes two phalanges from a child, potentiallyindicating and infant burial beneath the floor of the structure. A radiocarbon sample from the deposit yielded a calendric age range of AD 1640-1890.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 9.0 m long by 8.5 m wide; c. 76.5 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure with internal dividing wall. The internal wall forms a small room in the northwest corner of the enclosure. There is some interior and exterior facing on the south wall. The walls range between 40 and 60 cm in height and are comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2049 PHRI: K-4 BPBM:
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, and 'ilima
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 27.0 m long by 10.0 m wide; c. 270.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Complex consists of an irregular enclosure and a rectangular enclosure. Possible firepit present in Fea. A. Features fit pattern of typical residences situated along the edge of a terraced slope. Numerous agriculture terraces surround the site.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, and 'ilima
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 7.2 m long by 6.0 m wide; c. 43.2 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Irregular nearly C-shaped enclosure. Possible terrace in the north half; possible firepit in the center. Walls range from *100 cm to 10 cm in height* and are comprised of stacked basalt boulders and cobbles.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, kiawe, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 8.5 m long by 7.5 m wide; c. 63.8 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure with small room in the southeast corner. A c. 20.0 m long terrace wall extends off the southeast corner of the enclosure. A two track road runs through this terrace. Walls average 30 cm in height and are comprised of stacked boulders and cobbles.

SITE NOS.: State: 2048 PHRI: K-5 BPBM: T-19
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, wattle, and grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 75.0 m long by 18.5 m wide; c. 1,387.5 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary Habitation/Agriculture
DESCRIPTION: Site consists of a C-shape, a platform, a modified outcrop wall, and surrounding terraces. The wall may have diverted water to a large earthen terrace system.

FEATURE A: Platform
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, wattle.
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 5.0 m long by 3.0 m wide; c. 15.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Paved collapsed platform. Given its size and shape (triangular), the platform may have served an

agricultural function; however, testing is necessary to verify function. Feature is c. 30 cm high and is comprised of stacked basalt boulders and cobbles.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: lantana, grasses, 'ilima, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 7.0 m long by 6.8 m wide; c. 47.6 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: C-shaped enclosure open to the southwest. Possible midden within enclosure, as the soil inside is darker and finer than the surrounding soil. Position of surrounding features indicates the enclosure may be agricultural.

SITE NOS.: State: 2029 PHRI: K-6 BPBM:
FORMAL TYPE: Complex (4 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 75.0 m long by 60.0 m wide; c. 4,500.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Burial/Habitation /Agriculture
DESCRIPTION: Complex consists of three enclosures, a mound, and agricultural features.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses, and wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 13.0 m long by 11.8 m wide; c. 153.4 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Notched rectangular enclosure with two internal platforms, an internal room, and an external platform. Internal platforms are in the northeast half of the enclosure and are connected by a step. The internal room is in the southwest portion of the enclosure near the notch. A test unit excavated in side the internal room revealed a subsurface cultural deposit containing volcanic glass and basalt flakes, sea urchin remains, coral fragments, marine shell, mammal and fish bone, charcoal, and kukui nut shell. A radiocarbon sample from the deposit yielded two possible calendric age ranges of AD 1470-1680 and AD 1739-1805.

FEATURE B: Mound
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 2.0 m long by 1.0 m wide; c. 2.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular mound surrounded by bedrock outcrops. Facing on southwest side of this feature indicates that it may be a partially collapsed burial platform. The mound has a maximum height of 30 cm and is comprised of stacked basalt boulders and cobbles.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 7.0 m long by 7.0 m wide; c. 49.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure with high well-faced walls, except for the east wall which is mostly collapsed. The enclosure is adjacent to a collapsed lava tube. The enclosure's external wall faces are higher than the internal ones (avr. 85 cm versus avr. 60 cm). Terraced level areas are adjacent to the north and south sides of the enclosure.

FEATURE D: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, wattle
CONDITION: Fair/Poor
INTEGRITY: Unaltered
DIMENSIONS: 5.8 m long by 5.6 m wide; c. 32.5 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: C-shaped enclosure open to the west. The walls look very deflated, though there is no evidence of collapse. Rocks from the wall may have been removed and utilized for the construction of Fea. C.

SITE NOS.: State: 2030 PHRI: K-7 BPBM: T-22
(Figure E-1)
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, wiliwili, panini
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 110.0 m long by 70.0 m wide; c. 7,700.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Complex consists of two enclosures, one rectangular and one oval. Surrounding the enclosures are numerous agriculture features.

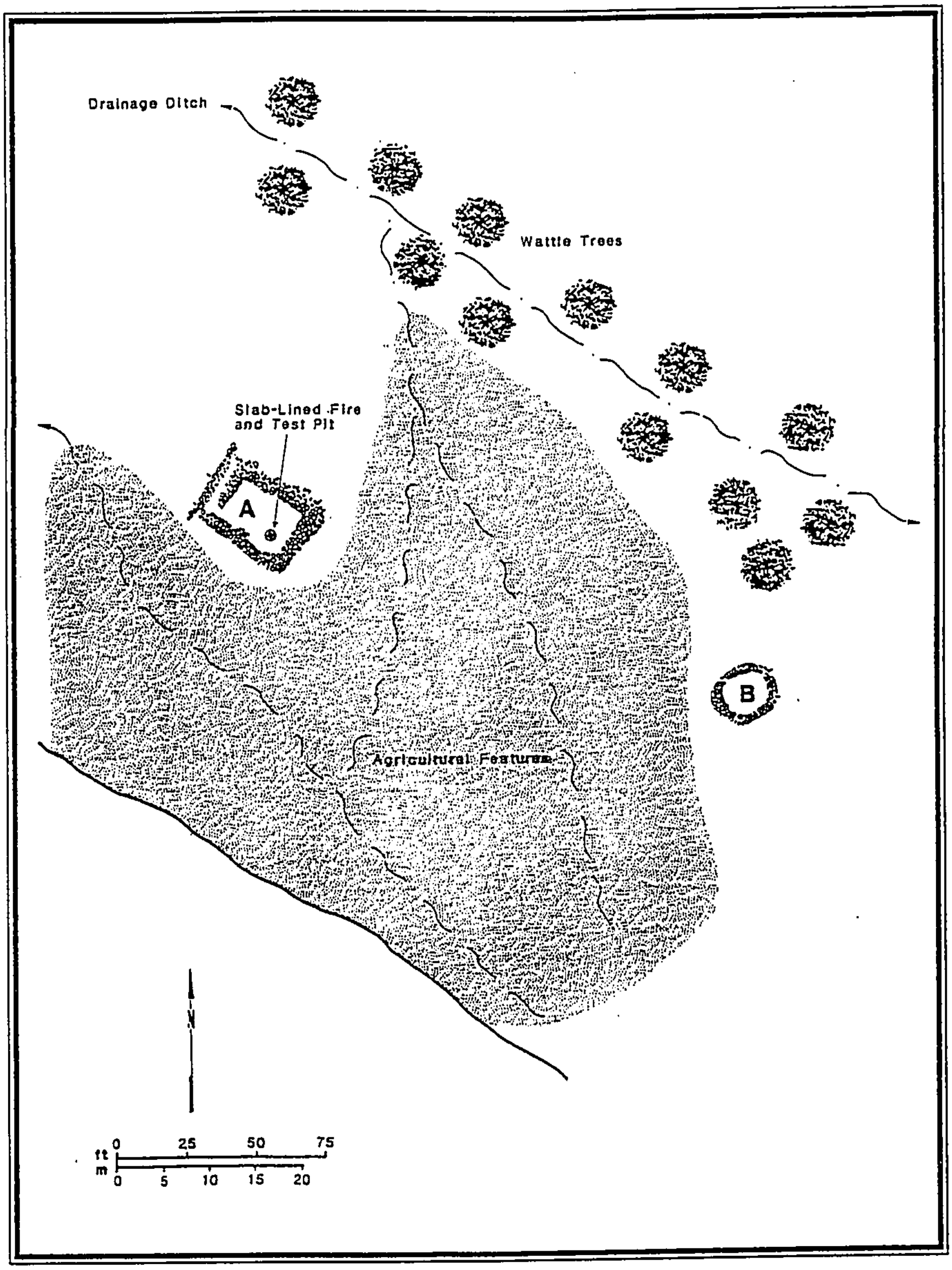

Figure E-1. SITE K-7, FEATURES A AND B.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, wiliwili
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 13.0 m long by 10.0 m wide; c. 130.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure with a terrace attached to the northwest wall. A probable entryway opens onto the terrace near the west corner of the northwest wall. Facing is intermittent along the walls which are 65 cm to 75 cm high and comprised of stacked basalt boulders and cobbles. A slab-lined firepit is centrally located in the eastern half of the structure.

A test unit was excavated which half-sectioned the firepit. The test unit revealed a subsurface cultural deposit containing marine shell, mammal bone, volcanic glass flakes, and charcoal. A radiocarbon sample collected from the deposit yielded three possible calendric age ranges: AD 680-1060, AD 1077-1125, and AD 1135-1157.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 5.5 m long by 5.0 m wide; c. 27.5 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Oval enclosure; walls mostly faced, some collapsed. The south part of the structure lies even with the ground surface. The walls average 80 cm in height and are comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2050 PHRI: K-8 BPBM: —
FORMAL TYPE: Complex (3 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 50.0 m long by 45.0 m wide; c. 2,250.00sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Complex consists of three rectangular enclosures, two rectangular and one irregular. Many agriculture features are present in the general area.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 20.0 m long by 15.0 m wide; c. 300.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Irregular in plan. South wall extends c. 4.0 m beyond the east wall. The southwest portion of the structure has wider walls and the exterior of these walls are collapsed. A short section of the south wall is faced. Maximum wall height is 1.0 m. Walls are comprised of stacked cobbles and boulders. A possible firepit is present in the north central portion of the enclosure.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima
CONDITION: Fair/Poor
INTEGRITY: Unaltered
DIMENSIONS: 13.0 m long by 6.0 m wide; c. 78.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure partially faced on the interior of the northeast corner. The outside of the east wall is partially covered by alluvium. The walls range in height from 30 cm to 40 cm and are comprised of stacked basalt boulders and cobbles.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 12.0 m long by 8.0 m wide; c. 96.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure with partial facing on the southeast exterior wall. The feature has been damaged by cattle to the extent that details of construction are difficult to ascertain. Maximum height of walls is 1.0 m and they average 1.5 m in width.

SITE NOS.: State: 2051 PHRI: K-9 BPBM: — T-38
FORMAL TYPE: Complex (3 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 95.0 m long by 90.0 m wide; c. 8,550.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Complex consists of two overhangs with associated walls, a rectangular enclosure, and a large irregular enclosure. The irregular enclosure surrounds an area of agricultural features. Both enclosures are attached to the wall of Site K-12.

FEATURE A: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, honey suckle.
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 10.0 m long by 5.0 m wide; c. 50.00 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Feature consists of two adjacent overhangs with associated walls on top of an outcrop. The south edge of the outcrop abuts the rock wall of Site K-12. The northern overhang is 3.0 m long, 2.5 m deep, and 1.5 m high. The southern overhang is 1.3 m long, 1.2 m deep, and 1.5 m high. Although no cultural remains noted on the surface of the overhangs their association with Feature B and size indicate possible use as shelters. Testing would be necessary to verify prehistoric use.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, wattle, Christmas-berry
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 10.0 m long by 8.0 m wide; c. 80.0 sq m
PROBABLE AGE: Prehistoric/Historic
DESCRIPTION: Rectangular enclosure; paved area adjacent to east wall. The paved area measures c. 8.0 by 4.0 m; its exact dimensions are difficult to determine because dense vegetation covers the feature. The walls have an average width of 80 cm and a maximum height of 80 cm. Walls are comprised of stacked basalt cobbles and boulders.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, Christmas-berry
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 45.0 m long by 15.0 m wide; c. 675.0 sq m
PROBABLE AGE: Historic/Prehistoric*
DESCRIPTION: Very large irregular-shaped enclosure surrounding an area of agricultural features. Feature forms part of the walls of Site K-12 a complex of of historic cattle control walls; however, the presence of a series of terraces and numerous mounds in the interior suggest the enclosure also functioned, potentailly prehistorically, as a garden enclosure. The walls range from 1.0 to 1.8 m in height and average 80 cm in thickness. they are comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2052 PHRI: K-10 BPBM: —
FORMAL TYPE: Complex (7 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, panini, wattle
CONDITION: Good/Fair
INTEGRITY: Unaltered
DIMENSIONS: 80.0 m long by 60.0 m wide; c. 4,800.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Complex consists of two square enclosures, two oval enclosures, one circular enclosure, one U-shaped enclosure, a platform, and many surrounding agricultural features.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses, panini
CONDITION: Good/Fair
INTEGRITY: Unaltered
DIMENSIONS: 3.6 m long by 3.5 m wide; c. 12.6 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Small square enclosure; most of the walls are faced internally and externally. A probable entryway is present in the western portion of the northeast wall. The walls have a maximum thickness of 70 cm and a maximum height of 1.3 m. Walls are comprised of stacked basalt boulders and cobbles.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, panini, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 5.7 m long by 3.8 m wide; c. 21.7 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Oval enclosure with high walls. The structure is built into a slope so that the northeast wall is almost at ground level; the wall opposite the northeast wall is very high, 1.5 m. The interior walls of the enclosure are faced, and most of the exterior walls are faced. Walls have a maximum thickness of 1.0 m and are comprised of stacked basalt cobbles and boulders.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, panini, wattle
CONDITION: Good/Fair
INTEGRITY: Unaltered
DIMENSIONS: 6.5 m long by 5.0 m wide; c. 32.5 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Oval enclosure; two internal cupboards present in east and south walls. The north wall is the highest and is built into the slope. Internal facing on the southeast and southwest corners. The walls have a maximum thickness of 1.0 m and range from 10 to 30 cm in height. Walls are

comprised of stacked basalt cobbles and boulders and occasionally incorporate bedrock outcrops.

FEATURE D: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, panini, wattle
CONDITION: Poor
INTEGRITY: Unaltered
DIMENSIONS: 4.0 m long by 4.0 m wide; c. 16.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Small circular enclosure; some interior facing on the southwest side. Just south of the enclosure, at the foot of Site K-12, is a small natural cupboard in bedrock. Walls average 20 cm in height and 70 cm in thickness. Walls are comprised of stacked basalt cobbles and boulders and occasionally incorporate bedrock outcrops.

FEATURE E: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 4.3 m long by 5.3 m wide; c. 22.8 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Square enclosure; exteriors of the southwest and northeast walls and interiors of northeast, southeast, and northwest walls are faced. Possible cupboard present in north corner. The walls have a maximum thickness of 1.3 m and a maximum height of 80 cm. Walls are comprised of stacked basalt cobbles and boulders.

FEATURE F: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 4.5 m long by 7.6 m wide; c. 34.2 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: U-shaped enclosure open to the northeast. Both sides of southeast and southwest walls are faced. The northwest wall is mostly collapsed. Walls average 20 cm in height and 70 cm in thickness. Walls are comprised of stacked basalt cobbles and boulders and occasionally incorporate bedrock outcrops.

FEATURE G: Platform/pavement
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 5.0 m long by 5.0 m wide; c. 25.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Platform or partially elevated pavement built on and around bedrock. One meter north of the platform is a faced wall which extends north for 4.0 m. The feature has a maximum height of 50 cm and is comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2053 PHRI: K-11 BPBM: — T-39
FORMAL TYPE: Terrace
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses, panini, wattle, koa-haole
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 6.0 m long by 4.0 m wide; c. 24.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Rectangular terrace; the east side and part of the west wall of the terrace consist of bedrock outcrops. Most of the west and north walls retain and rise slightly above a level area. Walls are unfaced. Many agricultural features in the general area.

SITE NOS.: State: 2054 PHRI: K-12 BPBM: —
FORMAL TYPE: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, wattle, 'ilima, wiliwili
CONDITION: Good/Fair
INTEGRITY: Unaltered
DIMENSIONS: 700.0 m long by 333.0 m wide; c. 23,3100.0 sq m
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Animal Control
DESCRIPTION: Site consists of a complex of variable length cattle walls some of which form large enclosures in a collapsed lava tube. The walls extend beyond the project area's southwestern corner. The most prominent wall extends the distance and loops around to return to the project area's west boundary.

SITE NOS.: State: 2055 PHRI: K-13 BPBM: —
FORMAL TYPE: Complex (6 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, cilantro (Coriandrum sativum L., 'ilima, wattle, panini
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 100.0 m long by 45.0 m wide; c. 4,500.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture

DESCRIPTION: Four rectangular enclosures, one D-shaped enclosure, and one oval enclosure. Agriculture features, mounds and terraces, present in the area.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 3.5 m long by 3.0 m wide; c. 10.5 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure; internal cupboard present on east wall; north-south wall extension off the east wall. Some of the inside of the north wall is faced; however, most walls are collapsed. Walls range from 30 cm to 60 cm in height and average 50 cm in thickness. Walls are comprised of stacked basalt cobbles and boulders.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, cilantro
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 6.2 m long by 5.8 m wide; c. 36.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Sub-rectangular enclosure with collapsed walls; no facing or internal features present. Faced terrace nearby. Walls average 60 cm in height and 1.4 m in thickness. Walls are comprised of stacked basalt cobbles and boulders.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, and 'ilima
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 5.7 m long by 5.3 m wide; c. 30.2 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure; north and northeast sides of the feature are built on bedrock. The walls are collapsed and the interior is filled with rubble. Walls average 60 cm in height and 1.4 m in thickness. Walls are comprised of stacked basalt cobbles and boulders and occasionally incorporate bedrock outcrops.

FEATURE D: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, panini, wattle, forbs
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 5.0 m long by 5.0 m wide; c. 25.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Oval enclosure with unfaced walls. Walls average 40 cm in height and 1.2 m in thickness. Walls are comprised of stacked basalt cobbles and boulders.

FEATURE E: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, morning glory, grasses, panini, 'ilima
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 5.6 m long by 4.5 m wide; c. 25.2 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: D-shaped enclosure. North wall formed by an overhang and the remaining walls are comprised of stacked rock. The east wall and portions of the west wall are faced. Walls average 40 cm in height and 80 cm in thickness. Walls are comprised of stacked basalt cobbles and boulders.

FEATURE F: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 6.5 m long by 5.5 m wide; c. 35.8 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Sub-rectangular structure with no facing. Walls average 40 cm in height and 1.2 m in thickness. Walls are comprised of stacked basalt cobbles and boulders.

SITE NOS.: State: 2056 PHRI: K-14 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, panini, grasses, forbs
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 50.0 m long by 35.0 m wide; c. 1,750.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Complex consists of a U-shaped structure and associated agriculture features. The U-shape opens to southwest. The feature is 6.0 m long, 5.5 m wide, and has a maximum height of 70 cm. The walls average 2.0 m in thickness and appear mostly collapsed. A cattle wall (Site K-12) runs through the site.

SITE NOS.: State: 2057 PHRI: K-16 BPBM: —
FORMAL TYPE: Complex (3 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, honey suckle, wattle, panini
CONDITION: Fair
INTEGRITY: Unaltered

DIMENSIONS: 85.0 m long by 55.0 m wide; c. 4,675.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION — Habitation
DESCRIPTION: Complex consists of four habitation enclosures. A cattle wall, which is part of Site K-12, runs through the site. Minor agricultural features surround complex.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, panini, Christmas-berry
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 4.0 m long by 3.7 m wide; c. 14.8 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Double enclosure. The eastern enclosure is circular, the walls are collapsed and they incorporate bedrock. The western enclosure is square, and the walls are collapsed. Walls average 80 to 100 cm in height and 100 cm in thickness. Walls are comprised of stacked basalt cobbles and boulders.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, Christmas-berry, panini
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 6.5 m long by 5.5 m wide; c. 35.8 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure; facing present on all of the exterior walls and on the interiors of the south and west walls. The stones used in construction are quite irregular so that the facing is not obvious. A break in the west wall is probably due to cattle, but may represent an entryway. Walls have a maximum height of 85 cm and and a maximum thickness of 80 cm.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses, panini
CONDITION: Poor
INTEGRITY: Unaltered
DIMENSIONS: 8.5 m long by 7.5 m wide; c. 63.8 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Oval enclosure with collapsed walls. Walls average 10 cm in height and 60 cm in thickness. Walls are comprised of stacked basalt cobbles and boulders.

SITE NOS.: State: 2058 PHRI: K-19 BPBM: —
FORMAL TYPE: Complex (3 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 60.0 m long by 45.0 m wide; c. 2,700.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Complex of three habitation structures and numerous agriculture features. Many of the agriculture features are well-defined, are well-constructed, and incorporate bedrock.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, wattle
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 5.0 m long by 4.2 m wide; c. 21.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Small circular structure with some internal facing. Walls average 50 cm in height and 65 cm in thickness. Walls are comprised of stacked basalt pebbles, cobbles and boulders.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, wattle, panini
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 4.2 m long by 3.5 m wide; c. 14.7 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Small C-shaped enclosure. No facing observed. Walls average 55 cm in height and 70 cm in thickness. Walls are comprised of stacked basalt cobbles and boulders.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, panini
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 8.5 m long by 8.0 m wide; c. 68.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Oval enclosure with some facing in the northeast corner. North wall is the highest. Walls average 80 cm in height and 60 cm in thickness. Walls are comprised of stacked basalt cobbles and boulders.

SITE NOS.: State: 2059 PHRI: K-20 BPBM: —
FORMAL TYPE: Complex (3 Features)
TOPOGRAPHY: Dissected alluvial slope

VEGETATION: Lantana, grasses, 'ilima, wattle, Christmas-berry
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 50.0 m long by 35.0 m wide; c. 1,750.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Complex consists of two enclosures, one residential terrace, and many surrounding agriculture terraces.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grass, 'ilima, wattle, Christmas-berry
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 6.3 m long by 0.0 m wide; c. 0.00 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Square unfaced enclosure; possible step on the interior of the east wall at a possible entryway. Walls have a maximum height of 50 cm. and are comprised of stacked basalt pebbles, cobbles and boulders.

FEATURE B: Terrace
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, wattle, panini
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 6.0 m long by 5.0 m wide; c. 30.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Rectangular level area with walls on three sides. A wall, or what may be a wall, extends off the northwest corner of the terrace. Walls average 80 cm in height and 80 m in thickness. Walls are comprised of stacked basalt cobbles and boulders and occasionally incorporate bedrock outcrops.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 2.0 m long by 2.0 m wide; c. 4.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: This is a small circular enclosure. There is some facing on the walls. A possible entryway is present in the sutheast side. Walls average 70 cm in height and 50 m in thickness. Walls are comprised of stacked basalt cobbles and boulders.

SITE NOS.: State: 2060 PHRI: K-21 BPBM: —
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses, wattle, panini
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 55.0 m long by 25.0 m wide; c. 1,375.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Complex consists of a notched enclosure and a badly collapsed circular enclosure. Within the notched enclosure is a small room. Agriculture features present in general area.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, wattle, panini
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 5.5 m long by 5.5 m wide; c. 30.3 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Circular enclosure bisected by a modified bedrock wall. The walls are severely collapsed. Walls average 60 cm in height and 35 m in thickness. Walls are comprised of stacked basalt cobbles and boulders and occasionally incorporate bedrock outcrops.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, Christmas-berry, panini
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 11.0 m long by 10.5 m wide; c. 115.5 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Notched structure with thick, 2.0+ m wide walls in the northeast corner and north end of the east wall. A small internal room, c. 2.5 m by 1.5 m in size, extends from the north wall. Some facing is evident around the structure, as well as on the internal room. Walls average 80 cm in height and 1.15 m in thickness. Walls are comprised of stacked basalt cobbles and boulders.

SITE NOS.: State: 2061 PHRI: K-25 BPBM: —
FORMAL TYPE: Complex (6 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, wattle, panini
CONDITION: Good
INTEGRITY: Altered

DIMENSIONS: 120.0 m long by 90.0 m wide; c. 10,800.0 sq m
PROBABLE AGE: Historic/Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture/Animal Control
DESCRIPTION: Complex consists of a circular enclosure, one irregular enclosure, two sub-rectangular enclosures, an L-shaped enclosure, one upslope-downslope wall, and many agriculture features. A series of well-faced, relatively high scallop-shaped terraces which frequently incorporate bedrock outcrops are present on the steeper slopes in the southeast portion of the site.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, wattle, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 4.0 m long by 3.5 m wide; c. 14.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: C-shaped enclosure with partially collapsed unfaced walls. Structure opens to the southwest. Walls average 30 cm in height and 60 m in thickness. Walls are comprised of stacked basalt cobbles and boulders.

FEATURE B: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, wattle
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 9.4 m long by 5.3 m wide; c. 49.8 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: L-shaped enclosure with some facing on the interior and exterior of the south wall. Feature is open to the southeast. The west wall is entirely collapsed. An area of rubble indicates feature may have once had a north wall. Walls have a maximum height of 1.2 m and average 90 cm in thickness. Walls are comprised of stacked basalt cobbles and boulders. There is a mound very close to the feature and a small C-shaped mound 2.0 m from the northwest corner.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, '<u>ilima</u>, <u>panini</u>
CONDITION: Good/Fair
INTEGRITY: Unaltered
DIMENSIONS: 12.0 m long by 9.0 m wide; c. 108.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Enclosure is irregular in plan view. The southwest wall runs upslope-downslope into Site K-36. Enclosure contains an internal terrace wall in poor condition. Facing is present on the interior of the northeast corner and parts of the south wall. Walls average 45 cm in height and are comprised of stacked basalt cobbles and boulders.

FEATURE D: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, '<u>ilima</u>, lantana, wattle, <u>panini</u>
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 20.5 m long by 15.0 m wide; c. 307.5 sq m
PROBABLE AGE: Prehistoric/Historic
DESCRIPTION: Large rectangular enclosure; the east and west walls form terraces. The north and south walls are free standing. A wing wall extends off the southeast corner for c. 15 m. A long upslope-downslope probable ranch wall extends off the northeast corner, and a terrace extends off the east wall.

FEATURE E: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, '<u>ilima</u>, <u>panini</u>
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 4.5 m long by 4.0 m wide; c. 18.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure with some facing present on the exterior of the northeast corner. Walls average 60 cm in height and are comprised of stacked basalt cobbles and boulders.

FEATURE F: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, '<u>ilima</u>, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 32.0 m long by 0.8 m wide; c. 25.6 sq m
PROBABLE AGE: Historic
DESCRIPTION: Upsole-downslope wall segment. West end of wall falls about 2.0 meters short of connecting with Fea. D. The east end of the wall is broken up into several walls and extends almost to a drainage. Walls average 60 cm in height and are comprised of stacked basalt cobbles and boulders.

SITE NOS.: State: 2062 PHRI: K-26 BPBM: — T-64
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, '<u>ilima</u>, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 40.0 m long by 20.0 m wide; c. 800.0 sq m
PROBABLE AGE: Prehistoric

FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Feature A is comprised of two rectangular rooms and a semicircular room. Feature B is a triangular platform. There are agricultural terraces throughout the general area.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 10.0 m long by 7.0 m wide; c. 70.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Three-roomed enclosure consisting of two rectangular enclosures which share a wall with a semicircular enclosure. Rectangular enclosures are situated just uphill from the semicircular enclosure. Wall of the semicircular enclosure is faced. Walls average 30 cm in height and are comprised of stacked basalt cobbles and boulders.

FEATURE B: Platform
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wiliwili
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 3.5 m long by 5.0 m wide; c. 17.5 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Triangular platform extends out from a gentle slope. The northwest wall is faced. The platform is 30 cm high and comprised of stacked basalt cobbles and boulders.

SITE NOS.: State: 2063 PHRI: K-27 BPBM: — T-62 *(Figure E-2)*
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 30.0 m long by 30.0 m wide; c. 900.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Complex consists of a rock shelter with a curved wall in front of it, and a rectangular enclosure which makes extensive use of bedrock. Agriculture features surround the complex.

FEATURE A: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 6.0 m long by 4.0 m wide; c. 24.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Two small chambers are present within the 50 cm high overhang. A wall fronting the overhang forms a semicircular enclosure with the overhang. The wall averages 60 cm in height and is comprised of stacked basalt cobbles and boulders. Off the east wall of the enclosure there is a level area consisting of rubble (possible pavement).

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 10.0 m long by 5.8 m wide; c. 58.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: A rectangular enclosure. The north wall consists of the outcrop Feature A cuts into. There is some facing on the south and east walls. A 50 cm high step or bench runs the length of the interior of the east wall and possibly extends a little on the north and south walls. Walls average 60 cm in height and are comprised of stacked basalt cobbles and boulders.

SITE NOS.: State: 2064 PHRI: K-29 BPBM: — T-63
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima
CONDITION: Good/Fair
INTEGRITY: Unaltered
DIMENSIONS: 50.0 m long by 50.0 m wide; c. 2,500.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Feature A has walls extending from the northwest and southwest corners. Feature B has a possible platform in the southeast corner and a paved trail in the southwest corner. Agriculture features surround the complex. Some distance from the complex an isolated piece of coral was found. The substantial nature of Feature B and its close proximity to the heiau, Site K-30 suggest it may have functioned as a high status and/or priestly residence.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: lantana, 'ilima, grasses
CONDITION: Good
INTEGRITY: Unaltered

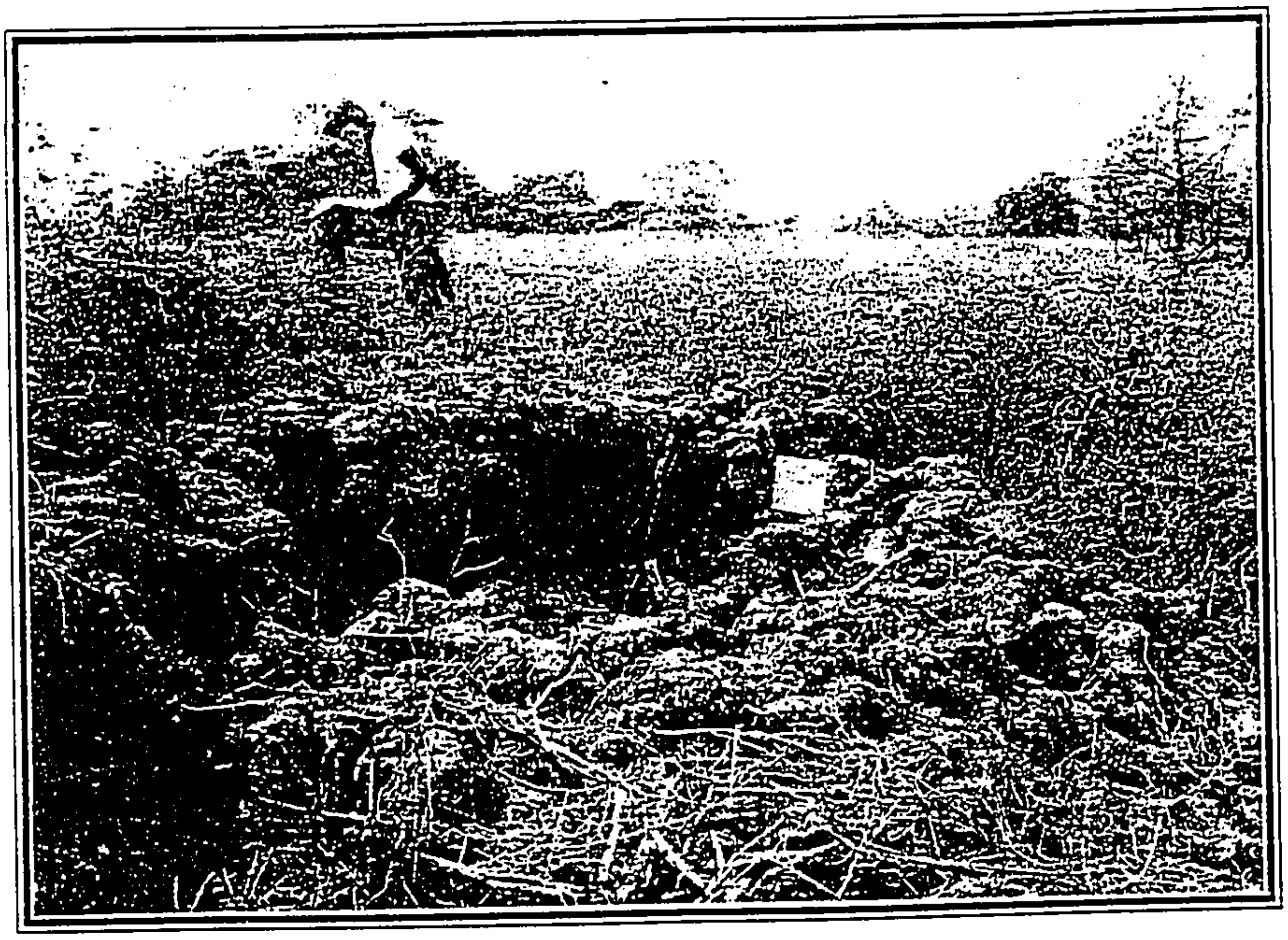

Figure E-2. SITE K-27, OVERHANG. VIEW TO WEST-NORTHWEST.
(PHRI Neg. 1143-10a)

DIMENSIONS: 12.0 m long by 10.0 m wide; c. 120.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure with modified bedrock walls extending off the northeast and southeast corners. These walls run upslope, the longest for 15.0 m, the other for 5.0 m. The north wall and the interior of the east wall are faced. Maximum wall height is 1.5 m. Walls are comprised of stacked cobbles and boulders.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 18.0 m long by 13.0 m wide; c. 234.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure with a possible collapsed platform in the southeast corner. Portions of the north wall are paved with pebbles, especially the eastern half of the north wall. The upper surface of the west wall is nearly flush with the interior of the structure and thus, may have served as a porch. The walls are very substantially constrcuted being nearly 2.0 m thick and up to 1.2 m high. Intact facing is present along most of the interior and exterior of the structure's walls. A paved walkway is present 0.5 m from the southwest corner of the enclosure; this walkway extends for 5.0 m to the west.

SITE NOS.: State: 2031 PHRI: K-30 BPBM: — *(Figure E-3)*
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, morning glory, castor bean
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 25.0 m long by 24.0 m wide; c. 600.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Religious
DESCRIPTION: Molohai Heiau; a large and notched enclosure. Internal features include a long low wall, two mounds (one of which is faced), a triangular platform faced on one side, a square platform in the north corner, a step or bench around most of the inside wall, and a step or bench along outside of the north and west walls. A fragment of coral is present on the step on the inside of the south wall.

A test unit was excavated near the triangular platform which revealed a subsurface cultural deposit containing volcanic glass and basalt flakes, marine shell, mammal bone, and charcoal.

SITE NOS.: State: 2065 PHRI: K-31 BPBM: —T-13
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 10.0 m long by 9.0 m wide; c. 90.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Sub-rectangular enclosure with very collapsed walls. Agricultural features surround this site. Some facing is present on the inside of the east wall. Possible platform present in the northeast corner. The wall ranges from 20 cm to 55 cm in height and averages 2.5 m in width. The wall is comprised of stacked basalt cobbles and boulders.

SITE NOS.: State: 2066 PHRI: K-32 BPBM: —
FORMAL TYPE: Terrace
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 6.0 m long by 5.5 m wide; c. 33.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Sub-rectangular terrace with walls on the north, south, and west sides. The walls range from 50 cm to 60 cm in height and average 1.3 m in thickness. Walls are comprised of stacked basalt cobbles and boulders. The east side is defined by a bedrock alignment. A short wall extends off the south corner.

SITE NOS.: State: 2067 PHRI: K-35 BPBM: —
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle, grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 80.0 m long by 65.0 m wide; c. 5,200.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Complex consists primarily of a interconnected complex of agricultural terraces with an associated small enclosure and a small overhang.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, wattle, grasses
CONDITION: Fair

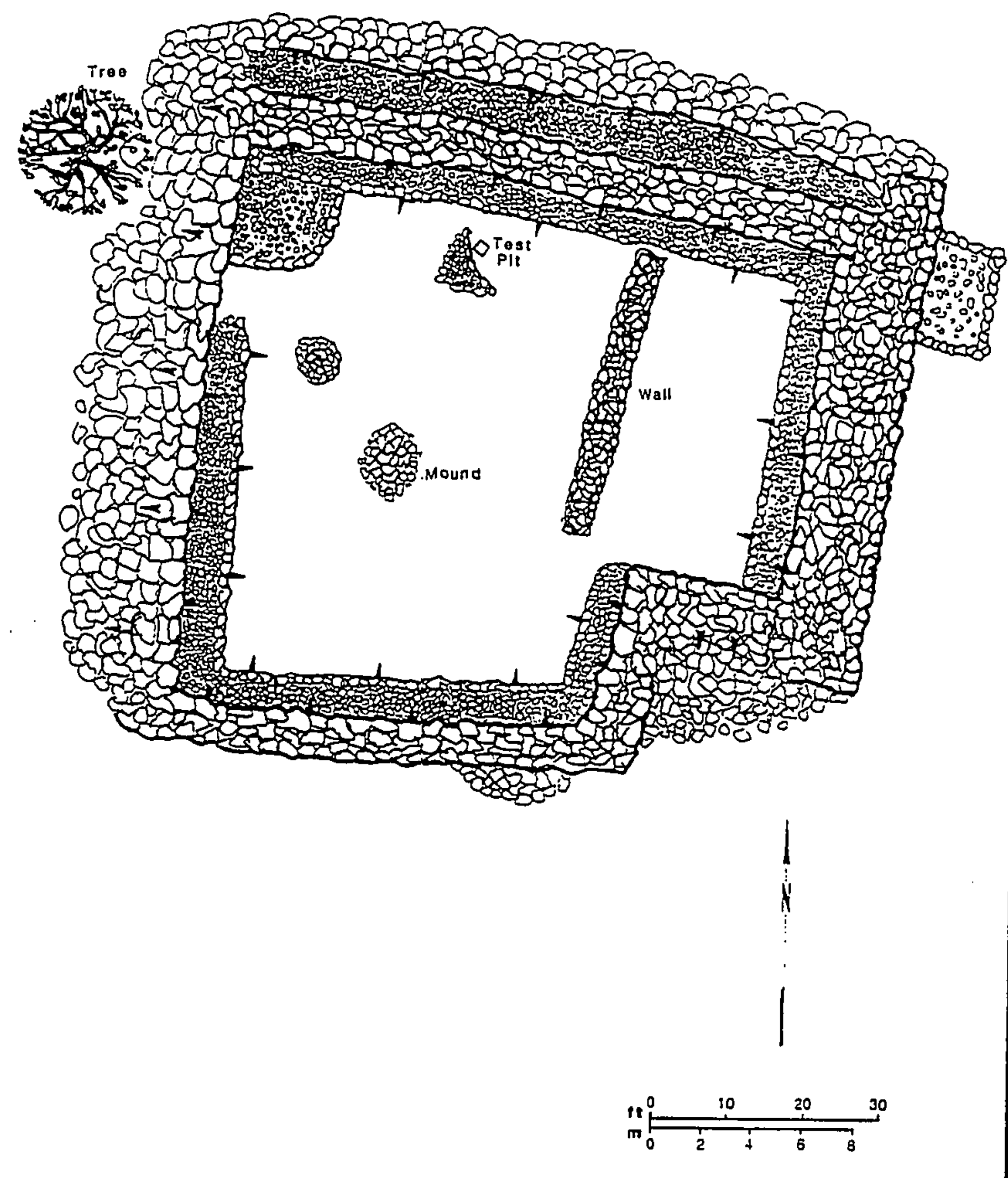

Figure E-3. SITE K-30.

INTEGRITY: Unaltered
DIMENSIONS: 6.5 m long by 5.6 m wide; c. 36.4 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: D-shaped enclosure with two terrace walls curving off the northwest and southeast sides. The walls connect with a larger terrace 5.0 m to the south. Another wall may have once been connected to the east side of the enclosure; this wall is now separated from the enclosure by a cattle trail.

FEATURE B: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, wattle, 'ilima, grasses, vines
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 4.7 m long by 3.1 m wide; c. 14.6 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Natural partially collapsed lava blister. The 50 cm high blister opening is partially blocked with a cobble wall. The wall is faced on the inside of its northwest end.

SITE NOS.: State: 3032 PHRI: K-36 BPBM: —
FORMAL TYPE: Complex (5 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses, wattle
CONDITION: Excellent
INTEGRITY: Unaltered
DIMENSIONS: 100.0 m long by 90.0 m wide; c. 9,000.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Complex consists of two rectangular enclosures, one trapezoidal enclosure, two attached circular enclosures, one very large rectangular enclosure, and numerous associated agriculture features.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, wattle, Christmas-berry, 'ilima
CONDITION: Very Good
INTEGRITY: Unaltered
DIMENSIONS: 4.8 m long by 3.3 m wide; c. 15.8 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure with a cupboard and intact facing on interior of the southwest wall. The feature has very high walls, up to 2.0 m (exterior measurement). The walls average 1.0 m in thickness and are comprised of stacked basalt cobbles and boulders.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, wattle, grasses, morning glory
CONDITION: Excellent
INTEGRITY: Unaltered
DIMENSIONS: 5.9 m long by 5.4 m wide; c. 31.9 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: All walls are faced on both sides. A few small areas of the wall are collapsed. The walls average 80 cm in height and average 1.0 m in thickness. Walls are comprised of stacked basalt cobbles and boulders.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, Christmas-berry, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 9.0 m long by 7.5 m wide; c. 67.5 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Sub-trapezoidal enclosure. Inside of west wall is faced. Present on exterior of north wall is a bedrock overhang (3.3 m long by 60 cm deep by 60 cm high). All walls are partially collapsed. The walls have a maximum height of 1.0 m and average 70 cm in thickness. Walls are comprised of stacked basalt cobbles and boulders. Feature is within and attached to Feature E.

FEATURE D: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 65.0 m long by 37.0 m wide; c. 2,405.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Feature C is within this very large enclosure; a Feature E is attached to the outside of the enclosure. Terraces are present throughout the enclosure's interior. The enclosure average 75 cm in height ane are comprised of stacked basalt cobbles and boulders.

FEATURE E: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, wattle
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 10.0 m long by 5.0 m wide; c. 50.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Double enclosure consisting of two attached, roughly circular enclosures. The walls are very collapsed. North wall is formed by Feature D. Much of the east wall is formed by an outcrop. The walls have a maximum height of 90 cm and average 60 cm in thickness. Walls are comprised of stacked basalt cobbles and boulders.

SITE NOS.: State: 2068 PHRI: K-39 BPBM: —
FORMAL TYPE: Overhangs
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, Christmas-berry, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 28.0 m long by 10.0 m wide; c. 280.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Consists of two shelters situated on the same side of a collapsed lava tube. The northern shelter is smaller than the southern one. The northern shelter is approximately 11 m long, 1.0m to 1.6 m deep, and 40 cm to 60 cm high. The southern shelter is approximately 8 m long, 1.6 m to 4.6 m deep, and 40 cm to 90 cm high. A terrace is fronts the southern shelter extending 5.0 m outside the shelter opening. The terrace has a maximum height of 2.0 m.

SITE NOS.: State: 2069 PHRI: K-40 BPBM: — *(Figure E-4)*
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, grasses, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 12.0 m long by 8.0 m wide; c. 96.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Complex consists of a rockshelter situated directly beneath a rectangular enclosure.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 11.0 m long by 8.4 m wide; c. 92.4 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure with a c. 1.0 m-wide bench or step along the east wall. The northwest corner is comprised of bedrock, which extends over the top of Feature B. The west and north walls, and the southeast corner of the enclosure are partially faced. The walls range from 30 to 70 cm in height and are comprised of stacked basalt cobbles and boulders.

FEATURE B: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 4.0 m long by 3.6 m wide; c. 14.4 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Natural rock shelter in partially collapsed blister. The shelter is 90 cm high. Two basalt flakes noted at the north end of the shelter.

SITE NOS.: State: 2070 PHRI: K-41 BPBM: —
FORMAL TYPE: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, grasses, Christmas-berry
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 1.2 m long by 1.0 m wide; c. 1.20 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Temporary Habitation
DESCRIPTION: Very small rock shelter. Shelter is 60 cm high. Kukui nut fragment found inside.

SITE NOS.: State: 2071 PHRI: K-42 BPBM: — *(Figure E-5)*
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle, grasses
CONDITION: Very Good
INTEGRITY: Unaltered
DIMENSIONS: 50.0 m long by 18.0 m wide; c. 900.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Rectangular enclosure with core-fill walls. Walls average 90 cm in height. A piece of columnar basalt is present in the east wall. Sixteen meters away from the enclosure is a 26.0 m long wall.

SITE NOS.: State: 2072 PHRI: K-44 BPBM: —
FORMAL TYPE: Complex (4 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 55.0 m long by 45.0 m wide; c. 2,475.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Complex consists of a rectangular structure, an irregular enclosure, two C-shape enclosures, and surrounding agriculture features.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope

Figure E-4. SITE K-40, OVERHANG. VIEW TO SOUTHEAST.
(PHRI Neg. 1157-10)

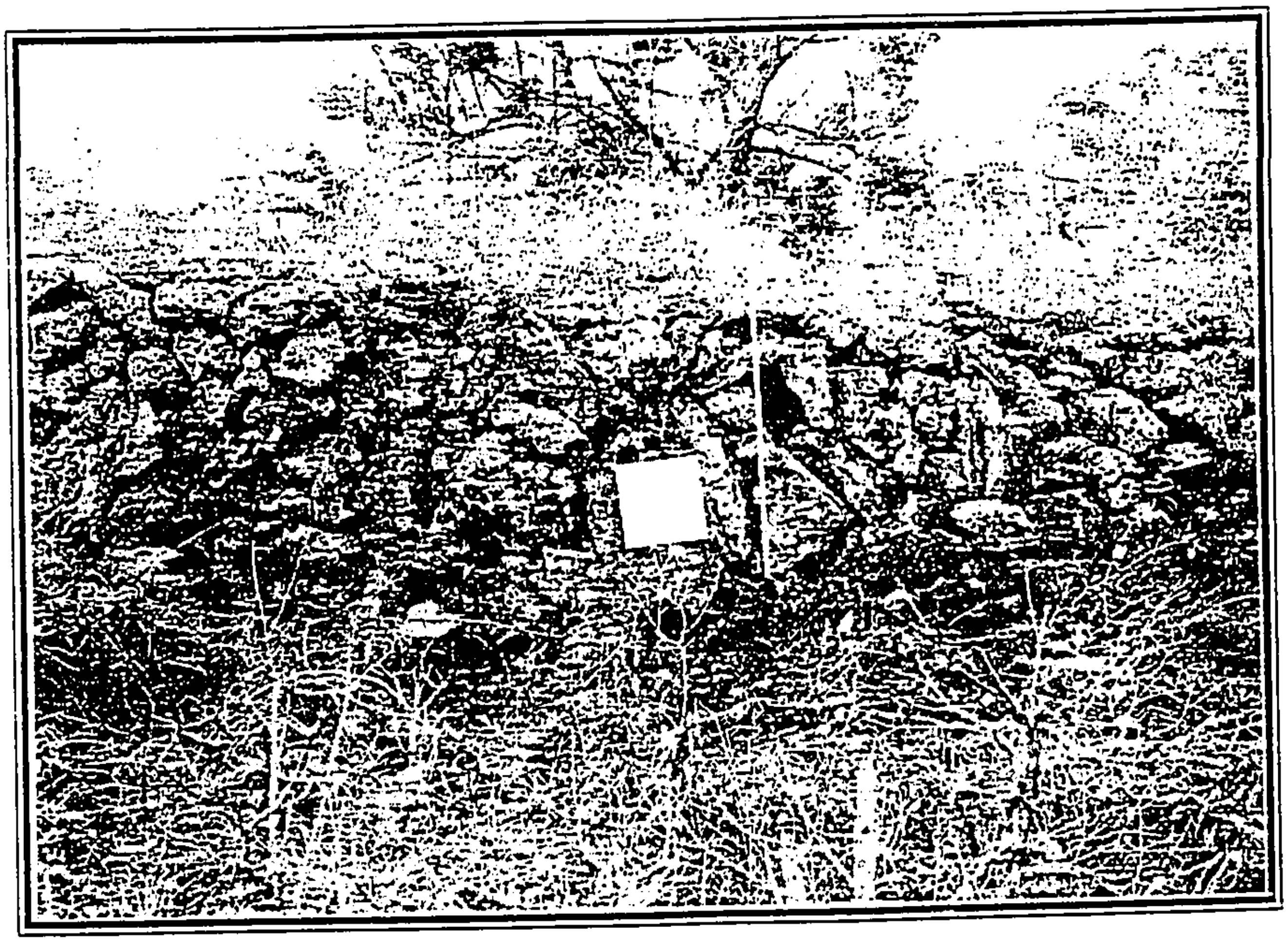

Figure E-5. SITE K-42, NE WALL OF FEATURE A. VIEW TO SOUTHWEST.
(PHRI Neg.1151-1)

VEGETATION: Lantana, 'ilima, wattle, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 7.5 m long by 6.0 m wide; c. 45.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular structure with very thick (2-3.0 m) walls. Interior of the east and west walls are faced. North and west walls are somewhat collapsed. The walls range from 50 (interior) to 1.1 m (exterior) in height and are comprised of stacked basalt cobbles and boulders.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 17.0 m long by 13.0 m wide; c. 221.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Double enclosure consisting of a roughly square and a roughly rectangular enclosure. The walls of the enclosure are very thick, up to 4.0 m thick on the southeast side. The south corner of the enclosure is faced. Near the south corner, on the southwest wall, is an opening. The walls range from 60 cm (interior) to 80 cm (exterior) in height and are comprised of stacked basalt cobbles and boulders occasionally incorporating bedrock outcrops.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 9.0 m long by 8.5 m wide; c. 76.5 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Large C-shaped enclosure with walls faced on both sides. A short wall extends off the west corner of the enclosure. The southeast wall of the enclosure is collapsed. The walls average 55 cm in height and are comprised of stacked basalt cobbles and boulders.

FEATURE D: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 3.0 m long by 3.0 m wide; c. 9.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Small C-shaped enclosure open to the north. The back wall of the enclosure is built into an outcrop. On this same outcrop are several small terraces.

SITE NOS.: State: 2073 PHRI: K-45 BPBM: — T-60
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, panini, wattle, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 7.8 m long by 6.5 m wide; c. 50.7 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Rectangular enclosure with most of each wall faced. The northeast wall is built partially on bedrock. North of the feature is a long terrace which forms an arc; level areas are present above and below the terrace. The walls average 50 cm in height and are comprised of stacked basalt cobbles and boulders.

SITE NOS.: State: 2074 PHRI: K-46 BPBM: — T-60
FORMAL TYPE: Complex (4 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, panini, wattle, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 74.0 m long by 35.0 m wide; c. 2590.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Complex consists of two rectangular enclosures, one C-shaped enclosure, one D-shaped enclosure, and numerous surrounding agricultural features.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, wattle, 'ilima, grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 6.5 m long by 6.0 m wide; c. 39.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: The northwest side of this rectangular-shaped feature is very collapsed. The northwest side incorporates a bedrock outcrop. Small portions of both sides of the walls are faced. The walls average 50 cm in height and are comprised of stacked basalt cobbles and boulders.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 7.0 m long by 5.5 m wide; c. 38.5 sq m
PROBABLE AGE: Prehistoric

DESCRIPTION: C-shaped enclosure open to the southwest. The back of the C-shape is comprised of an outcrop. The outside of north wall is faced. A rock alignment runs across the front of the enclosure. The walls are comprised of stacked basalt cobbles and boulders.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: *7.5 m long by 5.5 m wide; c. 41.3 sq m*
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure. Exteriors of all walls except east wall are faced. East wall is totally collapsed. The west wall incorporates some bedrock. The walls are comprised of stacked basalt cobbles and boulders.

FEATURE D: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 7.0 m long by 5.0 m wide; c. 35.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: D-shaped enclosure comprised of a bedrock outcrop and a wall. The outcrop forms the straight wall and part of the western portion of the D-shape. The walls are comprised of stacked basalt cobbles and boulders.

SITE NOS.: State: 2033 PHRI: K-48 BPBM: T-61-17-58 ***(Figure E-6)***
FORMAL TYPE: Complex (4 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, wattle, 'ilima, Christmas-berry, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 145.0 m long by 75.0 m wide; c. 10,875.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Very large complex consisting of a very large enclosure, a double enclosure, a small square enclosure, and an irregular enclosure. An extensive series of large contour terraces is situated along a broad ridge which extends through the central portion of the site.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle, Christmas-berry, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 67.0 m long by 67.0 m wide; c. 4,489.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Large irregular-shaped enclosure with substantial walls, several of which incorporate large upright slabs as facing stones. Some of the walls are faced. Walls have a maximum thickness of 2.0 m and are up to 1.5 m in height. Walls are comprised of stacked basalt boulders and cobbles.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, wattle, vines, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 12.0 m long by 10.5 m wide; c. 126.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Double enclosure in good condition. Lanai of porch present outside of the west wall. Situated just above the northeast corner of the enclosure is a curved paved terrace. Much facing present on interior walls. The walls have a maximum height of 1.1 m and maximum thickness of 2.0 m.

Two test units were excavated in the feature, one in each room. The units revealed a subsurface cultural deposit containing sea urchin remains, mammal and fish bone, a shark tooth, basalt and volcanic glass flakes, and charcoal. A radiocarbon sample collected from the deposit yielded a calendric age range of AD 1518-1591.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, wattle, Christmas-berry, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 17.0 m long by 17.0 m wide; c. 289.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Generally rectangular in plan view. The north and east walls are very thick, the west wall is thin, and the south wall is single-stacked, single-coursed. Present in the northeast corner is a platform.

FEATURE D: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, wattle, grasses, Christmas-berry
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 9.0 m long by 9.0 m wide; c. 81.0 sq m

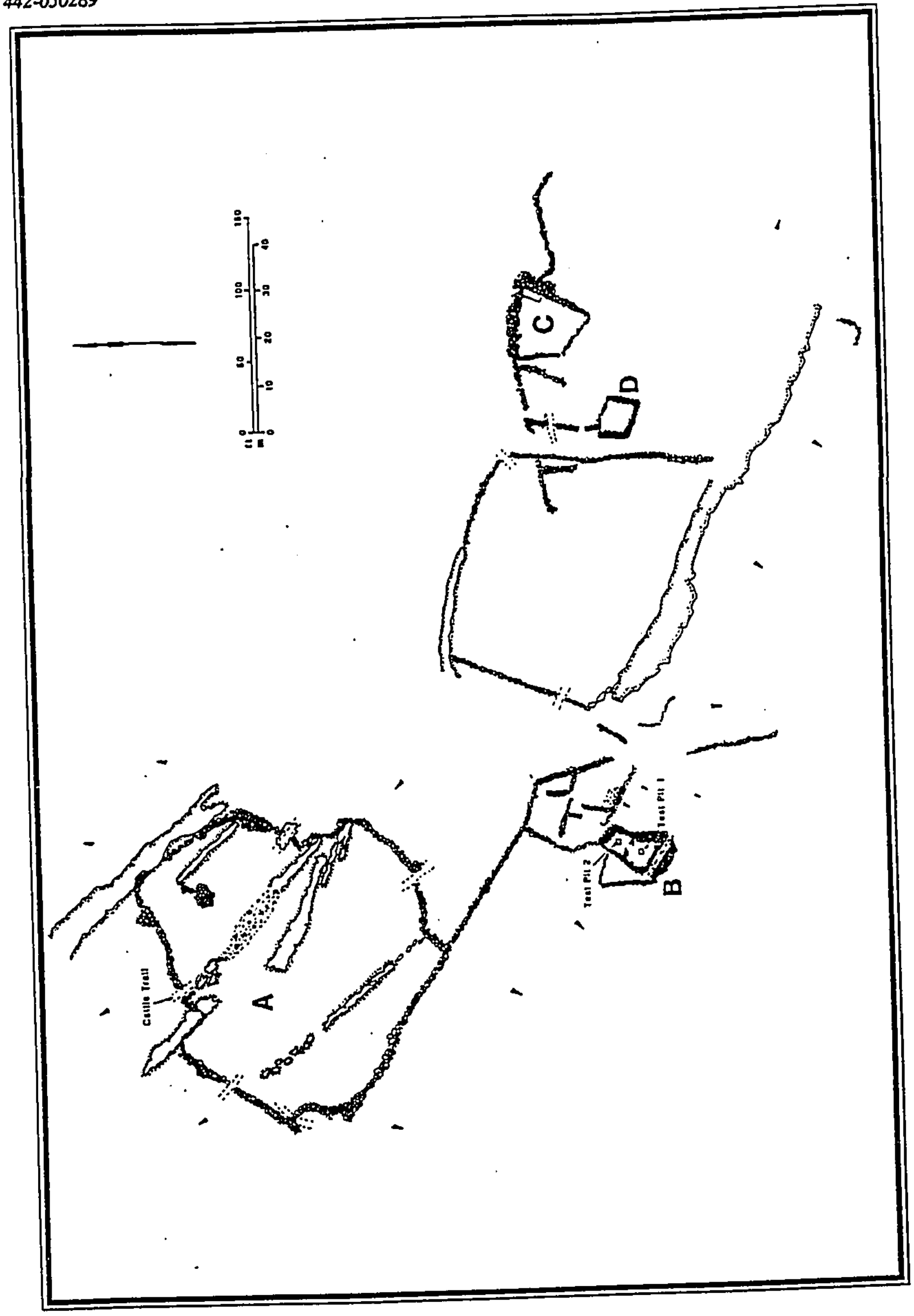

Figure E-6. SITE K-48.

PROBABLE AGE: Prehistoric
DESCRIPTION: Feature has very low intact walls. Walls have a maximum thickness of 1.5 m and are up to 30 cm in height. Walls are comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2075 PHRI: K-50 BPBM: —
(Figure E-7)
FORMAL TYPE: Complex (3 Features)
TOPOGRAPHY: Steep dissected alluvial slope
VEGETATION: Lantana, wattle, 'ilima, Christmas-berry, grasses
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 40.0 m long by 35.0 m wide; c. 1,400.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Complex features are spread along a steep slope. At the top of the slope is a rectangular enclosure; further down the slope is an oval enclosure, and further down from the oval enclosure is a double enclosure. Numerous agricultural features, primarily terraces, are present in the area.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, Christmas-berry, grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 9.0 m long by 7.8 m wide; c. 70.2 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure; parts of the northwest corner and south wall are missing. The north and east walls are mostly bedrock. Walls have a maximum height of 80 cm. Walls are comprised of stacked basalt boulders and cobbles.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, Christmas-berry, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 7.2 m long by 7.0 m wide; c. 50.4 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Oval enclosure with well built and preserved walls. Internal walls are mostly faced. Opening present on northwest side. Walls have a maximum height of 90 cm. Walls are comprised of stacked basalt boulders and cobbles.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle, Christmas-berry, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 12.8 m long by 8.0 m wide; c. 102.4 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Two circular enclosures connected by a short wall. The southern enclosure is built almost entirely within a natural circle of bedrock. The northern enclosure is built on a flat area of bedrock; the southwest wall of the enclosure consists of modified bedrock. Walls have a maximum height of 70 cm. Walls are comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2076 PHRI: K-51 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, wattle, morning glory, panini
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 12.0 m long by 5.5 m wide; c. 66.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Sub-rectangular enclosure with an attached terrace. East wall has some internal facing; the rest of the walls are mostly collapsed. The northwest wall is totally collapsed. Maximum wall height is 42 cm. Walls average 75 cm in thickness and are copmrised of stacked basalt cobbles and boulders. Agricultural features surround the feature.

SITE NOS.: State: 2077 PHRI: K-52 BPBM: T-31
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, wattle, Christmas-berry, panini
CONDITION: Fair/Good
INTEGRITY: Unaltered
DIMENSIONS: 42.0 m long by 35.0 m wide; c. 1,470.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Complex consists of an irregular ovoid enclosure with an adjacent area of possible paving. Agricultural features surround the enclosure.

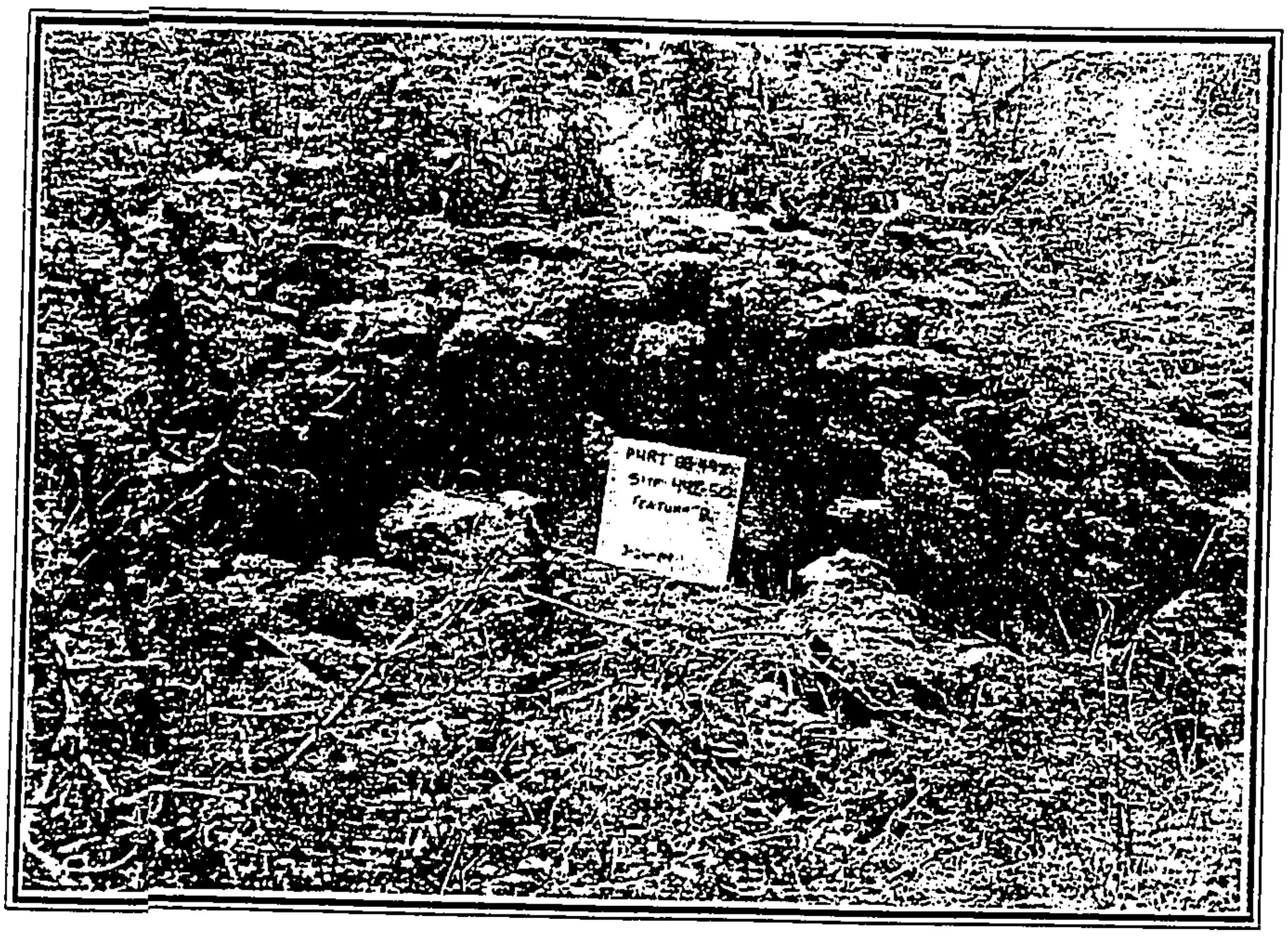

Figure E-7. SITE K-50, FEATURE B. VIEW TO SOUTHEAST.
(PHRI Neg. 1155-6)

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle, lantana, 'ilima, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 24.0 m long by 18.0 m wide; c. 432.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Western part of feature is built into a bedrock outcrop. There are two cupboards at the southwest end of the enclosure and a paved area at the south end. The walls of the enclosure have some facing. The walls include sections of multiple stacked and core-fill construction. Maximum wall height is 1.5 m.

FEATURE B: Paved Area
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, wattle, grasses, honey suckle, panini
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 15.0 m long by 15.0 m wide; c. 225.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Feature consists of an irregularly-shaped area of paving adjacent to the west wall of the structure.

SITE NOS.: State: 2078 PHRI: K-53 BPBM: —
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, wattle, panini
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 42.0 m long by 40.0 m wide; c. 1,680.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Complex consists of a group of connected agricultural and habitation features surrounded by a larger area of agricultural features.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, wattle, panini
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 3.0 m long by 1.7 m wide; c. 5.1 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: C-shaped enclosure attached to Feature B. Feature opens to the south. Wall averages 30 cm in height and averages 75 cm in thickness. Wall is constructed of stacked basalt boulders and cobbles. Feature is either a planting windbreak or a temporary habitation structure.

FEATURE B: Terrace
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, panini
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 20.0 m long by 15.0 m wide; c. 300.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Raised terrace with three small planting features adjacent to the main wall. Wall averages 1.05 m in height and averages 40 cm in thickness. Wall is constructed of stacked basalt boulders and cobbles.

SITE NOS.: State: 2079 PHRI: K-54 BPBM: T-30
(Figure E-8)
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, 'ilima, grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 14.0 m long by 11.0 m wide; c. 154.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: The feature is built on bedrock. It consists of an irregular-shaped enclosure with an internal rectangular terrace at the south end. The east wall is basically a terrace. Portions of the northeast wall are faced on the inside. Wall averages 30 m in height and averages 1.5 m in thickness. Wall is constructed of stacked basalt boulders and cobbles occaissionally incorporating bedrock outcrops.

SITE NOS.: State: 2080 PHRI: K-55 BPBM: —
FORMAL TYPE: Complex (3 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle, Christmas-berry, grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 41.0 m long by 41.0 m wide; c. 1,681.00 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Complex consists of two enclosures and an overhang. Numerous agricultural features surround the site.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle, grasses, Christmas-berry

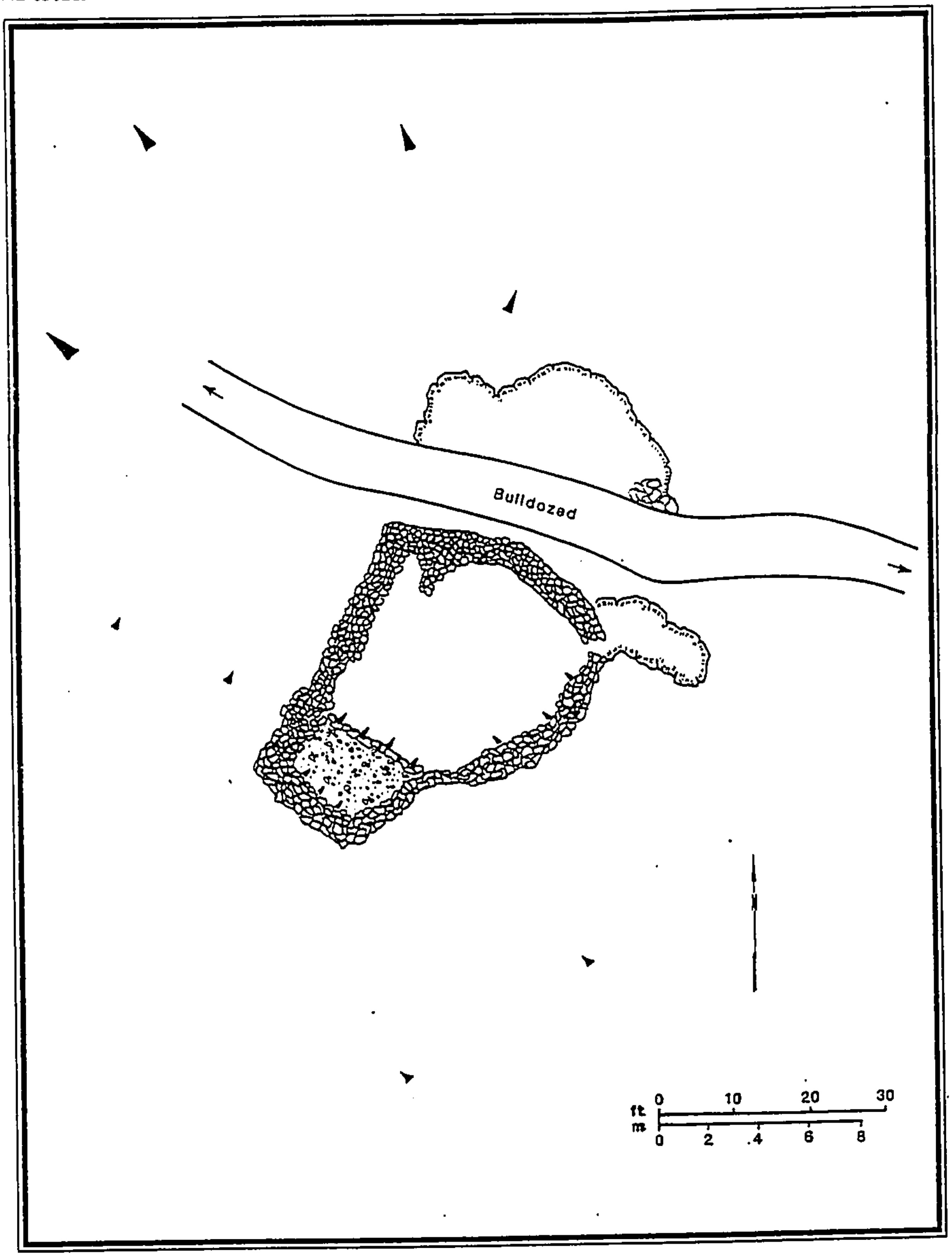

Figure E-8. SITE K-54.

CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 7.0 m long by 5.0 m wide; c. 35.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure with downslope wall also forming a terrace. A smaller enclosure or room is attached to the northeast side of the terrace. The terrace/ enclosure walls average 55 cm in height and are comprised of stackeed basalt boulders and cobbles.

FEATURE B: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, wattle, Christmas-berry
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 5.0 m long by 3.0 m wide; c. 15.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: A low semicircular wall fronts the overhang. Ceiling of the shelter is 85 cm high.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle, grasses, Christmas-berry
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 16.0 m long by 7.5 m wide; c. 120.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Feature consists of two small enclosures connected by a wall of bedrock; the bedrock forms the northeast wall of both rooms. The lower room is triangular in plan, and its northwest wall forms a terrace. The upper room is square in plan. An upright slab is present on the wall of bedrock between the two rooms. The walls range from 55 cm to 90 cm in height and are comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2081 PHRI: K-57 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, Christmas-berry, wattle, Silky Oak
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 30.0 m long by 24.0 m wide; c. 720.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Sub-rectangular enclosure built against an outcrop. The south and southeast walls incorporate bedrock. There is some facing on the enclosure's north corner. The walls average 80 cm in height and are comprised of stacked basalt boulders and cobbles. Many terraces present upslope and downslope of feature.

SITE NOS.: State: 2082 PHRI: K-59 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 36.0 m long by 28.0 m wide; c. 1,008.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Rectangular enclosure with short walls extending from the southeast and northeast corners. Interior of southeast wall and the exterior of northwest wall are faced. Part of the southwest wall is collapsed. The wallls have a maximum thickness of 1.5 m and a maximum height of 1.1 m. Walls are comprised of stacked basalt boulders and cobbles. The enclosure, excluding the extending walls, measures 11.0 by 5.5 by 0.7 m. Numerous small terraces usualy incorporating bedrock outcrops are present to the east of the feature.

SITE NOS.: State: 2083 PHRI: K-60 BPBM: —
FORMAL TYPE: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, wattle, 'ilima
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 5.5 m long by 1.1 m wide; c. 6.1 sq m
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Animal Control
DESCRIPTION: Wall segment is bifaced and core-filled and runs upslope-downslope. Wall averages 50 cm in height and is composed of stacked basalt boulders and cobbles.

SITE NOS.: State: 2084 PHRI: K-62 BPBM: —
FORMAL TYPE: Complex (3 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 45.0 m long by 35.0 m wide; c. 1,575.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Religious/Burial/ Habitation/Agriculture
DESCRIPTION: Complex consists of a rectangular enclosure with an internal probable burial platform, a trapezoidal enclosure with an associated probable shrine/

altar platform, a square enclosure and surrounding agricultural features.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 12.0 m long by 5.5 m wide; c. 66.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure with a platform in the southeast end; platform is faced on the northwest and southeast sides. It is 55 cm high, roughly 2.0 m square, and has a relatively level upper surface. Cobble pavement surrounds the platform and on three sides extends to the enclosure walls. Not much of the northwest end of the enclosure remains. The enclosure wall average 1.2 m in thickness and have a maximum height of 50 cm. The walls and platform are comprised of stacked basalt boulders and cobbles.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 8.0 m long by 7.0 m wide; c. 56.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Enclosure's southwest wall is part of a natural volcanic "sill". Facing is present on the interiors of the northeast, west, and southwest walls, and on the exterior of the southwest wall. The walls have a maximum thickness of 1.0 m and nmaximum height of 1.3. About 2.0 m east of the enclosure is a small platform faced on its northeast side. A large 1.2 m long fallen upright stone is present on the platform. A small cavity, centrally-located in the platform's upper surface, apparently once held the stone upright. Both the enclosure and platform are comprised of stacked basalt boulders and cobbles occasionally incorporating bedrock outcrops. A alignment extends from Feature B to Feature C.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 11.0 m long by 10.0 m wide; c. 110.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Large square enclosure with an internal mound or collapsed platform. The northeast and northwest walls of the enclosure consist of alignments; the southeast and southwest walls are wide, up-to 1.0 m in height, and are constructed primarily of boulders. The mound/platform extends from the middle of the northwest wall of the enclosure.

SITE NOS.: State: 2085 PHRI: K-63 BPBM: —
FORMAL TYPE: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, wattle, 'ilima, grasses, Christmas-berry
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 15.0 m long by 1.0 m wide; c. 15.0 sq m
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Animal Control*
DESCRIPTION: Well-faced and well-built upslope-downslope oriented wall segment. Wall is of multiple-stacked construction, comprised of basalt boulders and cobbles. Wall averages 1.0 m in thickness and 1.1 m in height.

SITE NOS.: State: 2034 PHRI: K-64 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 13.0 m long by 11.0 m wide; c. 143.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agricultural
DESCRIPTION: Enclosure is attached to a terrace located c. 3.0 m downslope. Most of the area between the enclosure and the terrace is filled with rubble. Interior of the southeast wall of the enclosure is faced. Enclosure has an opening in the northwest wall. The walls range in height from 20 cm to 55 cm and are comprised of stacked basalt boulders and cobbles occassionally incorporating bedrock outcrops. Agricultural features surround the enclosure.

A test unit excavated outside the enclosure near the opening revealed a subsurface cultural deposit containing one basalt flake, sea urchin remains, and charcoal. A radiocarbon sample from the deposit yielded a calendric age range of AD 1420-1660.

SITE NOS.: State: 2086 PHRI: K-65 BPBM: —
FORMAL TYPE: Complex (7 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 215.0 m long by 90.0 m wide; c. 19,350.0 sq m
PROBABLE AGE: Prehistoric

FUNCTIONAL INTERPRETATION: Habitation/ Agricultural
DESCRIPTION: Complex consists of enclosures and agricultural features close to each other. Six of the enclosures are habitation features, one is probably a field boundary.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 8.2 m long by 6.2 m wide; c. 50.8 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Square enclosure with some facing on the interior of the northwest wall. A small cupboard-like overhang is present west of the southwest corner of the enclosure. Walls have a maximum height of 1.1 m and a maximum thickness of 60 cm. Walls are comprised of stacked basalt boulders and cobbles. A bedrock outcrop is incorporated into the southwest corner.

FEATURE B: Walls
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 45.0 m long by 5.0 m wide; c. 225.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Two parallel walls on either side of a collapsed lava tube. The walls begin at the bottom of a short steep slope and extend to top of the slope, where they are joined together by a bedrock outcrop. The northwest wall ends at this point. The southeast wall continues through the site. Walls have a maximum height of 1.5 m and a maximum thickness of 1.0 m. Walls are comprised of stacked basalt boulders and cobbles occasionally incorporating bedrock outcrops.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 8.0 m long by 6.5 m wide; c. 52.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Square enclosure. The interior of the southwest wall is faced. The other walls are somewhat collapsed. Walls have a maximum height of 90 cm and a maximum thickness of 1.1 m. Walls are comprised of stacked basalt boulders and cobbles.

FEATURE D: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 15.0 m long by 14.0 m wide; c. 210.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Large D-shaped enclosure; the east wall consists of a bedrock outcrop. A few terraces are present within the enclosure. A 3.0 m long wall extends from the northwest portion of the enclosure generally toward the northwest. The northeast side of this wall is faced. Walls have a maximum height of 75 cm and a maximum thickness of 85 cm. Walls are comprised of stacked basalt boulders and cobbles occasionally incorporating bedrock outcrops.

FEATURE E: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 5.0 m long by 3.7 m wide; c. 18.5 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Somewhat square in plan view. Part of the interior of the south wall is faced. Walls have a maximum height of 80 cm and a maximum thickness of 80 cm. Walls are comprised of stacked basalt boulders and cobbles.

FEATURE F: Enclosures
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 12.0 m long by 7.5 m wide; c. 90.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Large oval enclosure with a slightly smaller enclosure attached to its northeast side. Most of the walls of both enclosures are collapsed. Walls have a maximum height of 65 cm and a maximum thickness of 90 cm. Walls are comprised of stacked basalt boulders and cobbles.

FEATURE G: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 8.0 m long by 7.4 m wide; c. 59.2 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Square enclosure; interior and exterior of north corner is faced. The west corner of the feature is collapsed. Walls have a maximum height of 60 cm and an

average thickness of 90 cm. Walls are comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2087 PHRI: K-69 BPBM: T-37
(Figure E-9)
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, panini, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 8.0 m long by 8.0 m wide; c. 64.0 sq m
PROBABLE AGE: Prehistoric/Historic
FUNCTIONAL INTERPRETATION: Water Tank
DESCRIPTION: Square enclosure faced on the southwest, northwest, and part of the northeast sides. The southeast and part of the northeast walls, which are lower than the rest of the structure, are constructed of generally larger stones than those used in the other walls. Within the enclosure are the remains of a wooden platform for a water tank, and metal hoops used to bind boards of tank together.

SITE NOS.: State: 2088 PHRI: K-70 BPBM: T-27
FORMAL TYPE: Terrace
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, wattle, grasses
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 35.0 m long by 12.0 m wide; c. 420.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Agricultural
DESCRIPTION: Terrace extends southward for 10.0 m from a upslope-downslope oriented wall. The junction of the wall and the terrace abuts a basalt outcrop. The south end of the wall curves to create a small terrace measuring 5.0 m in diameter.

SITE NOS.: State: 2089 PHRI: K-71 BPBM: —
FORMAL TYPE: Complex (3 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, wattle, Christmas-berry, grasses
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 60.0 m long by 50.0 m wide; c. 3,000.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Burial*/Habitation
DESCRIPTION: Complex consists of two enclosures with terraces between them, and connected to them. One enclosure has unusually thick walls and a small interior. Southwest of this feature is a large rubble area which may be natural. Feature C is a possible lava tube burial.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, wattle, grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 9.0 m long by 8.5 m wide; c. 76.5 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Large square enclosure with low, collapsed walls. The north corner of the enclosure rises 1.5 m above the slope the enclosure is on. A terrace wall extends 5.0 m southwest off the southwest corner of the enclosure. Walls are comprised of stacked basalt boulders and cobbles.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, Christmas-berry, grasses
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 7.0 m long by 7.0 m wide; c. 49.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Enclosure consists of a square area of paving with a small sunken area in the middle of it. A wall built on the paving forms the southwest and part of the northwest wall of the room. The interior of the sunken area and the wall are faced. Walls average 50 cm in height and are comprised of stacked basalt boulders and cobbles. A terrace runs off the northeast wall.

FEATURE C: Paved Mound
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses, wattle
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 10.0 m long by 5.0 m wide; c. 50.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Feature consists of a level area of rubble fill with a wall on it. The feature is situated in front of collapsed lava tube. This tube may have an opening plugged up with rubble. Several aligned large upright slabs to the southeast and northwest appear to remnants of a terrace wall which would have retained the rubble fill.

SITE NOS.: State: 2090 PHRI: K-76 BPBM: —
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 55.0 m long by 18.0 m wide; c. 990.0 sq m
PROBABLE AGE: Prehistoric

Figure E-9. SITE K-69, WALL AND WATERTANK. VIEW TO WEST. (PHRI Neg#.1151-19).

FUNCTIONAL INTERPRETATION: Habitation/ Agricultural
DESCRIPTION: Complex consists of a U-shaped terrace with some paving and a free standing upslope-downslope-oriented wall segment.

FEATURE A: Terrace
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, 'ilima, wattle, lantana
CONDITION: Fair/Poor
INTEGRITY: Altered
DIMENSIONS: 10.5 m long by 8.0 m wide; c. 84.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: U-shaped terrace with low walls. A small paved area is present in the southeast portion of the feature. Northwest of the terrace is a short terrace. Walls have a maximum height of 45 cm and an average thickness of 1.2 m. Walls are comprised of stacked basalt boulders and cobbles.

FEATURE B: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, 'ilima, lantana, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 8.0 m long by 1.1 m wide; c. 8.8 sq m
PROBABLE AGE: Historic/Prehistoric*
DESCRIPTION: Core-filled wall segment oriented upslope-downslope. The wall is faced on both sides and is collapsed in some areas. Wall has a maximum height of 1.1 m and an average thickness of 1.2 m. Wall is comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2091 PHRI: K-78 BPBM: —
FORMAL TYPE: Complex (6 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, wattle, Christmas-berry
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 115.0 m long by 70.0 m wide; c. 8,050.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Religious*/ Habitation/Agricultural
DESCRIPTION: Complex consists of two habitation terrace complexes, one stepped and paved platform, one rectangular enclosure, and one area of modified bedrock. Agricultural terraces are present north of the main features.

FEATURE A: Terraces
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, wattle, Christmas-berry
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 25.0 m long by 10.0 m wide; c. 250.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Three paved terraces oriented upslope-downslope and connected to each other. Northeast boundary of the terraces consists of a bedrock outcrop. The south and west sides of the terraces are raised above the adjacent slope. The northwest wall of the westernmost terrace is faced. The eastern terrace measures 10 m by 7 m by 20 cm high. The central terrace measures 8.9 m by 6.3 m by 40 cm high. The western terrace measures 8.5 m by 5.3 m by 75 cm high.

FEATURE B: Terrace
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, Christmas-berry, wattle
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 10.0 m long by 8.0 m wide; c. 80.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Probable residential terrace with a small notch in the northwest corner. The inside of the east wall and the outside of the south wall are faced. Interior of terrace has possible paving.

FEATURE C: Platform/terrace
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, wattle, 'ilima, Christmas-berry
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 12.5 m long by 10.5 m wide; c. 131.3 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Consists of a smaller paved platform built on a larger one. The lower platform forms a paved area which extends out c. 0.8 m beyond the limits of smaller platform. Some facing is present on the west and south sides of the platform.

FEATURE D: Complex
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, wattle, Christmas-berry
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 32.5 m long by 25.0 m wide; c. 812.5 sq m
PROBABLE AGE: Prehistoric

DESCRIPTION: Complex is located on bedrock and is delineated by retaining walls. Modified bedrock outcrops and a possible walkway are present on the north wall. Within the walls are alignments/terraces and areas cleared of stones presumably for planting.

FEATURE E: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, wattle, Christmas-berry
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 9.4 m long by 8.0 m wide; c. 75.2 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure; the east and south walls are built into a slope and are higher than the north and west walls. The interior of the east and south walls are faced, as are both sides of the west wall. A possible cupboard is present in the west wall. A possible firepit is present in the interior of the structure. Walls average 1 m in height and 1.2 m in width. Walls are comprised of stacked basalt boulders and cobbles.

FEATURE F: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses, wattle, Christmas-berry
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 22.5 m long by 22.5 m wide; c. 506.3 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Large irregular enclosure with the majority of its walls standing on the edge of a low cliff. The northwest wall consists of a single course of rocks. Wing walls extend off the southeast and southwest corners of the enclosure. Enclosure walls have a maximum height of 1.3 m and an average width of 60 cm. Walls are composed of stacked basalt boulders and cobbles occasionally incorporating bedrock outcrops. Feature appears to be either a agricultural enclosure or corral.

SITE NOS.: State: 2092 PHRI: K-79 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, wattle, lantana, panini, 'ilima
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 22.0 m long by 20.0 m wide; c. 440.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Agricultural
DESCRIPTION: Large enclosure irregular in plan view. The south wall is constructed on a collapsed lava tube. The interior of the north wall is faced. The northeast wall consists of a loose alignment of rocks. Walls have a maximum height of 1.0 m and an average thickness of 60 cm. Walls are comprised of stacked basalt boulders and cobbles. Within the enclosure are several terraces.

SITE NOS.: State: 2093 PHRI: K-80 BPBM: T-46
FORMAL TYPE: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 50.0 m long by 1.5 m wide; c. 75.0 sq m
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Animal Control
DESCRIPTION: Upslope-downslope oriented wall partly with a fence along it. The wall ranges in height from 30 cm to 90 cm and is comprised of stacked basalt boulders and cobbles. At the north end the wall curves slightly to the west and connects with an outcrop situated above a drainage. Near the upslope portion of the wall is a terrace.

SITE NOS.: State: 2094 PHRI: K-81 BPBM: T-1036
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 80.0 m long by 40.0 m wide; c. 3,200.0 sq m
PROBABLE AGE: Historic/Prehistoric
FUNCTIONAL INTERPRETATION: Animal control/ Agricultural
DESCRIPTION: Complex consists of a large rectangular enclosure, a small circular enclosure, and numerous agricultural terraces. A wall extends off the southeast corner of the large enclosure.

FEATURE A: Enclosure
TOPOGRAPHY: Steep dissected alluvial slope
VEGETATION: Wattle Forest
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 36.0 m long by 50.0 m wide; c. 1,800.0 sq m
PROBABLE AGE: Historic
DESCRIPTION: Large rectangular enclosure. The northern two-thirds of the west wall consists of a single course of rocks. Present in the southern half of the enclosure is an outcrop. A wall extends c. 25.0 m northeast off the southeast corner of the enclosure.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 4.0 m long by 3.5 m wide; c. 14.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Small circular enclosure built against a low outcrop. The walls of the enclosure are built with large rocks and are relatively high. The walls are not faced.

SITE NOS.: State: 2095 PHRI: K-84 BPBM: T-55
FORMAL TYPE: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 4.5 m long by 3.5 m wide; c. 15.8 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Indeterminate
DESCRIPTION: L-shaped wall open to the northeast. The northwest portion of the wall is collapsed. Wall has a maximum height of 1.2 m and is comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2096 PHRI: K-85 BPBM: —
FORMAL TYPE: Wall and terrace complex
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 80.0 m long by 60.0 m wide; c. 4,800.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Animal Control/ Agricultural
DESCRIPTION: Complex is largely built on and around bedrock. Site consists of an area of rough terrces and a long well-preserved wall segment. The long wall probably connects to a wall at Site K-101.

SITE NOS.: State: 2097 PHRI: K-87 BPBM: T-25
(Figure E-10)
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 28.0 m long by 8.0 m wide; c. 224.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Burial
DESCRIPTION: The complex consists of a faced mound and a faced platform. Both features are small. The platform has a small wall around the top; the platform is probably a burial. The mound is a possible burial.

FEATURE A: Platform
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Excellent
INTEGRITY: Unaltered
DIMENSIONS: 3.8 m long by 2.1 m wide; c. 7.9 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: The sides and top of this feature are faced. A wall c. 20 cm high outlines the level upper surface of the platform. Platform has a maximum height of 1.2 m and is comprised of stacked basalt boulders and cobbles.

FEATURE B: Mound/platform
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 2.0 m long by 2.0 m wide; c. 4.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: The east and west sides of the mound are faced; the north and south sides are somewhat collapsed. The feature is built on a L-shaped, rock-retained terrace. The feature has a maximum height of 1 m and is comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2098 PHRI: K-89 BPBM: —
FORMAL TYPE: Terrace
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 150.0 m long by 125.0 m wide; c. 18,750.0 sq m
PROBABLE AGE: Prehistoric/Historic*
FUNCTIONAL INTERPRETATION: Agricultural/ Habitation/Animal control
DESCRIPTION: Long terrace with a paved area. The terrace connects sides of a collapsed lava tube. Walls are built along the sides of the tube and intersect with the terrace and another large terrace downslope. There are many other small terraces to the north. The terraces appear to be largely agricultural in function, excepting the paved portion which may be a remnant of a habitation feature. For the most part, the walls appear to be ranch-related features. The site roughly resembles the map of Papakea Heiau contained in the SIHP Site Form No. 50-50-10-1036; however, the described location and coral offerings in the form do not match.

Figure E-10. SITE K-87, BURIAL PLATFORM. VIEW TO NORTHWEST.
(PHRI Neg#.1151-36)

SITE NOS.: State: 2099 PHRI: K-90 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, wattle
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 17.0 m long by 10.0 m wide; c. 170.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Possibly notched enclosure which has been heavily disturbed. The enclosure has no northwest wall. The notch is in the south corner. Adjacent to the northwest side are two paved terraces or lanai. An internal wall subdivides the enclosure interior into upper and lower portions. The walls have a maximum height of 60 cm and are comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2300 PHRI: K-95 BPBM: —
FORMAL TYPE: Complex (3 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, wattle, lantana
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 50.0 m long by 30.0 m wide; c. 1,500.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agricultural
DESCRIPTION: Complex consists of an ovoid enclosure, a partially walled terrace, and a wall segment. There numerous agricultural terraces in the area.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, wattle, lantana
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 7.0 m long by 6.0 m wide; c. 42.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: The west side and portions of the south wall of this enclosure are built into bedrock. The interiors of the east, west, and north walls, and the exterior of the west and north walls are faced. The top of the east wall is even with the ground surface on the exterior, uphill side. Walls have a maximum height of 60 cm. Wall are comprised of stacked basalt boulders and cobbles and incorporate bedrock outcrops.

FEATURE B: Terrace
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, wattle, lantana
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 9.0 m long by 8.0 m wide; c. 72.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Terrace has east and south walls only; built on bedrock. Feature is eroded and heavily vegetated making it very difficult to determine its exact form and function. Feature may be agricultural in function.

FEATURE C: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, wattle, lantana
CONDITION: Fair/Poor
INTEGRITY: Unaltered
DIMENSIONS: 4.0 m long by 2.0 m wide; c. 8.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Two course high wall faced on the west side but mostly collapsed. Maximum wall height is 20 cm. Walls are comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2301 PHRI: K-96 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, wattle, lantana
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 5.4 m long by 4.5 m wide; c. 24.3 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation*/ Animal Control
DESCRIPTION: Circular enclosure with unfaced walls. The southeast wall is built into a small outcrop of rock. Maximum wall height is 40 cm. Walls are comprised of stacked basalt boulders and cobbles. A small drainage is present c. 4.0 m west of the enclosure.

SITE NOS.: State: 2302 PHRI: K-97 BPBM: —
FORMAL TYPE: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 7.0 m long by 0.6 m wide; c. 4.2 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Agricultural
DESCRIPTION: Modified bedrock wall c. 0.5 m high (maximum). Feature is probably agricultural. Small agricultural terraces present in the area.

SITE NOS.: State: 2303 PHRI: K-98 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest

CONDITION: Fair
INTEGRITY: Altered*
DIMENSIONS: 9.5 m long by 8.5 m wide; c. 80.8 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agricultural
DESCRIPTION: Rectangular enclosure with very low walls which look disturbed. There is some facing in the south corner of the enclosure. About 2.0 m southwest of the enclosure are two rock-retained terraces. Walls average 1.5 m in thickness and have a maximum height of 60 cm. Walls are comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2304 PHRI: K-99 BPBM: T-3
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 7.0 m long by 5.5 m wide; c. 38.5 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Rectangular enclosure with openings in the south corner and northwest side. The southwest wall of the enclosure is built on a small bedrock outcrop. Possible slab-lined firepit in the center of enclosure. Walls have a maximum height of 70 cm and are comprised of stacked basalt boulders and cobbles.

A test unit excavated in the enclosure sectioning the possible firepit did not reveal any subsuface cultural remains indicating the feature is either not a habitation (i.e., an agricultural enclosure) or that the feature was little used.

SITE NOS.: State: 2305 PHRI: K-100 BPBM: —
FORMAL TYPE: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Poor
INTEGRITY: Altered
DIMENSIONS: 21.0 m long by 0.8 m wide; c. 16.8 sq m
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Animal/Control
DESCRIPTION: Cattle wall roughly faced on both sides. Wall has a maximum height of 60 cm; comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2306 PHRI: K-101 BPBM: T-24
FORMAL TYPE: Mounds and Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 300.0 m long by 1.0 m wide; c. 300.0 sq m
PROBABLE AGE: Historic/Prehistoric
FUNCTIONAL INTERPRETATION: Animal Control/ Agricultural
DESCRIPTION: Long cattle wall which curves to form a large arc which opens downslope. In the northeast portion of this arc are several probable agricultural mounds. The wall is roughly faced on both sides. Wall has a maximum height of 60 cm; comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2307 PHRI: K-102 BPBM: —
FORMAL TYPE: Terrace and Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 18.0 m long by 6.0 m wide; c. 108.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agricultural
DESCRIPTION: Rectangular terrace built on the top of a knoll. The wall is built across a small steep-sided drainage situated 6.0 m south of the terrace. The south and north walls of the terrace are situated on the edge of the knoll. An alignment extends 4.0 m north from the northwest corner of the terrace.

SITE NOS.: State: 2308 PHRI: K-103 BPBM: T-56
FORMAL TYPE: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Wattle forest
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 32.0 m long by 22.0 m wide; c. 704.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Feature includes large walled area in front of the 80 cm high overhang. The walls of the area run down a steep, short slope (from the cliff to the bottom of the drainage) where the northeast wall runs parallel to the drainage. A level area extends 5.0 m out from the dripline of the overhang.

SITE NOS.: State: 2035 PHRI: K-105 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, wattle, lantana
CONDITION: Good
INTEGRITY: Altered

DIMENSIONS: 26.0 m long by 26.0 m wide; c. 676.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agricultural
DESCRIPTION: Rectangular enclosure. Outside of the east wall and portions of the inside of the north and south walls are faced. Walls are collapsed on the north and west sides. In the northeast corner is a possible rock-filled pit. Terraces are present north of the enclosure.

A test unit excavated inside the enclosure revealed a subsurface cultural deposit containing fish and mammal bone, kukui nut shell, and and charcoal. A radiocarbon sample from the deposit yielded three posssible calendric age ranges of AD 1470-1670, AD 1775-1793, and AD 1947-1953.

SITE NOS.: State: 2310 PHRI: K-106 BPBM: —
FORMAL TYPE: Stone
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 2.0 m long by 2.0 m wide; c. 4.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Tool Manufacturing
DESCRIPTION: Site consists of abraded depressions in several pahoehoe slabs at the bottom of a hill. The slabs range in size from 20 cm to 90 cm in diameter.

SITE NOS.: State: 2311 PHRI: K-107 BPBM: —
FORMAL TYPE: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, Christmas-berry, wattle, koa-haole
CONDITION: Good
INTEGRITY: Altered*
DIMENSIONS: 14.0 m long by 6.0 m wide; c. 84.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Burial/Agricultural
DESCRIPTION: Consists of a burial in a lava blister overhang. The blister is 0.3 m high and c. 4.0 m in diameter. Bones (patella and rib) were observed inside. A wall extends from the opening 9.0 m to the northwest. The entrance may have been plugged at one time, but is now open. Agricultural features surround the site.

SITE NOS.: State: 2312 PHRI: K-108 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 6.0 m long by 4.0 m wide; c. 24.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: C-shaped enclosure open to the northwest; interior of the southeast portion is faced. The southeast wall, which is the highest, abuts a slope. The wall averages 60 cm in thickness and has a maximum height of 90 cm. Wall is comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2313 PHRI: K-109 BPBM: T-49
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, wattle, panini
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 55.0 m long by 40.0 m wide; c. 2,200.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Agricultural
DESCRIPTION: The complex consists of a C-shaped terrace, and agricultural features. Several terraces extend from an outcrop. Terraces situated downslope from C-shape.

FEATURE A: Terraces
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, wattle, 'ilima, panini
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 3-5 m long by 0.5-1.0 m wide by 0.3-0.5 m high
PROBABLE AGE: Prehistoric
DESCRIPTION: Small terraces scattered across slope. Most incorporate bedrock outcrops and are roughy constructed. They are opportunistically placed to utilized scattered pockets of soil.

FEATURE B: Terrace
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, wattle, Christmas-berry
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 3.7 m long by 3.4 m wide; c. 12.6 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: C-shaped terrace, probably agricultural in function. A slightly modified bedrock terrace is present immediately below the feature.

SITE NOS.: State: 2314 PHRI: K-110 BPBM: T-48
FORMAL TYPE: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, wattle

CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 36.0 m long by 14.0 m wide; c. 504.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Agricultural
DESCRIPTION: Large terrace forms a rough C-shape. Terrace is situated in the bottom and sides of a drainage. A wall extends upslope-downslope from the south end of the terrace and continues downslope.

SITE NOS.: State: 2036 PHRI: K-111 BPBM: —
FORMAL TYPE: Complex (3 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, Christmas-berry, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 40.0 m long by 20.0 m wide; c. 800.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Complex consists of a pair of adjoining overhangs, a paved terrace, and a small overhang with possible walls delineating a level area.

FEATURE A: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, Christmas-berry, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 12.0 m long by 11.0 m wide; c. 132.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Two adjoining overhangs with a possible wall in front of the western one. In front of the overhangs is a natural terrace area which extends 4.0 m to the west. Subsurface testing was conducted at the feature.

The test unit excavated near the dripline of the overhang revealed a subsurface cultural deposit containing volcanic glass flakes, marine shell, bone and charcoal. A radiocarbon sample from the deposit yielded a calendric age range of AD 1640-1955.

FEATURE B: Terrace
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, Christmas-berry, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 10.0 m long by 7.5 m wide; c. 75.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: This paved terrace is on a very steep slope and is built to extend the top of the ridge. About 1.5 m of the north wall is faced, and the other 1.5 m of the same wall is collapsed.

FEATURE C: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, Christmas-berry, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 5.0 m long by 4.0 m wide; c. 20.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Overhang alone measures 1.4 m by 0.7 m; a level area fronts it. A possible modified bedrock wall is situated west of the overhang; this wall curves and connects with Feature B and encloses a level area.

SITE NOS.: State: 2315 PHRI: K-112 BPBM: T-43
FORMAL TYPE: Complex (3 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, panini
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 60.0 m long by 50.0 m wide; c. 3,000.0 sq m
PROBABLE AGE: Prehistoric/Historic
FUNCTIONAL INTERPRETATION: Habitation/ Agricultural/Animal Control
DESCRIPTION: Complex consists of an overhang, an oval enclosure, and a cattle wall. Agricultural features surround the site.

FEATURE A: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, panini
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 2.0 m deep by 1.8 m wide; c. 3.6 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Feature consists of an 1 m high overhang with collapsed bedrock in front. Soil deposit present inside overhang.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses, panini
CONDITION: Poor
INTEGRITY: Unltered
DIMENSIONS: 5.5 m long by 5.0 m wide; c. 27.5 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Mostly collapsed oval enclosure. alls have a maximum height of 30 cm and are comprised of stacked basalt boulders and cobbles. No facing remains and the walls are rounded in cross-section.

FEATURE C; Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, panini

CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 60.0 m long by 0.75 m wide
PROBABLE AGE: Historic
DESCRIPTION: Cattle wall which may be connected to the walls of Site K-12. Multiple-stacked wall comprised of stacked basalt boulders and cobbles. Wall is 80 cm high and 75 cm in thickness.

SITE NOS.: State: 2316 PHRI: K-115 BPBM: T-42
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, kiawe
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 35.0 m long by 20.0 m wide; c. 700.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture
DESCRIPTION: Complex consists of a square enclosure, an enclosure irregular in plan, and agricultural terraces.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, kiawe
CONDITION: Excellent
INTEGRITY: Unaltered
DIMENSIONS: 8.9 m long by 7.9 m wide; c. 70.3 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Square enclosure with a 3.5 m square platform adjacent to the walls in the northeast quadrant of the structure's interior. The level upper surface of the platform is flush with the upper surfaces of the adjacent walls which are also level. Both sides of all walls are well-faced. The south wall is massive, 1.9 m thick. The walls average 80 cm in height and average 1.5 m in thickness. A possible external cupboard is present on the outside of the north wall near the northeast corner. The walls are comprised of stacked basalt boulders and cobbles.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, kiawe
CONDITION: Poor
INTEGRITY: Unaltered
DIMENSIONS: 30.0 m long by 20.0 m wide; c. 600.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Enclosure irregular in plan view surrounding a small sink. The walls of the enclosure are poorly constructed and are low. The north wall may have been altered during fence building. The western wall is the only wall which is easily discernible; the east wall is covered with lantana. The walls have a maximum height of 80 cm and are comprised of stacked basalt boulders and cobbles.

SITE NOS.: State: 2317 PHRI: K-116 BPBM: T-41
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses, kiawe
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 75.0 m long by 55.0 m wide; c. 4,125.0 sq m
PROBABLE AGE: Historic
FUNCTIONAL INTERPRETATION: Animal Control
DESCRIPTION: Complex consists of two large enclosures, one square and one trapezoidal. Both are probably historic corrals for cattle based on their size, location relative to other similar features, and construction.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, panini
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 30.0 m long by 22.0 m wide; c. 660.0 sq m
PROBABLE AGE: Historic
DESCRIPTION: Large square enclosure with intermittent facing on the walls. Most of the west wall is missing due to bulldozer activity during the building of a fence in the area. A upslope-downslope oriented wall segment extends for c. 5.0 m off the northeast corner. The walls average 75 cm to 80 cm in thickness and have a maximum height of 1.0 m. The walls are of multiple-stacked to core-filled construction and are composed of stacked basalt cobble and boulders.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, panini
CONDITION: Fair
INTEGRITY: Altered
DIMENSIONS: 30.0 m long by 22.0 m wide; c. 660.0 sq m
PROBABLE AGE: Historic
DESCRIPTION: Large trapezoidal enclosure with only the north and east walls intact. The other walls are linear piles of rubble having been probably destroyed by bulldozer activity. There is a depression in the northwest one-third of the enclosure. The walls average 80 cm in thickness and have a maximum height of 1.3 m. The walls are of multiple-stacked to core-filled construction and are composed of stacked basalt cobble and boulders.

SITE NOS.: State: 2318 PHRI: K-118 BPBM: —
FORMAL TYPE: Complex (3 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, panini, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 70.0 m long by 40.0 m wide; c. 2,800.0 sq m
PROBABLE AGE: Prehistoric/Historic
FUNCTIONAL INTERPRETATION: Habitation/Agricultural/Animal Control
DESCRIPTION: Complex consists of a large square enclosure, a circular enclosure, a sub-rectangular enclosure and associated agricultural features. The large enclosure is probably a historic cattle corral based on it's size, location relative to other similar features, and construction.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, panini, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 35.0 m long by 30.0 m wide; c. 1,050.0 sq m
PROBABLE AGE: Prehistoric/Historic
DESCRIPTION: Large square enclosure. Most of the walls are faced, the west wall, however, is somewhat collapsed. The south wall is in the best condition. A collapsed terrace extends c. 5.0 m from the north corner, then extends 8.0 m to the northeast, then extends eastward and ends 5.0 m from Feature B. The enclosure walls average 70 cm in thickness and have a maximum height of 1.2 m. The walls are of multiple-stacked construction and are composed of stacked basalt cobble and boulders.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, panini, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 5.0 m long by 4.3 m wide; c. 21.5 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Circular enclosure. The north half of the enclosure is collapsed, and the south half is in very good condition. Walls of the south half are faced on both sides. The enclosure walls average 70 cm in thickness and have a maximum height of 90 m. The walls are of multiple-stacked construction and are composed of stacked basalt cobble and boulders.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, panini, wattle
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 9.0 m long by 4.5 m wide; c. 40.5 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Sub-rectangular enclosure with very collapsed walls. Most of the south half of the east wall is missing.

SITE NOS.: State: 2319 PHRI: K-120 BPBM: T-40
FORMAL TYPE: Complex (3 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, panini, morning glory
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 60.0 m long by 25.0 m wide; c. 1,500.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/Agricultural
DESCRIPTION: Complex consists of a paved terrace, a small lava tube, and a rectangular enclosure.

FEATURE A: Paved terrace
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses, panini, morning glory
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 7.0 m long by 4.5 m wide; c. 31.5 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Feature consists of an outcrop of cobbles which has been modified into a terrace. A faced retaining wall is present on the southeast downslope side of the platform. The upper surface of the terrace is roughly paved.

FEATURE B: Lava Tube
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, panini, morning glory
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 1.8 m long by 0.8 m wide; c. 1.4 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: A small lava tube open at both ends. Some possible stacking of cobbles at one opening, or the cobbles may represent collapse. Floor of tube has a soil deposit. internal height ranges from 35 cm to 55 cm.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, panini, morning glory

CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 6.2 m long by 3.7 m wide; c. 22.9 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure with all walls faced. There may be an opening in the south corner. Walls have a maximum height of 1.1 m. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles.

SITE NOS.: State: 2037 PHRI: K-124 BPBM: —
FORMAL TYPE: Complex (3 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 65.0 m long by 60.0 m wide; c. 3,900.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agricultural
DESCRIPTION: Complex consists of an oval enclosure, an overhang wall, a rectangular enclosure, and surrounding agricultural features.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 7.0 m long by 6.0 m wide; c. 42.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: An oval enclosure built into an natural collapsed lava tube depression. Portions of the interiors and exteriors of the walls are faced. The walls range from 60 cm to 80 cm in thickness and range from 1.2 m to 1.4 m in height. The walls are of multiple-stacked construction comprised of basalt boulders and cobbles. Just north of the enclosure is a small lava tube which extends to the northwest for an indeterminable length.

A test unit excavated inside the enclosure revealed a subsurface cultural deposit containingsmall and medium mammal bone, three basalt flakes, and charcoal. A radiocarbon sample from the deposit yielded a calendric age range of AD 1640-1955.

FEATURE B: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 3.4 m long by 2.5 m wide; c. 8.5 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Overhang with a small curved wall fronting it. The wall encloses a small area in front of the overhang and both ends of the wall connects to an outcrop equal in height to the wall. A few boulders are present on the outcrop, above the lip of the overhang. The walls have a maximum height of 1.0 m and a maximum thickness of 50 cm. Walls are comprised of stacked basalt boulders and cobbles.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses lantana, 'ilima, wattle
CONDITION: Poor
INTEGRITY: Unaltered
DIMENSIONS: 8.0 m long by 6.0 m wide; c. 48.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure. The walls of the enclosure are quite collapsed making it difficult to determine their exact dimensions. The north wall, being on the side of a swale, is higher than the others. Part of the exterior of the west wall is faced. The walls have a maximum height of 1.0 m and a maximum thickness of 1.0 m. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles.

SITE NOS.: State: 2320 PHRI: K-127 BPBM: —
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, panini, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 65.0 m long by 35.0 m wide; c. 2275.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agricultural
DESCRIPTION: Complex consists of a circular enclosure, a small overhang with an associated wall, and many surrounding agricultural features.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, 'ilima, lantana, panini, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 9.0 m long by 8.2 m wide; c. 73.8 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Circular enclosure; the interior of the south wall and the exterior of the north wall are faced. A possible cupboard is present in the south wall. The walls have a maximum height of 85 cm and a maximum thickness of 1.0 m. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles.

FEATURE B: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 1.8 m long by 0.4 m wide; c. 0.7 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: A small shallow overhang in a lava blister. A 8.0 m long somewhat informal appearing wall extends north from the overhang. The wall measures 0.5 m wide; c. 0.5 m high. The overhang is 0.7 m high.

SITE NOS.: State: 2038 PHRI: K-130 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, panini
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 40.0 m long by 40.0 m wide; c. 1,600.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agricultural
DESCRIPTION: Rectangular enclosure with a small associated overhang containing a pig mandible. Most of the interior walls are faced. The walls have a maximum height of 1.3 m and a maximum thickness of 80 cm. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles. The overhang is 1.4 m high, 1.4 m wide, and 50 cm deep. There are many agricultural features in the area.

A test unit excavated inside the enclosure revealed a subsurface cultural deposit containing small mammal bone, marine shell, three basalt flakes, and charcoal. A radiocarbon sample from the deposit yielded five possible calendric age ranges: AD 1523-1566, AD 1629-1696, AD 1726-1818, AD 1859-1861, and AD 1921-1955.

SITE NOS.: State: 2321 PHRI: K-131 BPBM: —
FORMAL TYPE: Complex (3 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, morning glory, panini
CONDITION: Good
INTEGRITY: Altered
DIMENSIONS: 80.0 m long by 50.0 m wide; c. 4,000.0 sq m
PROBABLE AGE: Prehistoric/Historic
FUNCTIONAL INTERPRETATION: Habitation/ Agriculture/Animal Control
DESCRIPTION: Complex consists of a square enclosure, an oval enclosure, an overhang and a wall, and associated agricultural features. A wall of Site K-12 bisects the site.

FEATURE A: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, morning glory, panini
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 3.0 m long by 0.4 m wide; c. 1.2 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Very shallow, 50 cm high overhang with a possible deposit on the floor. A nearby wall is probably not associated with the overhang, as it appears to be a cattle wall. The wall is 50+ m long, 70 cm thick, and 50 cm high. There is also a probable road between this wall and the wall of Site K-12.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, morning glory, panini
CONDITION: Fair/Poor
INTEGRITY: Unaltered
DIMENSIONS: 5.0 m long by 5.0 m wide; c. 25.00 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Square enclosure with collapsed walls and rock mounds possibly associated with the enclosure. The walls have a maximum height of 30 cm. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, morning glory, panini
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 6.0 m long by 5.0 m wide; c. 30.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Circular enclosure with collapsed walls. No facing was present on any of the walls. The walls have a maximum height of 50. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles.

SITE NOS.: State: 2322 PHRI: K-134 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, panini
CONDITION: Fair-Poor
INTEGRITY: Altered
DIMENSIONS: 18.5 m long by 13.2 m wide; c. 244.2 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Religious*/ Habitation

DESCRIPTION: Large substantial rectangular enclosure with wide walls and internal features. The east wall is intermittently faced on both sides. There is a possible internal step, or bench along the south half of the east wall. A natural step in the bedrock floor separates the higher north one-quarter of the floor from the lower south three-quarters. The later portion of the interior may have been futher subdivided by a wall which is now completely collapsed. A cattle wall has been constructed along the west wall of the feature. Stones from the remaining walls, especially the north and south ones, have been removed to construct the cattle wall. The walls average 70 cm in height and have a *maximum thickness of up-to 2.0 m. Walls are comprised of* stacked basalt boulders and cobbles. The feature commands a broad view of the surrounding terrain. The enclosure is one of the largest within the project area and probably represents a small heiau, a men's house, or high status residence based on its size, construction, and location.

SITE NOS.: State: 2323 PHRI: K-135 BPBM: —
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, panini, morning glory
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 35.0 m long by 15.0 m wide; c. 525.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agricultural
DESCRIPTION: Complex consists of an enclosed portion of a collapsed lava tube, and an L-shaped wall within a collapsed lava tube. Along the tube, throughout the site, there are small associated features. A long wall, which may be part of Site K-112 or Site K-12, is situated nearby.

FEATURE A: Lava Tube
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, morning glory, ferns
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 12.0 m long by 12.0 m wide; c. 144.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: An enclosure built within a collapsed lava tube; the northeast and southwest walls have been built on the sides of the tube. The walls have a maximum height of 1.5 m and a maximum thickness of 85 cm. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles.

FEATURE B: Wall
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, morning glory, ferns
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 7.0 m long by 6.0 m wide; c. 42.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: L-shaped wall built within a collapsed lava tube. One leg of the L-shape is on the top of the tube and the other crosses the tube. The northeast side of the tube is steep enough to act as a wall—which creates an over all *U-shape open to the northwest. The walls have a maximum* height of 1.5 m and a maximum thickness of 80 cm. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles.

SITE NOS.: State: 2324 PHRI: K-137 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, Christmas-berry
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 4.0 m long by 3.6 m wide; c. 14.4 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agricultural
DESCRIPTION: Sub-rectangular enclosure with some facing on the east wall. Northeast side of structure is built into an outcrop. The walls have a maximum height of 70 cm. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles. Agicultural features, mounds, terraces, and modified outcrops, surround site.

SITE NOS.: State: 2325 PHRI: K-140 BPBM: —
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, vines
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 50.0 m long by 40.0 m wide; c. 2,000.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Indeterminate
DESCRIPTION: Complex consists of a large ovoid enclosure, and a C-shaped enclosure. Associated with these features are two small overhangs.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, vines
CONDITION: Good

INTEGRITY: Unaltered
DIMENSIONS: 30.0 m long by 16.0 m wide; c. 480.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Large ovoid enclosure situated in a depression/sink. Much of the south wall consists of a small cliff. The other walls are high and are intermittently faced. Wall average 1.0 m in height. Walls are multiple-stacked comprised of basalt cobbles and boulders and frequently incorporate bedrock outcrops. Interior is thickly vegetated possibly indicating feature served as an garden enclosure.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, vines
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 4.8 m long by 3.8 m wide; c. 18.2 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: C-shaped enclosure open to the west. The walls are low and are not faced. The walls have an average height of 20 cm. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles.

SITE NOS.: State: 2326 PHRI: K-142 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, vines
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 7.8 m long by 6.0 m wide; c. 46.8 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agricultural
DESCRIPTION: Rectangular enclosure with intermittent facing on all sides. Terraces are present north and south of the west wall. The terraces form the edge of a level area which runs to the base of a ridge situated to the east and north. The walls have an average height of 40 cm. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles.

A test unit excavated in the enclosure sectioning the possible firepit did not reveal any subsuface cultural remains indicating the feature is either not a habitation (i.e., an agricultural enclosure) or that the feature was little used.

SITE NOS.: State: 2327 PHRI: K-143 BPBM: —
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, Christmas-berry, panini
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 50.0 m long by 25.0 m wide; c. 1,250.00 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agricultural
DESCRIPTION: Complex consists of an irregular enclosure, an overhang, and surrounding agricultural features.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, Christmas-berry, panini
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 8.0 m long by 7.0 m wide; c. 56.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Enclosure is irregular in plan view. Walls are infrequently faced on the north and west sides. In the southwest corner is a possible small platform. In the northwest corner is a low area defined by a terrace connected to the possible platform and north wall. The walls have an maximum height of 80 cm and a maximum thickness of 80 cm. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles.

FEATURE B: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, Christmas-berry, panini
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 2.5 m long by 1.5 m wide; c. 3.8 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: A 80 cm overhang with short walls of modified bedrock on either side of the entrance. Present in the vicinity of the overhang are numerous agricultural terraces.

SITE NOS.: State: 2328 PHRI: K-146 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, Christmas-berry, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 7.0 m long by 6.0 m wide; c. 42.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: U-shaped enclosure open to the southeast. Northwest side of enclosure is built into a small outcrop. A level area is present on the other side of the outcrop. The walls have a maximum height of 70 cm. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles.

SITE NOS.: State: 2329 PHRI: K-148 BPBM: —
(Figure E-11)
FORMAL TYPE: Complex (5 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, wattle, Christmas-berry
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 90.0 m long by 60.0 m wide; c. 5,400.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Site consists of three circular enclosures, one U-shaped enclosure, one rectangular enclosure, and surrounding agricultural features.

FEATURE A: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, wattle, Christmas-berry
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 6.5 m long by 6.5 m wide; c. 42.3 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Circular enclosure with low, unfaced walls. The walls have a maximum height of 25 cm. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, Christmas-berry, wattle
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 10.0 m long by 7.5 m wide; c. 75.0 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: U-shaped enclosure open to the northeast, with associated walls. Small portion of southwest wall is faced. Present within the enclosure is a small wall which extends 2.0 m northeast off the enclosure's southwest wall. The walls have a maximum height of 80 cm. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles and occasionally incorporating bedrock outcrops. Three meters east of the enclosure is what appears to be a very collapsed U-shape.

FEATURE C: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, Christmas-berry, wattle
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 7.5 m long by 7.0 m wide; c. 52.5 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Circular enclosure with unfaced walls quite collapsed. The walls have a maximum height of 35 cm. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles.

FEATURE D: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, Christmas-berry, wattle
CONDITION: Poor
INTEGRITY: Unaltered
DIMENSIONS: 5.4 m long by 5.2 m wide; c. 28.1 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Rectangular enclosure with very collapsed walls. The only portions of the enclosure above ground level are the south wall, the southeast corner, and a small bit of the east wall. A wall extends c. 4.0 m south from the southwest corner of the enclosure. The walls have a maximum height of 30 cm. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles.

SITE NOS.: State: 2330 PHRI: K-149 BPBM: —
FORMAL TYPE: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: lantana, 'ilima, wattle, grasses, panini
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 8.0 m long by 3.5 m wide; c. 28.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Overhang is enclosed; it is small and low, and a wall seals off one-quarter of the entrance. Fronting the overhang is a fairly level area which is terraced. The overhang measures 2.9 by 1.1 by 0.5 m.

SITE NOS.: State: 2331 PHRI: K-152 BPBM: —
FORMAL TYPE: Complex (2 Features)
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, 'ilima, grasses, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 40.0 m long by 40.0 m wide; c. 1,600.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/Agricultural
DESCRIPTION: Complex consists of a double terrace, a U-shaped enclosure, and surrounding agricultural features.

Figure E-11. SITE K-148, FEATURE B. VIEW TO SOUTHWEST.
(PHRI Neg.# 1154-20)

FEATURE A: Double terrace
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, wattle, 'ilima, lantana
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 5.9 m long by 5.8 m wide; c. 34.2 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: Feature consists of two attached paved terraces. The downslope and northwest side of each level area is well faced. The upper terrace surface is 80 cm above the lower one. The southeast corner of each terrace is level with the slope of the hill. The lower terrace is 70 cm high.

FEATURE B: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 5.7 m long by 5.0 m wide; c. 28.5 sq m
PROBABLE AGE: Prehistoric
DESCRIPTION: U-shaped enclosure open to the southwest. The walls of the enclosure are faced. The back wall of the U-shape, the northeast side, is collapsed. The walls have a maximum height of 40 cm. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles.

SITE NOS.: State: 2332 PHRI: K-200 BPBM: —
FORMAL TYPE: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, panini, wattle, Christmas-berry, grasses
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 10.7 m long by 3.0 m wide; c. 32.1 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Site consists of an 1.1 m high overhang with a partially walled entrance. One wall is on the southeast side of the entrance. The wall has a faced corner. The wall on the other side is collapsed. Inside the overhang is a small oval-shaped level terraced area.

SITE NOS.: State: 2333 PHRI: K-201 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 3.3 m long by 2.8 m wide; c. 9.3 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Small square enclosure with collapsed walls. There is a bit of facing on the southwest corner. A possible entryway is present in the southwest wall. The walls have a maximum height of 30 cm. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles. Five meters south of the enclosure is a wall of Site K-12.

SITE NOS.: State: 2334 PHRI: K-202 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, wattle
CONDITION: Poor
INTEGRITY: Unaltered
DIMENSIONS: 4.0 m long by 3.0 m wide; c. 12.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: A small rectangular enclosure with a modified bedrock terrace extending 10.0 m off the southwest corner. The walls have a maximum height of 70 cm. Walls are of multiple-stacked construction comprised of basalt boulders and cobbles occasionally incorporating bedrock outcrops.

SITE NOS.: State: 2335 PHRI: K-203 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Lantana, grasses, 'ilima, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 45.0 m long by 22.0 m wide; c. 990.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation/ Agricultural
DESCRIPTION: Large irregular-shaped enclosure with two rooms on the southwest side. Probable agricultural features within enclosure including modified outcrops and terraces. The walls have a maximum height of 1.5 m. Walls are of multiple-stacked to core-fill construction. Walls are comprised of basalt boulders and cobbles occasionally incorporating bedrock outcrops.

SITE NOS.: State: 2336 PHRI: K-204 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: grasses, lantana, 'ilima, wattle, Christmas-berry
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 6.2 m long by 5.0 m wide; c. 31.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Circular enclosure with collapsed walls. The interior of the southwest wall is partially faced. Possible

opening present in a section of the west wall. The walls have a maximum height of 55 cm. Walls are of multiple-stacked and are comprised of basalt boulders and cobbles.

SITE NOS.: State: 2337 PHRI: K-205 BPBM: —
FORMAL TYPE: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, Christmas-berry, panini
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 18.0 m long by 5.0 m wide; c. 90.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Overhang with a terraced area in front of it. Overhang has two deep recesses at either end; recesses differ in elevation and are separated by a collapsed modified bedrock wall. Overhang ceiling ranges from 50 cm to 90 cm in height.

SITE NOS.: State: 2338 PHRI: K-206 BPBM: T-1
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, 'ilima, lantana
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 6.6 m long by 5.5 m wide; c. 36.30 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation*/ Agricultural
DESCRIPTION: The northwest and southeast walls of this enclosure are formed by a collapsed lava tube. Possible cupboard present in the middle of the northeast wall. Within the tube, 6.0 m upslope of the enclosure, is a terrace. The walls have a maximum height of 90 cm. Walls are of multiple-stacked and are comprised of basalt boulders and cobbles.

SITE NOS.: State: 2339 PHRI: K-207 BPBM: T-45
FORMAL TYPE: Sink, Burial
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, Christmas-berry, panini
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 36.0 m long by 5.0 m wide; c. 180.00 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Burial/Habitation
DESCRIPTION: Very deep sink with a small circular alignment in lava tube at the bottom. A lava tube extends to the west. Human bone noted on surface in tube. Sink is filled with trash and dead animals. Areas of charcoal-stain noted on floor of tube.

SITE NOS.: State: 2340 PHRI: K-208 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, Christmas-berry
CONDITION: Fair
INTEGRITY: Unaltered
DIMENSIONS: 5.0 m long by 4.3 m wide; c. 21.5 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Sub-rectangular enclosure built on a bedrock outcrop. *Interiors and exteriors of walls are faced.* The walls have a maximum height of 90 cm. Walls are of multiple-stacked and are comprised of basalt boulders and cobbles. Many agricultural terraces present northwest of the enclosure.

SITE NOS.: State: 2341 PHRI: K-209 BPBM: —
FORMAL TYPE: Enclosure
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, morning glory, kiawe
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 30.0 m long by 15.0 m wide; c. 450.0 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Indeterminate
DESCRIPTION: Large oval enclosure encircling a sink. Aside from the east wall, which is built on a slope and which utilizes bedrock, all walls are faced on both sides. The walls have a maximum height of 1.4 m and a maximum thickness of 90 cm. Walls are of multiple-stacked and are comprised of basalt boulders and cobbles. Agricultural terraces surround the enclosure.

SITE NOS.: State: 2342 PHRI: K-210 BPBM: —
FORMAL TYPE: Overhang
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, wattle
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 4.1 m long by 2.9 m wide; c. 11.9 sq m
PROBABLE AGE: Prehistoric
FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Overhang with irregular enclosure in front. Two sides of the enclosure consist of bedrock; one of the bedrock sides has a small overhang. The interior portion of the northwest wall is faced; all other walls are collapsed. The walls have a maximum height of 90 cm and a maximum thickness of 60 cm. Walls are of multiple-stacked and are comprised of basalt boulders and cobbles.

SITE NOS.: State: 2343 PHRI: K-211 BPBM: —
FORMAL TYPE: Terrace
TOPOGRAPHY: Dissected alluvial slope
VEGETATION: Grasses, lantana, 'ilima, wattle, lilikoi
CONDITION: Good
INTEGRITY: Unaltered
DIMENSIONS: 13.0 m long by 6.5 m wide; c. 84.50 sq m
PROBABLE AGE: Prehistoric

FUNCTIONAL INTERPRETATION: Habitation
DESCRIPTION: Probable residential terrace with modified bedrock walls present on the south and west sides. The other walls were vaguely defined. Terrace is situated on the end of a ridge. The walls have a maximum height of 80 cm and a maximum thickness of 1.1 m. Walls are of multiple-stacked and are comprised of basalt boulders and cobbles.

APPENDIX F

FULL UTM COORDINATES, ELEVATION AND PROXIMITY TO WATER FOR IDENTIFIED SITES

PHRI TEMP. NUMBER	FULL UTM COORDINATES EASTING	FULL UTM COORDINATES NORTHING	ELEVATION (ft. above sea level)	DISTANCE AND DIRECT. TO WATER* (ft.) (approx.)
WAIOHULI				
W- 1	774,450	2,296,100	1820	625 (S)
W- 2	774,350	2,295,850	1820	175 (N)
W- 3	774,300	2,295,800	1820	375(N/NE),450(S)
W- 4	774,300	2,295,700	1820	175 (SW)
W- 5	774,350	2,295,700	1840	225 (SW)
W- 6	774,300	2,295,700	1820	150 (S/SW)
W- 8	774,200	2,295,550	1820	550 (SW)
W-10	774,500	2,295,750	1880	375 (N), 375 (S)
W-11	774,600	2,296,000	1900	500 (S)
W-12	774,600	2,295,900	1900	150 (S)
W-13	774,500	2,295,250	1960	250 (S)
W-14	774,500	2,295,400	1940	625 (S), 575 (N)
W-15	774,700	2,295,500	1980	50 (N)
W-17	774,700	2,295,650	1940	300 (S)
W-18	774,850	2,295,850	1980	375 (SW)
W-20	774,800	2,295,700	1980	125 (N)
W-21	774,700	2,295,600	1960	275 (S)
W-27	775,050	2,295,550	2100	300 (N), 300 (S)
W-28	774,800	2,295,150	2100	375 (SW)
W-30	775,150	2,295,600	2100	225 (N)
W-31	775,100	2,295,600	2100	150 (N)
W-32	775,200	2,295,600	2100	125 (N)
W-35	774,950	2,294,900	2200	175 (N)
W-36	775,050	2,295,100	2180	875 (W/SW)
W-37	774,950	2,294,950	2200	250 (W/SW)
W-42	776,350	2,295,100	2720	575 (S)
W-45	775,600	2,295,500	2320	275 (S)
W-46	775,500	2,295,550	2280	425 (SW)
W-47	776,650	2,294,950	2860	250 (S)
W-48	776,550	2,294,900	2840	100 (S)
W-49	776,450	2,295,050	2760	500 (S)
W-55	776,250	2,294,500	2820	950 (N)
W-57	776,250	2,294,650	2780	550 (N)
W-58	776,200	2,294,600	2760	675 (N)
W-59	776,150	2,294,500	2760	1000 (N)
W-60	776,250	2,294,550	2820	800 (N)
W-65	775,650	2,294,750	2500	1000 (S)
W-67	775,400	2,294,800	2400	575 (S/SW)
W-71	775,400	2,294,950	2340	1000 (S)
W-73	776,400	2,294,700	2800	75 (N)
W-75	776,050	2,294,800	2640	225 (N)
W-77	776,050	2,294,850	2640	125 (N)
W-80	775,750	2,295,050	2400-2540	225 (N)
W-82	775,700	2,295,050	2440	325 (N)
W-83	775,450	2,295,250	2300	100 (N)
W-88	776,450	2,294,750	2840	100 (S)
W-90	775,950	2,295,050	2540	125 (S)
W-96	774,250	2,295,650	1820	100 (N)
W-97	774,200	2,295,400	1820	125 (S)
W-98	775,000	2,295,750	2020	200 (S)
W-101	776,500	2,294,750	2860	200 (S)
KEOKEA				
K- 1	774,150	2,293,450	2220-2260	-
K- 2	774,200	2,293,400	2240	-
K- 3	774,300	2,293,600	2300-2320	-
K- 4	774,300	2,293,350	2280	-
K- 5	774,250	2,293,300	2280-2300	-
K- 6	774,150	2,293,250	2260-2280	-
K- 7	774,100	2,293,200	2250-2280	-
K- 8	774,050	2,293,150	2260-2280	-
K- 9	773,900	2,292,850	2280-2320	-
K-10	773,900	2,292,800	2320-2340	-
K-11	773,850	2,292,750	2300-2320	-
K-12	773,900	2,292,400	2380-2480	-

* Water = Intermittent drainage. There are no known water sources in the Keokea parcel.

FULL UTM COORDINATES, ELEVATION AND PROXIMITY TO WATER FOR IDENTIFIED SITES (cont.)

PHRI TEMP. NUMBER	FULL UTM COORDINATES EASTING	FULL UTM COORDINATES NORTHING	ELEVATION (ft. above sea level)	DISTANCE AND DIRECT. TO WATER (ft.) (approx.)	PHRI TEMP. NUMBER	FULL UTM COORDINATES EASTING	FULL UTM COORDINATES NORTHING	ELEVATION (ft. above sea level)	DISTANCE AND DIRECT. TO WATER (ft.) (approx.)
K-13	773,800	2,292,650	2320-2360	-	K-64	774,400	2,292,800	2480	-
K-14	773,900	2,292,700	2360	-	K-65	774,400	2,292,600	2540-2600	-
K-16	774,000	2,292,700	2360	-	K-69	774,450	2,292,350	2680	-
K-19	774,100	2,292,900	2340	-	K-70	774,450	2,292,400	2640	-
K-20	774,150	2,292,900	2360	-	K-71	774,500	2,292,550	2580-2600	-
K-21	774,100	2,293,000	2320	-	K-76	774,550	2,292,700	2540-2560	-
K-25	774,200	2,293,100	2320-2380	-	K-78	774,650	2,292,700	2560	-
K-26	774,200	2,293,200	2300	-	K-79	774,650	2,292,850	2560	-
K-27	774,300	2,293,200	2340	-	K-80	774,700	2,292,800	2560	-
K-29	774,250	2,293,250	2300	-	K-81	774,600	2,292,650	2580-2600	-
K-30	774,300	2,293,300	2300	-	K-84	774,500	2,292,400	2660	-
K-31	774,300	2,293,500	2300	-	K-85	774,450	2,292,300	2680	-
K-32	774,400	2,293,450	2320	-	K-87	774,450	2,292,200	2720	-
K-35	774,250	2,293,100	2320-2340	-	K-89	774,400	2,292,150	2700-2720	-
K-36	774,200	2,293,000	2260-2280	-	K-90	774,250	2,292,150	2660	-
K-39	774,000	2,292,600	2340-2420	-	K-95	774,200	2,291,900	2700	-
K-40	774,000	2,292,600	2420	-	K-96	774,450	2,292,100	2740	-
K-41	774,050	2,292,500	2560-2480	-	K-97	774,550	2,292,100	2760	-
K-42	774,250	2,292,800	2440	-	K-98	774,650	2,292,500	2640	-
K-44	774,300	2,292,800	2440-2460	-	K-99	774,700	2,292,650	2600	-
K-45	774,300	2,292,850	2440	-	K-100	774,750	2,292,650	2600-2620	-
K-46	774,300	2,292,900	2420-2440	-	K-101	774,550	2,292,200	2700-2740	-
K-48	774,400	2,293,000	2320-2520	-	K-102	774,600	2,292,100	2780	-
K-50	774,200	2,292,600	2480-2520	-	K-103	774,700	2,292,400	2680-2700	-
K-51	774,100	2,292,400	2540	-	K-105	774,100	2,291,900	2680	-
K-52	774,200	2,292,400	2560	-	K-106	774,100	2,292,050	2620	-
K-53	774,250	2,292,450	2560	-	K-107	774,200	2,292,150	2640	-
K-54	774,200	2,292,500	2540	-	K-108	774,150	2,292,300	2580	-
K-55	774,300	2,292,600	2520	-	K-109	774,100	2,292,200	2580-2600	-
K-57	774,350	2,292,700	2500	-	K-110	774,100	2,292,150	2600	-
K-59	774,350	2,292,750	2480	-	K-111	774,000	2,292,100	2600	-
K-60	774,400	2,292,950	2440	-	K-112	773,400	2,292,200	2360	-
K-62	774,500	2,293,000	2440-2460	-	K-115	773,500	2,292,300	2360	-
K-63	774,500	2,292,800	2480-2500	-	K-116	773,550	2,292,300	2380	-

FULL UTM COORDINATES, ELEVATION AND PROXIMITY TO WATER FOR IDENTIFIED SITES (cont.)

PHRI TEMP. NUMBER	FULL UTM COORDINATES		ELEVATION (ft. above sea level)	DISTANCE AND DIRECT. TO WATER (ft.) (approx.)
	EASTING	NORTHING		
K-118	773,600	2,292,400	2380	-
K-120	773,700	2,292,450	2380	-
K-124	773,850	2,292,600	2380	-
K-127	773,800	2,292,450	2400	-
K-130	773,600	2,292,200	2400-2420	-
K-131	773,700	2,292,150	2460-2480	-
K-134	773,800	2,292,300	2460	-
K-135	773,800	2,292,350	2440	-
K-137	773,950	2,292,400	2440	-
K-140	773,900	2,292,300	2480-2500	-
K-142	773,800	2,292,250	2480	-
K-143	773,800	2,292,100	2500	-
K-146	773,950	2,292,250	2520	-
K-148	774,050	2,292,350	2520	-
K-149	774,050	2,292,400	2500-2520	-
K-152	774,000	2,292,200	2560	-
K-200	774,300	2,293,100	2360-2380	-
K-201	773,950	2,202,500	2420	-
K-202	774,500	2,293,450	2360	-
K-203	774,150	2,292,800	2400	-
K-204	774,250	2,292,700	2500	-
K-205	773,900	2,292,700	2360	-
K-206	775,000	2,292,400	2800	-
K-207	774,250	2,291,950	2700	-
K-208	774,250	2,292,300	2600	-
K-209	773,500	2,292,150	2380	-
K-210	774,250	2,292,650	2500	-
K-211	774,200	2,292,600	2500	-

Appendix C-1

State Historic Preservation Division Correspondence dated July 24, 1995

JUL 31 1995

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

MICHAEL D. WILSON, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY
GILBERT COLOMA-AGARAN

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION DIVISION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

6 T

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

July 24, 1995

Ms. Gwen Ohashi
Acting Director
Land Use & Codes Administration
Department of Public Works
County of Maui
200 South High Street
Wailuku, Hawaii 96793

LOG NO: 15140
DOC NO: 9507RC41

Dear Ms. Ohashi:

**SUBJECT: DHHL Kula Residential Lots, Unit 1 – Subdivision of Lot A
Waiohuli, Kula, Maui
TMK: 2-2-02: 56**

Thank you for the opportunity to respond to the subdivision. Our office has been working with the Department of Hawaiian Home Lands (DHHL) and with their planner (Munekiyo & Arakawa) to adequately handle historic preservation concerns for this subdivision.

42 significant sites are present within Lot A. For those 42, two different kinds of mitigation approches have been agreed upon. However, all sites are to be protected for the time being, with different sized buffer zones. We are recommending two conditions to cover the protection of these sites. These are fairly standard conditions, with some additional wording to cover the fact that parcels will be awarded out to individuals by DHHL.

33 sites are significant solely for their information content. These sites can be archaeologically data recovered and then destroyed, or they can be preserved, or they can be temporarily preserved until data recovery is done. DHHL may decide to have these sites data recovered before awarding, or they might have these decisions be made by the individual awardees based on how they plan to use their lots. Currently, they must be considered to be slated for preservation until data recovery occurs. At this point, we have recommended that 15 foot buffers be placed around these sites. They need only small buffer zones around their edges; to protect the site's information. For these 33 sites, we recommend the following condition, to ensure their protection:

1. 33 sites have archaeological data recovery as the agreed upon mitigation measure. These sites must be protected until data recovery occurs. Prior to any data recovery work, an archaeological data recovery plan (scope of work) must be approved by the State Historic Preservation Division. The suceessful execution of this plan must be verified in writing by that Division to the Department of Hawaiian Home Lands. Until these sites are data

Ms. Gwen Ohashi
Page 2

recovered, 15 foot buffers shall be placed around these sites -- as interim protection measures. Awardees shall be notified by DHHL of the presence of any of these sites that have not yet been data recovered that are on their plots, and the mitigation concerns shall be explained to them. Prior to any land altering construction, the buffers shall be marked -- with an archaeologist verifying the markers are correctly placed.

9 sites are recommended for preservation, some intended for interpretation. The sites consist of house sites, shrines, burials, and one heiau. These sites need larger buffer zones to allow the inclusion of some of the surrounding terrain to preserve the visual and physical context of the site. And they will eventually need long-range preservation plans, with interpretive elements in some cases. Buffer zones still need to be fixed for 6 of these sites, and we are working with the planners on alternatives. Awardees also need to be aware of these sites, if they are on their land, and interim protection measures are needed. Eventually, interpretative/preservation plans will be needed, and our Division will probably assist DHHL in preparing these plans. At this time, we recommend the following condition to ensure protection of these sites:

2. 9 sites shall be preserved (W-11,-27, -28, -30, -32, -35, -36, -45, -90 as identified in the PHRI archaeological survey) some for interpretive purposes. DHHL shall establish buffers around these sites which are acceptable to the State Historic Preservation Division. Preservation plans for these sites shall be developed, and the plans must be approved by the State Historic Preservation Division prior to their implementation. Awardees shall be notified by DHHL of the presence of any of these sites that are on their plots, and the preservation concerns shall be explained to them. Prior to any land altering construction in the vicinity of any of these sites, the buffers shall be marked -- with an archaeologist verifying the markers are correctly placed.

If your department or DHHL finds some of the above wording to have problems, please let us know, and acceptable alternatives can easily be worked out. The above conditions however, should ensure that the subdivision will have "no adverse effect" on the significant historic sites.

Please contact Dr. Sara Collins (587-0013) if you have any questions.

Aloha,

Don Hibbard, Administrator

RC:jen

c: Planning Office, Department of Hawaiian Home Lands
Glenn Tadaki, Munekiyo & Arakawa, Inc.

Appendix D

Traffic Impact Analysis Report

TRAFFIC IMPACT ANALYSIS REPORT

KULA RESIDENCE LOTS
UNIT 1
KULA, MAUI, HAWAII

AUGUST 1995

Prepared for

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS

Prepared by

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS • SURVEYORS

TRAFFIC IMPACT ANALYSIS REPORT

FOR THE

KULA RESIDENCE LOTS - UNIT 1

ISLAND OF MAUI

Prepared for

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS

Prepared By

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
Engineers • Surveyors
Honolulu • Wailuku • Hilo, Hawaii

August, 1995

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

TABLE OF CONTENTS

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

TABLE OF CONTENTS
(Continued)

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

TED S. KAWAHIGASHI, P.E.
KENNETH K. KUROKAWA, P.E.
IVAN K. NAKATSUKA, P.E.
LAMBERT J. YAMASHITA, P.E.
HOWARD H.W. MAU, P.E.

TRAFFIC IMPACT ANALYSIS REPORT

FOR THE

KULA RESIDENCE LOTS - UNIT 1

ISLAND OF MAUI

I. INTRODUCTION

This report documents the findings of the traffic study conducted by Austin, Tsutsumi & Associates, Inc. (ATA) to evaluate the potential traffic impacts and circulation needs of Kula Residence Lots - Unit 1 Development.

A. Project Description

The Project is located in Kula, on the island of Maui. Figure 1 shows the Project's general location. The Department of Hawaiian Home Lands propose to develop 386 residential lots on 668 acres of land (TMK 2-2-02:56). Single family dwelling units are to be constructed on the lots by the individual owners. Access to the Project site is provided off Kula Highway.

B. Purpose and Scope

The purpose of the study is to analyze potential traffic impacts on the roadway system within the study area. Proposed roadway improvements, which are required to allow the street system to accommodate the future traffic volumes after the completion of the Project, are identified in this study. The following traffic scenarios are analyzed in the study:

- Existing Conditions - The analysis of existing traffic conditions is intended to provide a basis for the remainder of the study. The existing conditions

REPLY TO:
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HONOLULU, HAWAII
WAILUKU, MAUI, HAWAII • HILO, HAWAII

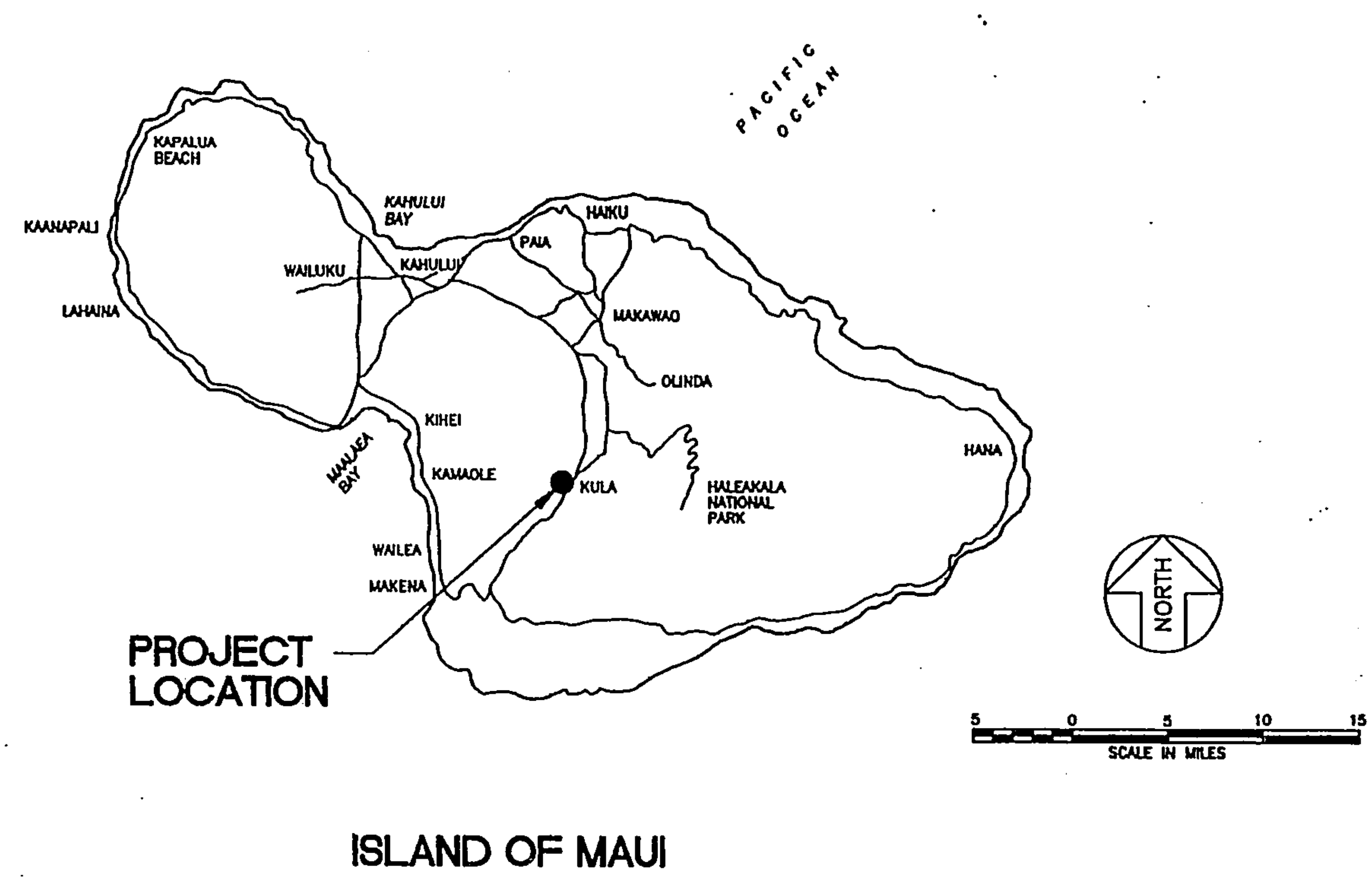
analysis includes an assessment of land use, streets and highways, traffic volumes, and current operating conditions.

- Year 2005 Base (Without Project) Conditions - This is an analysis of future traffic conditions for the study area in the Year 2005. The objective of this phase of the study is to forecast future traffic conditions for the study area in the Year 2005 without the Project, to serve as a basis against which Project impacts can be measured.

- Year 2005 With Project Conditions - This is an analysis of future traffic conditions with traffic expected to be generated by the proposed Project in the Year 2005 added to Year 2005 Base traffic forecasts, in order to identify impacts of the proposed Project on future traffic operating conditions.

A total of five existing intersections and two future intersections have been identified within the study area which are to be analyzed during the AM and PM peak traffic hour of traffic for each of the traffic scenarios described above. The seven intersections are as follows:

1. Hana Highway and Haleakala Highway (signalized)
2. Pukalani Bypass and Makawao Avenue (stop-controlled)
3. Pukalani Bypass/Kula Highway and Haleakala Highway or "Five Trees" (stop-controlled)
4. Kula Highway and Omaopio Road (stop-controlled)
5. Kula Highway and Kekaulike Avenue (stop-controlled)
6. Kula Highway and Project Access Road "A" (future stop-controlled)
7. Kula Highway and Project Access Road "B" (future stop-controlled)



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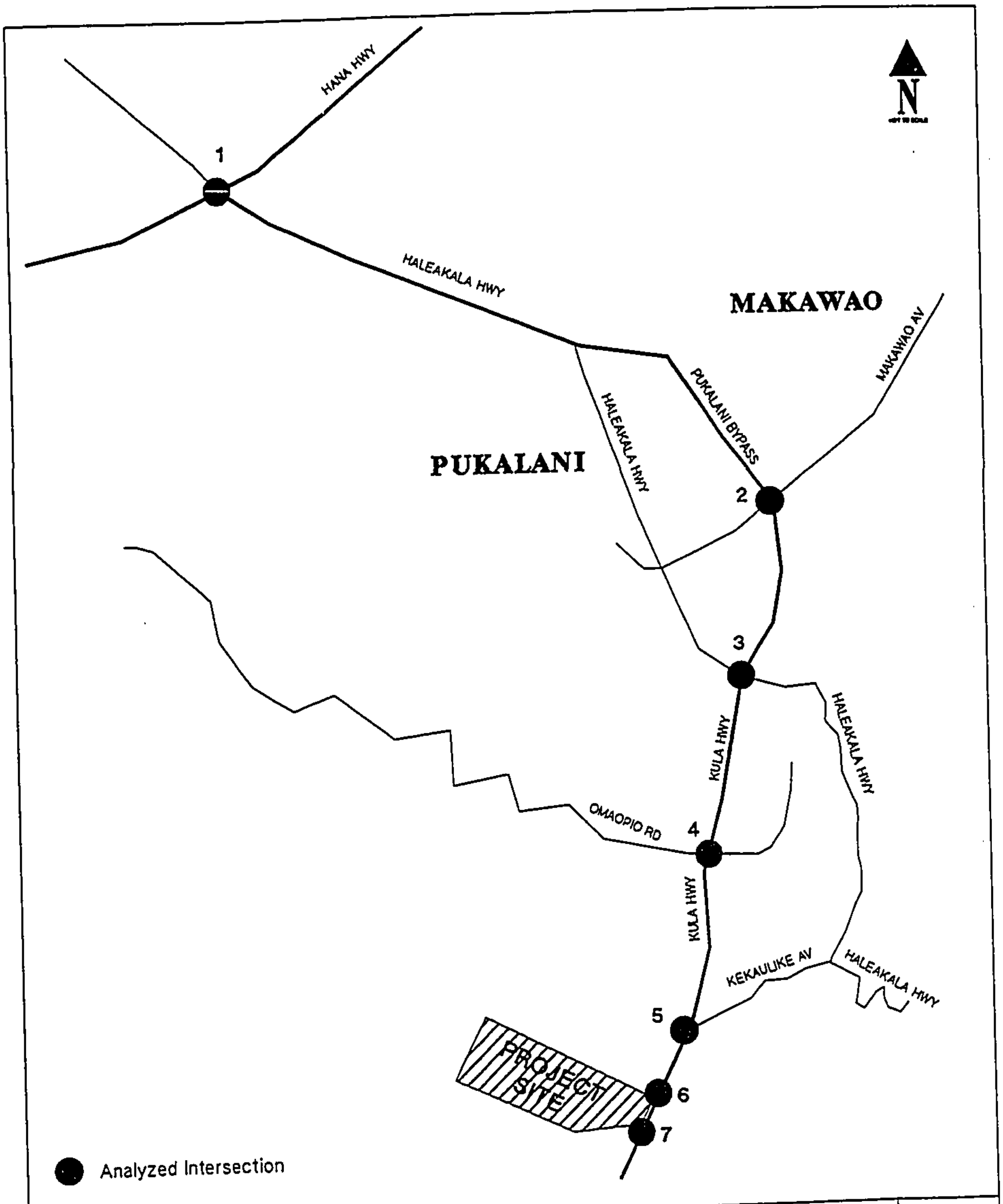
PROJECT LOCATION MAP

FIGURE 1

Figure 2 illustrates the study area and locations of the seven study intersections.



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STUDY AREA

FIGURE 2

II. EXISTING CONDITIONS

An extensive field investigation was undertaken to develop an accurate and detailed 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 street system.

A. Existing Roadway System

This section describes the existing circulation system serving the study area, including number of travel lanes, street classifications, and traffic control devices.

Brief descriptions of major facilities within the study area follow:

- Hana Highway - Hana Highway is a major State highway providing access from Kahului to Hana. West of Haleakala Highway, Hana Highway is a four-lane, divided highway with channelization at major intersections. East of Haleakala Highway, Hana Highway reduces to a two-lane Highway.

- Haleakala Highway - Haleakala Highway is a major arterial between Hana Highway and Pukalani town. Between Hana Highway and the Pukalani Bypass, Haleakala Highway provides two lanes in the southbound (mauka) direction and one lane in the northbound (makai) direction. During the morning peak period, Haleakala Highway is conned from the Pukalani Bypass (Pukalani Junction) to Hana Highway for contra-flow with two lanes in the northbound directions and one lane in the southbound direction. Between the Pukalani Bypass and Kula Highway (Five-Trees), Haleakala Highway is a two-lane road serving the town of Pukalani. From Kula Highway (Five-Trees), Haleakala Highway continues east as a two-lane road to Haleakala Crater.

- Pukalani Bypass - The Pukalani Bypass travels between Haleakala Highway at Pukalani Junction and Kula/Haleakala Highway (Five-Trees). Between Haleakala Highway (Pukalani Junction) and Makawao Avenue, the Bypass Highway provides two-lanes in the southbound direction and one lane in the northbound direction. South of Makawao Avenue the Bypass Highway reduces to one lane in the southbound direction toward Kula/Haleakala Highway (Five-Trees).

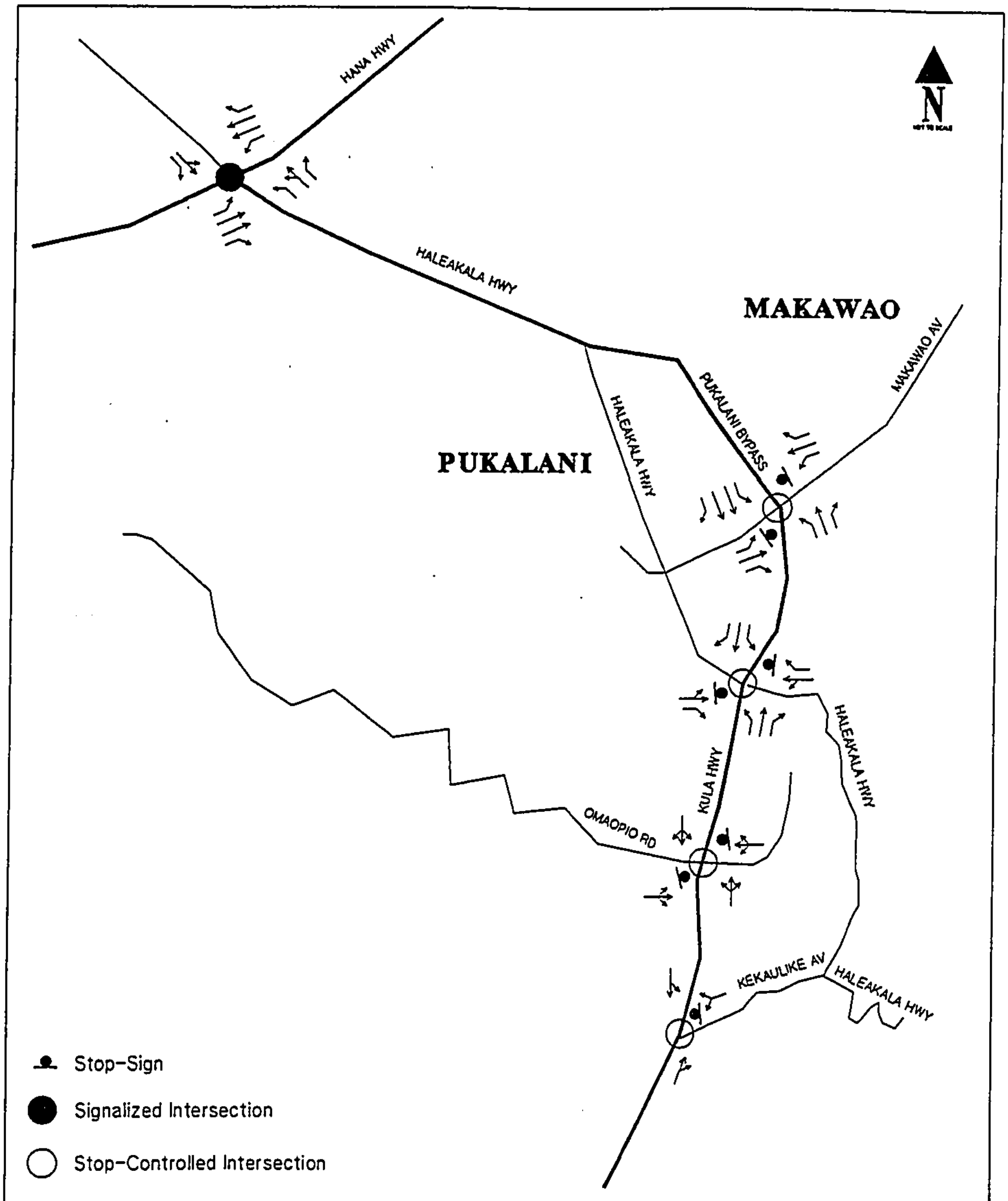
- Kula Highway - Kula Highway is a two-lane highway serving the Upcountry area from "Five-Trees" to the Kula area. From Five-Trees, Kula Highway is a north-south arterial serving mainly residential/ agricultural uses.

- Makawao Avenue - Within the study area, Makawao Avenue is a two-lane road serving the towns of Pukalani and Makawao. Makawao Avenue originates within Pukalani, at its intersection with Haleakala Highway, and extends north-east through Makawao Town. At the intersection with Baldwin Avenue, Makawao Avenue continue as Kaupakulua Road, which extends northeast and eventually connects with Hana Highway in the vicinity of Ulumalu. Baldwin Avenue extends northwest and connects with Hana Highway in Paia Town.

- Omaopio Road - Omaopio Road is a two-lane, rural, curving roadway originating at Kula Highway and extending north-west toward Kahului Town. Within the study area, Omaopio Road serves mainly residential/ agricultural uses.

- Kekaulike Avenue - Kekaulike Avenue is a two-lane, collector roadway originating at Kula Highway and extends north, where it terminates at Haleakala Highway. Kekaulike Avenue serve mainly residential uses in the Upcountry area.

Existing intersection configurations are illustrated in Figure 3.



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EXISTING INTERSECTION CONFIGURATIONS

FIGURE 3

B. Existing Traffic Operations

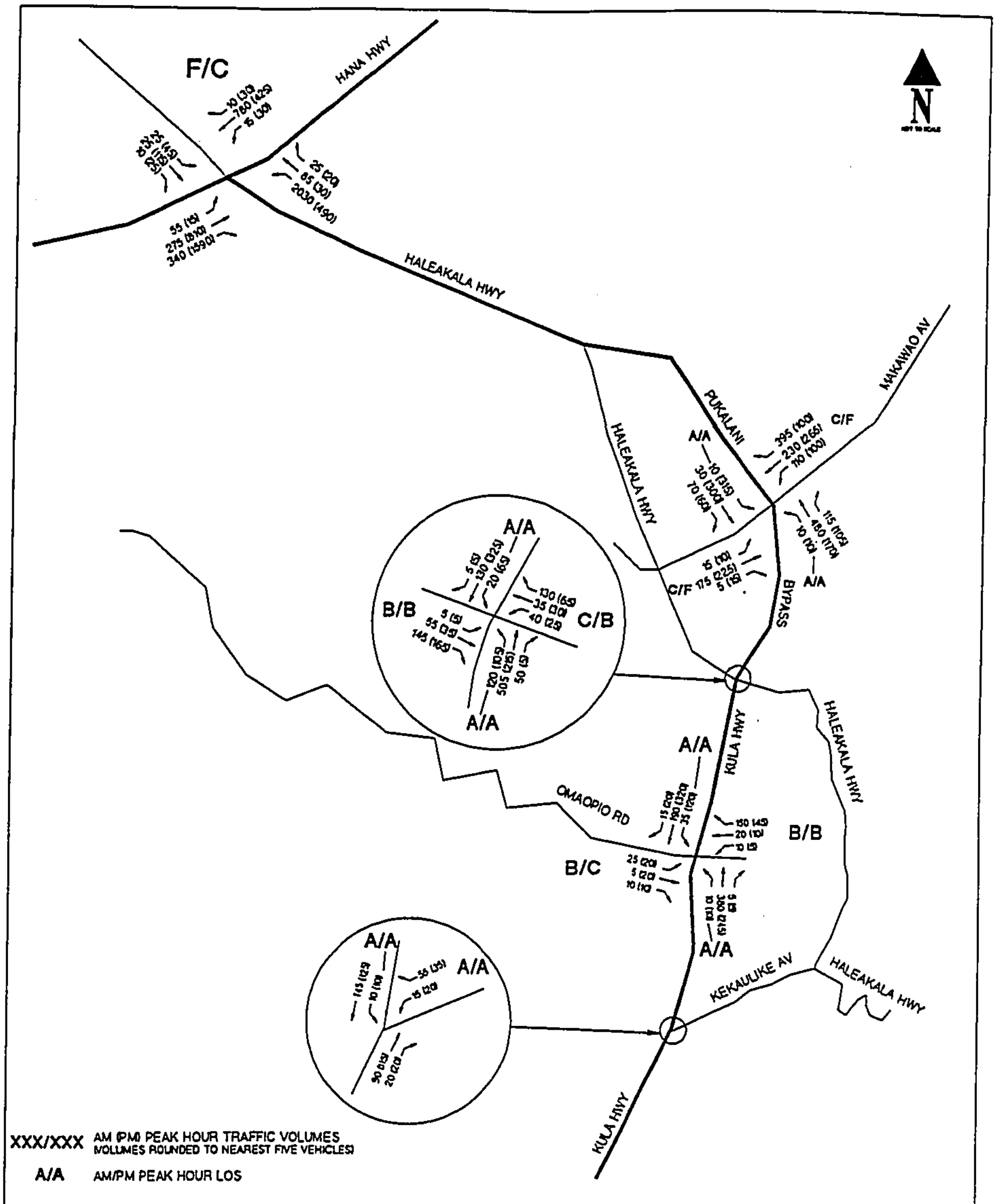
The following sections present the existing intersection peak hour traffic volumes, a description of the methodology utilized to analyze the intersection traffic conditions, and the resulting level of service conditions at each of the five analyzed intersections under existing conditions.

1. Existing Traffic Volumes

Weekday AM and PM peak period counts were obtained by ATA as part of this study at each of the *five existing intersections*. The results of the traffic counts are provided in Appendix A. Manual turning movement counts were obtained for the morning and evening peak period of traffic on September 28 and 29, 1994 at the five analyzed intersections. Figure 4 illustrates the existing peak hour traffic volumes within the study area.

Existing morning traffic level varies within the study area from the Upcountry area to Hana Highway. On Kula Highway near the intersections of Kekaulike Avenue and Omaopio Road, traffic is generally light with no noticeable traffic delay. In the Pukalani/Makawao area, makai-bound traffic on Pukalani Bypass is significantly heavier, with noticeable delays on the minor street approaches at the intersections at Five-Trees, and at Makawao Avenue, while Kula-bound traffic is relatively light. At the intersection of Hana Highway and Haleakala Highway, approximately 2,030 peak hour left-turning vehicles from Haleakala Highway to Hana Highway were observed.

Existing evening traffic in the study area also varies from Hana Highway to the Upcountry area. At the intersection of Hana Highway and Haleakala Highway, traffic is moderately heavy with approximately 1600 vehicles turning right from Hana Highway to Haleakala Highway. At the intersection of Pukalani Bypass and Makawao Avenue, noticeable



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EXISTING 1994 CONDITIONS

FIGURE 4

delay was observed on Makawao Avenue. Near the Kula area, traffic is generally light with little or no vehicular delay observed.

2. **Level Of Service Methodology**

Level of service (LOS) is a qualitative measure used to describe the condition of traffic flow, ranging from free-flow conditions at LOS A to congested conditions at LOS F. This section describes the current levels of service of the five existing intersections.

The 1994 Highway Capacity Manual-Special Report 209 "Operational" (Transportation Research Board, 1985) method of intersection volume to capacity (V/C) ratio, average stopped delay/vehicle and corresponding level of service was applied to each of the signalized intersections to be analyzed in this study. Intersections controlled by stop signs on minor street approach(es), the "Two-Way Stop Control" method described in the Highway Capacity Manual (Transportation Research Board, 1994) was employed to determine the available reserve capacity and corresponding level of service for each of the constrained movements (approaches from minor streets and left-turn movements from major streets) at the intersection.

Levels of service definitions for both signalized and unsignalized intersections are included in Tables 1 and 2, respectively.

3. **Existing Level Of Service**

Two of the five existing intersections are currently operating at an undesirable level of service (i.e. LOS E or F) during either the AM or PM peak hour, or both. The following describes the intersections that are operating at LOS E or F.

- Hana Highway & Haleakala Highway - The intersection is currently operating at LOS F during the AM peak hour of traffic. The heavy

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 UN-SIGNALIZED 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.

northbound left-turn traffic (2,030 vehicles) from Haleakala Highway to Hana Highway experiences long delays. Field observation reveals that, during the AM peak hour of traffic, the queue on Haleakala Highway is approximately 1 mile.

- Pukalani Bypass & Makawao Avenue - Both the eastbound and westbound approaches are operating at LOS F during the PM peak hour of traffic. Poor level of service is due to the relatively high traffic travelling on Pukalani Bypass. from field observation, it was also apparent that the left-turn and through vehicles on Makawao Avenue often hesitate, not sure as to who has the right-of-way, when there are gaps in traffic on the Bypass Highway.

Figure 4 also summarizes the existing level of service at each of the five analyzed intersections.

III. FUTURE TRAFFIC PROJECTIONS

In order to properly evaluate the potential impact of the Project on local traffic conditions, it is necessary to develop forecasts of future traffic volumes in the study area under conditions both with and without the proposed Project traffic. The methodologies and key assumptions used to develop these forecasts are described below.

A. Project Traffic Volumes

The development of traffic Projections for the proposed Project involves traffic generation, trip distribution, and traffic assignment. A description of each process follows:

1. Project Traffic Generation

Trip generation estimates for the development were developed by applying appropriate trip generation rates to the 386 dwelling units. This method provides an indication of the volume of traffic expected to be generated by the project.

The traffic expected to be generated by the Project was estimated by applying the trip generation rates for "Single Family Detached Housing", (ITE code 210), which are as follows:

- Average Daily: 9.55 vehicles per dwelling unit with 50% entering and exiting the Project site.
- AM Peak Hour: 0.74 vehicles per dwelling unit with 26% entering and 74% exiting the Project site.
- PM Peak Hour: 1.01 vehicles per dwelling unit with 65% entering and 35% exiting the Project site.

These trip generation rates were based upon data from "Trip Generation" 5th Edition, Institute of Transportation Engineers (ITE), 1991. The application of these rates provides an estimate of the total increases in future traffic expected to be generated by the project. It is estimated that the Project will generate approximately 3,686 daily vehicle trips; 286 AM peak hour trips (with 74 trips entering and 212 trips exiting the Project site) and 390 PM peak hour trips (with 253 trips entering and 137 trips exiting the Project site).

2. Project Traffic Distribution

The directional distribution pattern developed for the Project site was based on the existing traffic distribution pattern. The general distribution pattern used to distribute future Project traffic is illustrated in Figure 5.

3. Project Traffic Assignment

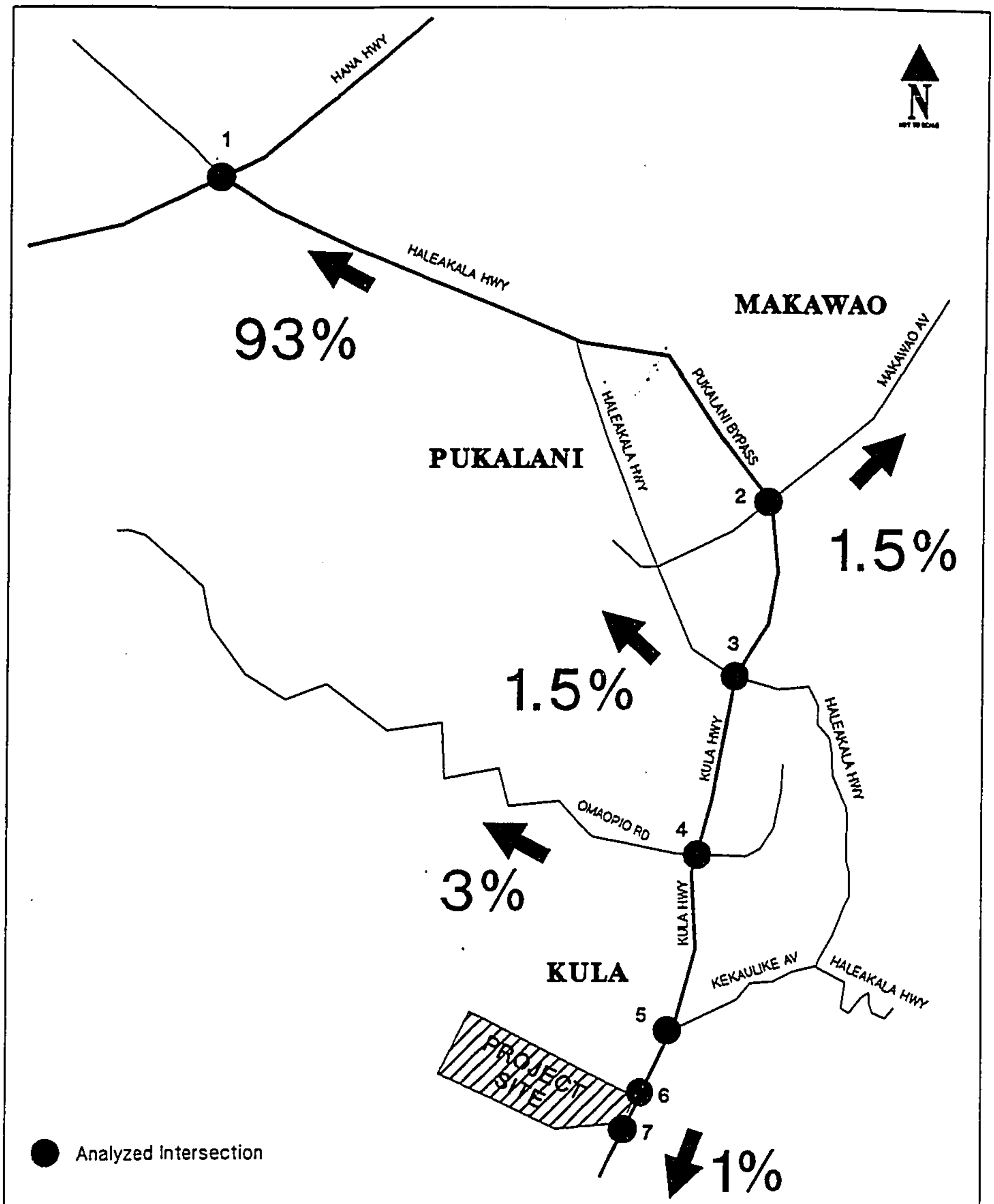
The trip distribution pattern identified in Figure 5 was used to assign the project-generated traffic to the local street network. The assignment to specific streets and intersections was based on the available access into and out of the site and the availability of local routes to access the regional highway system. The resulting estimated Project generated peak hour traffic volumes, at each of the five analyzed intersections, are illustrated in Figure 6.

B. Year 2005 Traffic Projections

The following sections describe Year 2005 Base (without project) and Year 2005 With Project traffic projections.

1. Year 2005 Base (Without Project) Traffic Volumes

The forecasts for Year 2005 Base traffic without the proposed Project are based on yearly growth of existing traffic volumes and proposed related development projects expected to be completed by the



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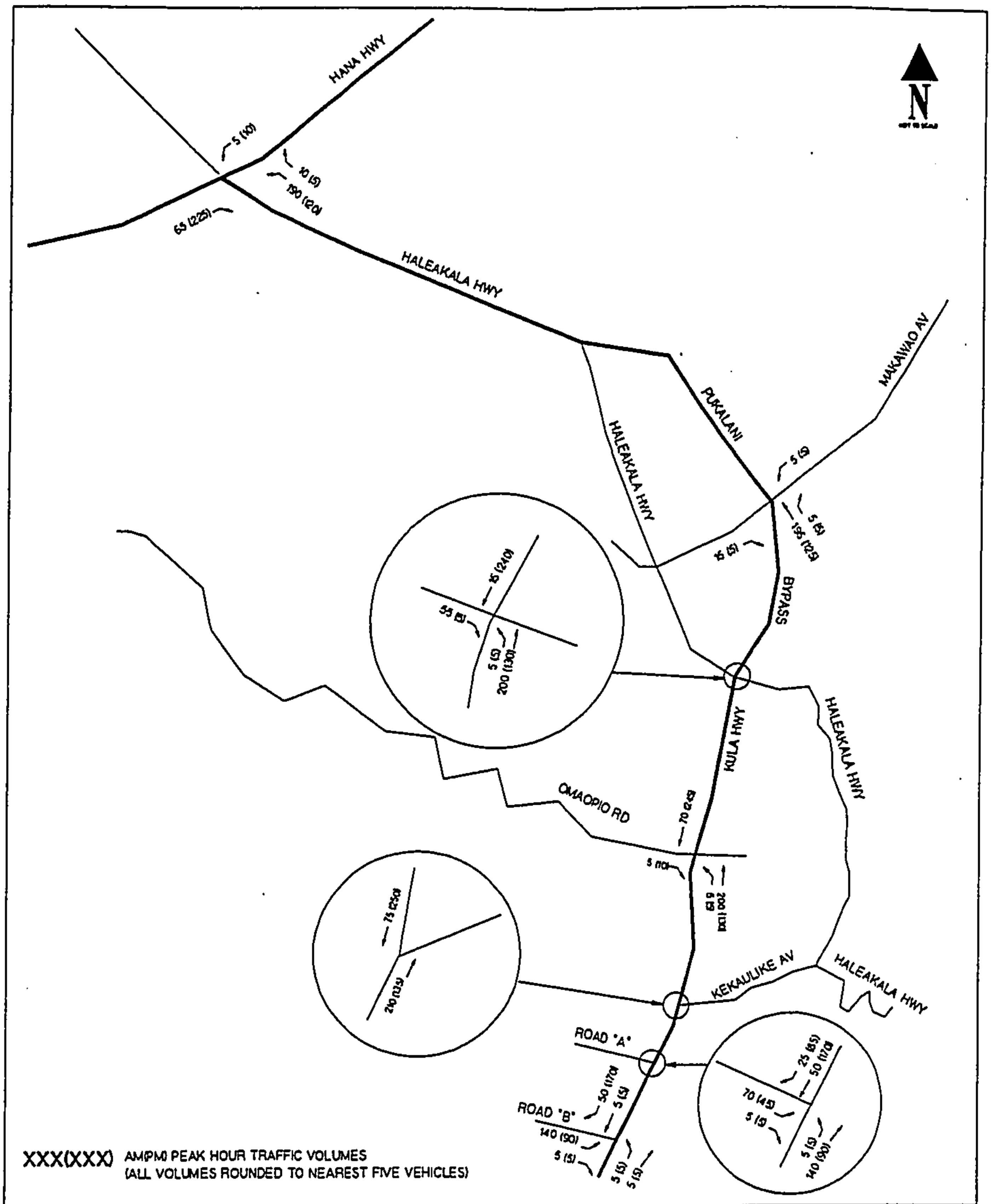
GENERAL DISTRIBUTION PATTERN

FIGURE 5



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PROJECT ONLY TRAFFIC VOLUMES

FIGURE 6

Year 2005 which could contribute traffic to the street system within the study area.

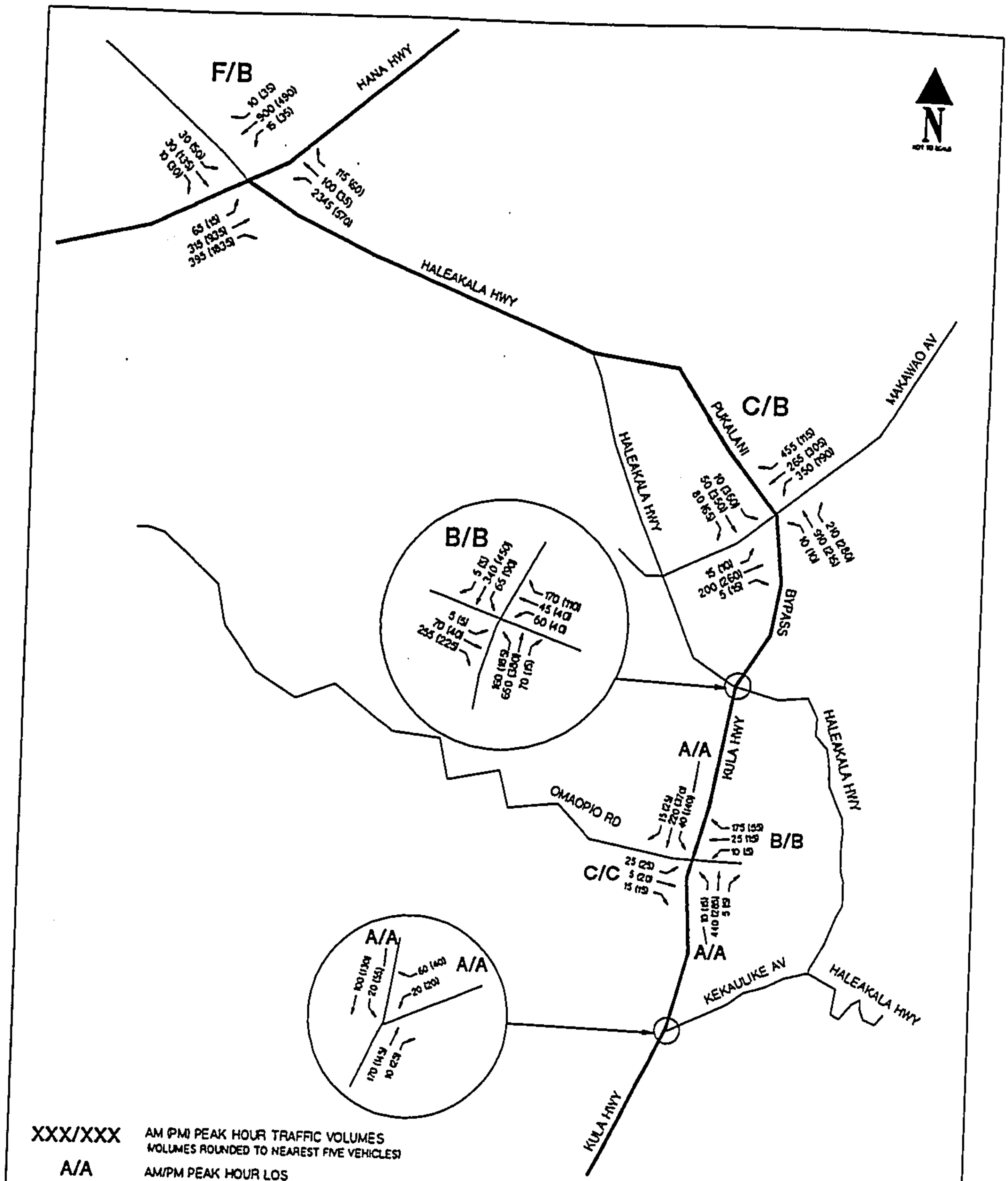
The background growth rate, which was applied to existing traffic volumes to estimate Year 2005 Base conditions, is based on the May 1991 "Maui Long Range Highway Planning Study (Island-Wide Plan)" prepared by ATA and historical traffic counts obtained from the State Department of Transportation.

The average annual traffic growth rate of approximately 1.3 percent per year in the Upcountry area was utilized to forecast the Year 2005 Base traffic conditions.

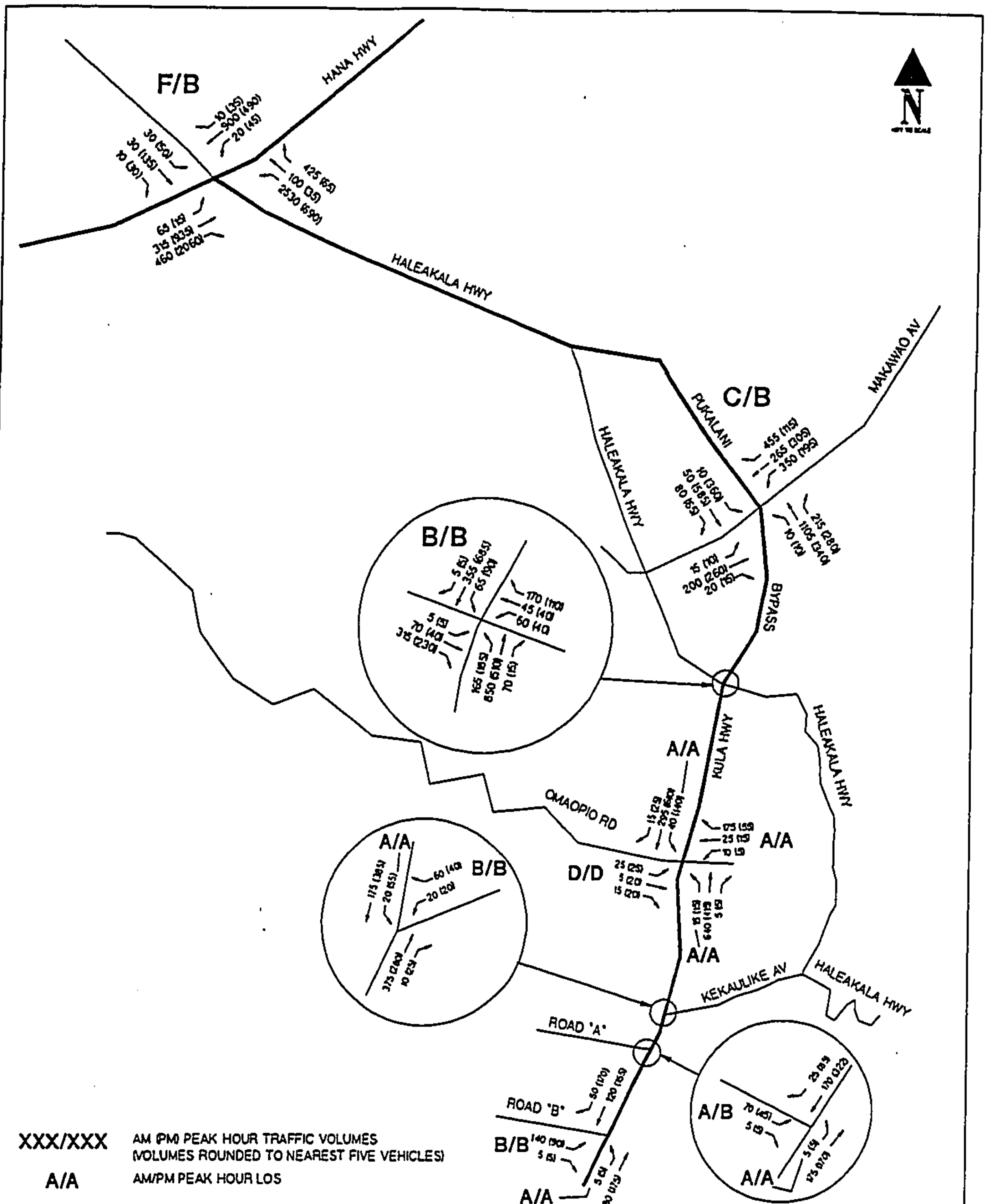
Traffic generated by the Upcountry Maui High School is included in this study. The trip generation and distribution of the high school were obtained from the November 1992 "Final Report Traffic Impact Study - Upcountry Maui High School", prepared by Parsons Brinckerhoff Quade & Douglas (PBQ&D), Inc.. Figure 7 illustrates Year 2005 Base traffic volumes.

2. Year 2005 With Project Traffic Volumes

The proposed development generated traffic volumes were then added to Year 2005 Base traffic volumes. The resulting Year 2005 With Project intersection traffic volumes are illustrated on Figure 8.



AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS • SURVEYORS	YEAR 2005 BASE CONDITIONS (WITHOUT PROJECT)	FIGURE 7



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YEAR 2005 WITH PROJECT CONDITIONS

FIGURE 8

IV. TRAFFIC IMPACT ANALYSIS

This section provides the results of the traffic impact analysis conducted to assess the potential Project impacts on the Year 2005 traffic conditions, based on the traffic forecasts developed in the previous section. The traffic impact analysis includes an assessment of projected Year 2005 conditions both without and with the Project for each of the analyzed intersections.

Potential roadway improvements and mitigation to alleviate traffic impacts within the study area will also be discussed.

A. Year 2005 Planned Improvements

By the Year 2005, the following roadway improvements are expected to be completed:

- Signalization of the intersection of Pukalani Bypass and Makawao Avenue. The design and installation of a traffic signal is currently underway and it is expected to be in operation in the near future.
- Signalization of the intersection of Pukalani Bypass/Kula Highway and Haleakala Highway (Five-Trees). This improvement is based on the recommendation contained in the November 1992 Maui High School traffic report prepared by PBQ&D, Inc.. The study indicates that, by the Year 1995, traffic volumes at the intersection will warrant a traffic signal. With the addition of the High School traffic, the traffic study recommends a traffic signal to accommodate future traffic demand at the intersection.
- Between Hana Highway and Pukalani Junction, Haleakala Highway will be widen from it current three lanes to four lanes.

The following analyses (Year 2005 Base and Year 2005 With Project scenarios) assume the improvements described above are implemented.

B. Year 2005 Base (Without Project) Traffic Impact Analysis

Figure 7 also summarizes the Year 2005 Base, level of service at each of the five analyzed intersections. Analysis indicates that, under base conditions, only the intersection of Hana Highway and Haleakala Highway will be operating at LOS F during the AM peak hour of traffic. The other four intersections will be operating at acceptable levels of service (i.e. LOS D or better).

Although traffic is expected to grow within the study area, the installation of traffic signals at the intersections of Pukalani Bypass/Makawao Avenue and at "Five Trees" will accommodate Year 2005 traffic demand. The intersection of Hana Highway and Haleakala Highway is currently operating at LOS F during the AM peak hour of traffic and it will continue to operate at LOS F.

C. Year 2005 With Project Traffic Impact Analysis

The Year 2005 With Project scenario was analyzed to determine the potential effect of the proposed development on the roadway system. Figure 8 also summarized the Year 2005 With Project level of service at each of the seven analyzed intersections (two additional intersections at Kula Highway and Project Access Road "A" and Road "B"). The results indicate that only the intersection of Hana Highway at Haleakala Highway will be operating at LOS F during the AM peak hour. The other six intersections will be operating at acceptable levels of service (i.e. LOS D or better). Table 3 summarizes the level of service at each of the analyzed intersections.

As discussed earlier, under the Year 2005 Base conditions, the overall growth in the study area will increase, but with the installation of traffic signals at Pukalani Bypass/Makawao Avenue and at "Five Trees", only the intersection of Hana Highway and Haleakala Highway will be operating at LOS F. The remaining four intersections will be operating at LOS D or better. With the

TABLE 3
SUMMARY OF LEVEL OF SERVICE

INTERSECTION	YEAR 1994 EXISTING						YEAR 2005 BASE						YEAR 2005 +PROJECT					
	AM			PM			AM			PM			AM			PM		
	V/C	ELA	LOS	V/C	DELAY	LOS	V/C	ELA	LOS	V/C	DELAY	LOS	V/C	DELAY	LOS	V/C	DELAY	LOS
1. HALEAKALA HWY & KULA HWY	1.29	*	F	0.62	15.5	C	1.26	*	F [a]	0.58	12.8	B [a]	1.46	*	F	0.68	13.9	B
2. PUKALANI BYPASS & MAKAWAO AV [b]							0.68	16.0	C	0.37	7.6	B	0.79	23.9	C	0.55	11.3	B
NB LEFT	-	2.4	A	-	3.3	A												
SB LEFT	-	4.4	A	-	4.6	A												
EB APPRCH	-	13.4	C	-	125.6	F												
WB APPRCH	-	12.5	C	-	888.0	F												
3. PUKALANI BYPASS/KULA HWY & HALEAKALA HWY (5-TREES) [b]							0.41	8.4	B	0.36	8.7	B	0.05	6.3	B	0.64	11.4	B
NB LEFT	-	2.6	A	-	3.3	A												
SB LEFT	-	4.0	A	-	2.9	A												
EB APPRCH	-	5.9	B	-	5.9	B												
WB APPRCH	-	10.1	C	-	8.5	B												
4. KULA HWY & OMAOPIO RD																		
NB LEFT	-	2.7	A	-	3.1	A	-	2.7	A	-	3.3	A	-	2.9	A	-	4.2	A
SB LEFT	-	3.3	A	-	3.2	A	-	3.6	A	-	3.4	A	-	4.6	A	-	4.1	A
EB APPRCH	-	9.8	B	-	10.2	C	-	12.7	C	-	13.0	C	-	20.9	D	-	25.5	D
WB APPRCH	-	6.3	B	-	5.6	B	-	7.5	B	-	6.7	B	-	11.5	C	-	10.8	C
5. KULA HWY & KEKAULIKE AV																		
SB LEFT	-	2.4	A	-	2.5	A	-	2.6	A	-	2.6	A	-	3.3	A	-	3.1	A
WB APPRCH	-	3.6	A	-	3.9	A	-	4.0	A	-	4.3	A	-	5.5	B	-	6.5	B
6. KULA HWY & ACCESS RD "A"		NA			NA			NA			NA							
NB LEFT													-	2.6	A	-	3.3	A
EB APPRCH													-	5.3	A	-	7.4	B
7. KULA HWY & ACCESS RD "B"		NA			NA			NA			NA							
NB LEFT													-	2.5	A	-	3.0	A
EB APPRCH													-	6.6	B	-	6.9	B

* Volume to capacity ratio exceeds 1.00, calculation of delay no feasible, LOS F based on v/c.
[a] Optimized signal timing improves intersection LOS from Existing to Base.
[b] Stop-controlled intersection is signalized under future scenarios.

addition of the Project traffic, the intersection of Hana Highway and Haleakala Highway will continue operating at LOS F during the AM peak hour while the remaining intersections will be operating at LOS D or better. The intersections at Kula Highway and the Project Access Road "A" and Road "B" are expected to operate at LOS B during both the AM and PM peak hours of traffic.

V. CONCLUSIONS AND RECOMMENDATIONS

This study was undertaken to analyze the potential traffic impacts of the Kula Residence Lots - Unit 1. The following summarizes the conclusions and recommendations of the study.

A. Conclusions

- Under existing 1994 traffic conditions, three of the five analyzed intersections are currently operating at an undesirable level of service (i.e. LOS E or F) during either the AM or PM peak hour, or both.
- The Project's 386 single-family dwelling units is expected to generate an average of 3,686 daily trips; 286 AM peak hour trips and 390 PM peak hour trips.
- Intersection improvements expected to be implemented by the Year 2005 include the signalization of the Pukalani Bypass/Makawao Avenue intersection and at the "Five Trees" intersection.
- Under the Year 2005 Base (without project) conditions, only the intersection of Hana Highway and Haleakala Highway will be operating at LOS F (AM peak hour). The other four intersections will be operating at acceptable levels of service (i.e. LOS D or better). The intersection of Hana Highway and Haleakala Highway is currently operating at LOS F during the AM peak hour of traffic.
- Under the Year 2005 With Project conditions, all of the intersections will be operating at acceptable levels of service (i.e. LOS D or better) except for the intersection of Hana Highway and Haleakala Highway, which is currently operating at LOS F during the AM peak hour and will continue to operating at LOS F, with or without the development of the Project.

- The intersection of Kula Highway and Project Access Road "A" and Road "B" will be operating at LOS B during both the AM and PM peak hours of traffic.
- Based on the results of the analysis, it is concluded that the Kula Residence Lots - Unit 1, will not have any significant traffic impact on any of the analyzed intersections.
- Based on the estimated traffic volume projection of the proposed Kula Residence Lots project, no roadway improvements to Kula Highway will be necessary in the vicinity of Project Access Roads "A" and "B".

B. Recommendations

- As concluded previously, the only intersection that will be operating at an undesirable level of service (i.e. LOS E or F) is the intersection of Hana Highway at Haleakala Highway. The intersection is currently operating at LOS F during the AM peak hour of traffic and will continue to operate at this level regardless whether the Kula Residential Lots is developed. One potential mitigation that will help alleviate the heavy demand at the intersection is the construction of a connector road between the Upcountry area and the Kihei area. The construction of this road will certainly redistribute traffic and help relieve some of the heavy demand at Hana Highway. A route study of the Upcountry-Kihei Connector Road is currently underway.
- Another potential regional mitigation to the congestion at Hana Highway and Haleakala Highway is to offer an alternative route to West Maui in addition to Haleakala Highway. Currently, Omaopio Road and Pulehu Road both can be used as an alternative to Haleakala Highway, but because both are rural, winding and relatively under-developed roads, they are not attractive to commuters. If one of the roads can be

upgraded, it can potentially relieve some of the demand at the Haleakala Highway/Hana Highway intersection.

REFERENCES

Institute of Transportation Engineers, Trip Generation, 5th Edition, 1991.

Parsons Brinckerhoff Quade & Douglas, Inc., Final Report Traffic Impact Study (Upcountry Maui High School), November 1992.

Austin, Tsutsumi & Associates, Inc., Maui County Long Range Highway Planning Study (Island-Wide Plan), March 1991.

APPENDIX A

TRAFFIC COUNTS

SITE CODE : 2
: HANA HWY
: HALEAKALA HWY
:

PAGE: 1
FILE: HANHALA

Primary Movements: Vehicles

DATE: 9/29/94

Time Begin	From North RT	From North THRU	From North LT	From East RT	From East THRU	From East LT	From South RT	From South THRU	From South LT	From West RT	From West THRU	From West LT	Vehicle Total
6:30	1	157	1	1	25	363	92	50	7	1	5	9	712
6:45	4	165	8	1	29	482	92	45	14	0	3	1	844
HR TOTAL	5	322	9	2	54	845	184	95	21	1	8	10	1556
7:00 AM	4	157	3	1	19	490	75	46	18	4	9	7	832
7:15	1	206	4	0	24	504	96	67	15	4	6	6	933
7:30	1	202	4	0	15	556	81	67	10	0	4	5	955
7:45	3	217	4	0	30	471	90	94	14	1	7	7	938
HR TOTAL	9	782	15	1	87	2031	342	274	57	9	26	25	3658
8:00 AM	3	131	3	1	17	398	103	85	18	2	5	9	775
8:15	5	122	0	6	18	321	98	82	11	1	6	10	680
DAY TOTAL	22	1357	27	10	176	3595	727	536	107	13	45	54	6669

PEAK PERIOD ANALYSIS FOR THE PERIOD: 6:30 AM - 8:30 AM

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	VOLUMES Thru	VOLUMES Left	VOLUMES Total	PERCENTS Right	PERCENTS Thru	PERCENTS Left
North	7:00 AM	0.90	9	782	15	806	1	97	2
East	6:45 AM	0.92	2	86	2042	2130	0	4	96
South	7:30 AM	0.91	372	328	53	753	49	44	7
West	7:00 AM	0.75	9	26	25	60	15	43	42

Entire Intersection

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	VOLUMES Thru	VOLUMES Left	VOLUMES Total	PERCENTS Right	PERCENTS Thru	PERCENTS Left
North	7:00 AM	0.90	9	782	15	806	1	97	2
East		0.91	1	87	2031	2119	0	4	96
South		0.85	342	274	57	673	51	41	8
West		0.75	9	26	25	60	15	43	42

SITE CODE : 1
: HANA HWY
: HALEAKALA HWY
:

PAGE: 1
FILE: HANHALP

Primary Movements: Vehicles

DATE: 9/28/94

Time Begin	From North RT	THRU	LT	From East RT	THRU	LT	From South RT	THRU	LT	From West RT	THRU	LT	Vehicle Total
4:00 PM	1	86	2	2	5	151	328	181	2	2	29	8	797
4:15	2	89	9	0	8	176	365	219	2	4	41	15	930
4:30	5	97	8	0	3	147	377	172	4	5	38	15	871
4:45	10	101	4	0	9	127	404	219	5	9	32	9	929
HR TOTAL	18	373	23	2	25	601	1474	791	13	20	140	47	3527
5:00 PM	4	84	8	0	3	107	402	215	2	9	15	10	864
5:15	10	141	12	0	11	111	405	203	2	2	31	10	938
5:30	4	102	6	5	11	139	339	129	3	3	44	14	799
5:45	5	132	10	0	4	122	294	146	2	1	19	11	746
HR TOTAL	23	459	36	5	34	479	1440	693	9	15	109	45	3347
6:00 PM	3	6	1	2	1	28	51	27	0	0	4	0	123
DAY TOTAL	44	838	60	9	60	1108	2965	1511	22	35	253	92	6997

PEAK PERIOD ANALYSIS FOR THE PERIOD: 4:00 PM - 6:15 PM

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	.... VOLUMES .... Right	Thru	Left	Total	.... PERCENTS ... Right	Thru	Left
North	5:00 PM	0.79	23	459	36	518	4	89	7
East	4:00 PM	0.85	2	25	601	628	0	4	96
South	4:30 PM	0.96	1588	809	13	2410	66	34	1
West	4:00 PM	0.86	20	140	47	207	10	68	23

Entire Intersection

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	Right	Thru	Left	Total	Right	Thru	Left
North	4:30 PM	0.74	29	423	32	484	6	87	7
East		0.87	0	31	492	523	0	6	94
South		0.96	1588	809	13	2410	66	34	1
West		0.80	25	116	44	185	14	63	24

SITE CODE : 4
: HALEAKALA HWY
: MAKAWAO AV
:

PAGE: 1
FILE: HALMAKA

Primary Movements: Vehicles

DATE: 9/29/94

Time Begin	From North RT	From North THRU	From North LT	From East RT	From East THRU	From East LT	From South RT	From South THRU	From South LT	From West RT	From West THRU	From West LT	Vehicle Total
6:24	67	33	6	8	57	0	0	22	1	0	3	4	201
6:39	98	38	20	24	130	0	0	36	5	1	4	11	367
6:54	108	48	15	23	114	0	0	50	4	1	8	10	381
7:09	142	55	30	31	152	1	3	35	3	0	8	19	479
7:24	74	58	38	30	104	5	1	38	3	3	10	25	389
7:39	72	67	29	29	111	2	1	52	4	5	4	16	392
7:54	63	57	17	31	73	1	4	43	2	4	8	11	314
8:09	45	43	16	19	85	2	1	47	2	1	5	5	269
DAY TOTAL	669	399	171	195	826	11	10	323	24	15	48	101	2792

PEAK PERIOD ANALYSIS FOR THE PERIOD: 6:24 AM - 8:24 AM

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	VOLUMES Thru	VOLUMES Left	VOLUMES Total	PERCENTS Right	PERCENTS Thru	PERCENTS Left
North	6:54 AM	0.81	396	228	112	736	54	31	15
East	6:39 AM	0.83	108	500	6	614	18	81	1
South	7:24 AM	0.87	7	180	11	198	4	91	6
West	7:09 AM	0.74	12	30	71	113	11	27	63

Entire Intersection

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	VOLUMES Thru	VOLUMES Left	VOLUMES Total	PERCENTS Right	PERCENTS Thru	PERCENTS Left
North	6:54 AM	0.81	396	228	112	736	54	31	15
East		0.82	113	481	8	602	19	80	1
South		0.85	5	175	14	194	3	90	7
West		0.72	9	30	70	109	8	28	64

SITE CODE : 3
: HALEAKALA HWY
: MAKAWAO AV
:

PAGE: 1
FILE: HALMAKP
DATE: 9/28/94

Primary Movements: Vehicles

Time Begin	From North RT	From North THRU	From North LT	From East RT	From East THRU	From East LT	From South RT	From South THRU	From South LT	From West RT	From West THRU	From West LT	Vehicle Total
4:00 PM	22	49	18	28	69	1	1	52	1	17	49	48	355
4:15	25	48	19	27	58	0	4	60	1	6	49	71	368
4:30	41	57	26	22	40	6	1	46	1	9	63	78	390
4:45	27	56	23	41	41	1	6	53	2	17	87	87	441
HR TOTAL	115	210	86	118	208	8	12	211	5	49	248	284	1554
5:00 PM	20	74	20	19	48	3	3	52	2	10	63	84	398
5:15	30	75	24	25	41	3	3	62	1	15	70	75	424
5:30	23	61	31	22	42	1	2	57	5	17	79	68	408
5:45	31	88	18	23	22	4	2	58	3	10	56	67	382
HR TOTAL	104	298	93	89	153	11	10	229	11	52	268	294	1612
DAY TOTAL	219	508	179	207	361	19	22	440	16	101	516	578	3166

PEAK PERIOD ANALYSIS FOR THE PERIOD: 4:00 PM - 6:00 PM

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	VOLUMES Thru	VOLUMES Left	VOLUMES Total	PERCENTS Right	PERCENTS Thru	PERCENTS Left
North	5:00 PM	0.90	104	298	93	495	21	60	19
East	4:00 PM	0.85	118	208	8	334	35	62	2
South	5:00 PM	0.95	10	229	11	250	4	92	4
West	4:45 PM	0.88	59	299	314	672	9	44	47

Entire Intersection

DIRECTION FROM	START PEAK HOUR	PEAK HR FACTOR	VOLUMES Right	VOLUMES Thru	VOLUMES Left	VOLUMES Total	PERCENTS Right	PERCENTS Thru	PERCENTS Left
North	4:45 PM	0.90	100	266	98	464	22	57	21
East		0.86	107	172	8	287	37	60	3
South		0.94	14	224	10	248	6	90	4
West		0.88	59	299	314	672	9	44	47

ATA

29-Sep-94

INTERSECTION TURNING MOVEMENT MANUAL COUNT REDUCTION WORKSHEET
TURNING MOVEMENT SUMMARY

North/South Street : KULA HWY (BYPASS)
East/West Street : HALEAKALA HWY
Abnormal Conditions: CLEAR

Time: AM
Date: 9-29-94
Day : THURSDAY

15 MINUTE PERIOD	KULA HWY (BYPASS) NORTHBOUND LEFT	THRU	RGHT	SOUTHBOUND LEFT	THRU	RGHT	HALEAKALA HWY EASTBOUND LEFT	THRU	RGHT	WESTBOUND LEFT	THRU	RGHT	TOTAL VOLUME 15 MIN	HOURLY
630 - 645	32	148	4	2	32	0	1	16	55	4	9	23	326	
645 - 700	28	117	1	4	24	0	0	12	36	1	2	25	250	
700 - 715	21	135	6	5	21	0	0	9	29	9	6	26	267	
715 - 730	19	111	32	5	40	0	0	15	37	9	26	33	327	
730 - 745	44	140	9	6	43	2	3	19	42	20	3	48	379	
745 - 800	21	55	1	3	19	0	0	9	31	2	3	11	155	
800 - 815	19	77	5	3	12	0	0	18	41	3	5	16	199	
815 - 830	22	41	5	0	29	0	0	13	38	6	9	29	192	
PEAK 15 MINUTE PERIOD: 730 - 745	44	140	9	6	43	2	3	19	42	20	3	48	379	--
PEAK HOUR PERIOD: 645 - 745	112	503	48	20	128	2	3	55	144	39	37	132	--	1223

PEAK HOUR TURNING MOVEMENT DIAGRAM

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                      2    128    20                              N
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                    <       |        >                            S
              ^             v           
             /                         \
      3   ---                            ---   132
     55   ----->                        <-----   37        HALEAKALA HWY
    144   ---                            ---    39
             \                          /
              v                        v
                    <       |       >
                     \      |      /
                      |     |     |

                     112   503    48

                      KULA HWY (BYPASS)
```

ATA 29-Sep-94

INTERSECTION TURNING MOVEMENT MANUAL COUNT REDUCTION WORKSHEET
TURNING MOVEMENT SUMMARY

North/South Street : KULA HWY (BYPASS) Time: PM
East/West Street : HALEAKALA HWY Date: 9-28-94.
Abnormal Conditions: CLEAR Day : WEDNESDAY

15 MINUTE PERIOD	KULA HWY (BYPASS) NORTHBOUND LEFT	THRU	RGHT	SOUTHBOUND LEFT	THRU	RGHT	HALEAKALA HWY EASTBOUND LEFT	THRU	RGHT	WESTBOUND LEFT	THRU	RGHT	TOTAL VOLUME 15 MIN	HOURLY
400 - 415	28	62	3	10	65	0	3	14	43	14	10	25	277	
415 - 430	18	44	1	7	67	2	5	7	47	11	5	8	222	
430 - 445	27	49	0	13	45	1	1	7	34	15	9	11	212	
445 - 500	28	53	3	16	105	0	1	9	40	4	9	16	284	
500 - 515	28	60	1	18	67	2	1	8	44	14	6	19	268	
515 - 530	25	48	1	18	72	0	2	8	36	2	7	14	233	
530 - 545	26	53	0	11	83	2	2	9	46	3	8	15	258	
545 - 600	37	39	1	14	64	1	0	14	38	11	6	9	234	
PEAK 15 MINUTE PERIOD: 445 - 500	28	53	3	16	105	0	1	9	40	4	9	16	284	--
PEAK HOUR PERIOD: 445 - 545	107	214	5	63	327	4	6	34	166	23	30	64	--	1043

PEAK HOUR TURNING MOVEMENT DIAGRAM

```
                    4    327    63                          N
                                                            |
                    |     |     |                        W--+--E
                   /      |      \                          |
                  <       |       >                         S
            ^             v           ^
           /                           \
    6   ---                             ---   64
   34   ----->                       <-----   30     HALEAKALA HWY
  166   ---                             ---   23
           \                           /
            v             ^           v
                  <       |       >
                   \      |      /
                    |     |     |

                  107    214    5

               KULA HWY (BYPASS)
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OMAORO RD
PM

Weather :
Counter :
Counted by:

JAMAR Technologies, Inc.
Traffic Counting Equipment & Supplies
2031 Stout Drive, Suite 4
Ivyland, PA 18974

Site Code : 00000004
Start Date: 09/28/94
File I.D. : KULOMAP
Page : 1

Vehicle group 1

	Southbound				Westbound				Northbound				Eastbound				
Date 09/28/94	Left	Thru	Right	Other	Left	Thru	Right	Other	Left	Thru	Right	Other	Left	Thru	Right	Other	Total
16:07	18	67	7	0	2	8	7	0	1	53	2	0	3	14	2	0	134
16:22	34	86	4	0	0	2	9	0	5	60	0	0	4	2	2	0	208
16:37	36	70	5	0	0	0	17	0	3	78	0	0	9	3	4	0	225
16:52	34	96	4	0	2	2	13	0	2	54	1	0	4	0	4	0	216
Hr Total	122	319	20	0	4	12	46	0	11	245	3	0	20	19	12	0	833
17:07	26	61	5	0	1	4	11	0	3	47	1	0	2	0	3	0	164
17:22	32	77	6	0	0	2	10	0	7	61	3	0	1	2	4	0	205
17:37	39	69	4	0	1	2	11	0	1	54	0	0	7	2	5	0	195
17:52	17	29	4	0	0	1	7	0	1	26	1	0	1	1	2	0	90
Hr Total	114	236	19	0	2	9	39	0	12	188	5	0	11	5	14	0	654
* BREAK *																	
TOTAL	236	555	39	0	6	21	85	0	23	433	8	0	31	24	26	0	1487

Peak Hour Analysis By Entire Intersection for the Period: 16:07 to 18:22 on 09/28/94

	Southbound				Westbound				Northbound				Eastbound			
Peak start	16:07				16:07				16:07				16:07			
Volume	122	319	20	0	4	12	46	0	11	245	3	0	20	19	12	0
Percent	26%	69%	4%	0%	6%	19%	74%	0%	4%	95%	1%	0%	39%	37%	24%	0%
Pk total	461				62				259				51			
Highest	16:52				16:07				16:37				16:07			
Volume	34	96	4	0	2	8	7	0	3	78	0	0	3	14	2	0
Hi total	134				17				81				19			
PHF	.86				.91				.80				.67			

Weather :
Counter :
Counted by:

JAMAR Technologies, Inc.
Traffic Counting Equipment & Supplies
2031 Stout Drive, Suite 4
Ivyland, PA 18974

Site Code : 00000004
Start Date: 09/29/94
File I.D. : KULOMAA
Page : 1

Vehicle group 1

	Southbound				Westbound				Northbound				Eastbound				
	Left	Thru	Right	Other	Left	Thru	Right	Other	Left	Thru	Right	Other	Left	Thru	Right	Other	Total
Date 09/29/94																	
06:30	3	28	3	0	1	1	31	0	2	96	2	0	3	0	0	0	170
06:45	2	27	5	0	0	2	46	0	1	88	1	0	5	0	3	0	180
07:00	2	40	3	0	1	12	48	0	2	93	1	0	4	1	3	0	210
07:15	9	55	3	0	4	1	39	0	1	101	0	0	7	0	3	0	223
Hr Total	16	150	14	0	6	16	164	0	6	378	4	0	19	1	9	0	783
07:30	13	54	5	0	0	4	36	0	3	90	3	0	7	0	3	0	218
07:45	9	43	4	0	3	5	27	0	2	96	2	0	3	1	2	0	195
08:00	16	44	1	0	2	1	19	0	3	66	2	0	4	2	3	0	163
08:15	8	46	2	0	1	0	21	0	4	63	0	0	4	2	3	0	154
Hr Total	46	187	12	0	6	10	103	0	12	315	7	0	20	5	11	0	734

---------- * BREAK * ----------

TOTAL	62	337	26	0	12	26	267	0	18	693	11	0	39	6	20	0	1517

Peak Hour Analysis By Entire Intersection for the Period: 06:30 to 09:00 on 09/29/94

Peak start	07:00				07:00				07:00				07:00			
Volume	33	192	15	0	8	22	150	0	8	380	6	0	23	2	11	0
Percent	14%	80%	6%	0%	4%	12%	83%	0%	2%	96%	2%	0%	64%	6%	31%	0%
Pk total	240				180				394				36			
Highest	07:30				07:00				07:15				07:15			
Volume	13	54	5	0	1	12	48	0	1	101	0	0	7	0	3	0
Hi total	72				61				102				10			
PHF	.83				.74				.97				.90			

KEKAULIKE RD
AM

JAMAR Technologies, Inc.
Traffic Counting Equipment & Supplies
2031 Stout Drive, Suite 4
Ivyland, PA 18974

Weather :
Counter :
Counted by:

Site Code : 00000005
Start Date: 09/29/94
File I.D. : KULKEKA
Page : 1

Vehicle group 1

Date 09/29/94	Southbound Left	Southbound Thru	Southbound Right	Southbound Other	Westbound Left	Westbound Thru	Westbound Right	Westbound Other	Northbound Left	Northbound Thru	Northbound Right	Northbound Other	Eastbound Left	Eastbound Thru	Eastbound Right	Eastbound Other	Total
06:30	3	21	0	0	4	0	16	0	0	30	3	0	0	0	0	0	77
06:45	3	9	0	0	2	0	16	0	0	30	2	0	0	0	0	0	62
07:00	3	23	0	0	3	0	12	0	0	37	[illegible]	0	0	0	0	0	82
07:15	4	19	0	0	3	0	23	0	0	45	2	0	0	0	0	0	96
Hr Total	13	72	0	0	12	0	67	0	0	142	11	0	0	0	0	0	317
07:30	7	29	0	0	7	0	12	0	0	29	1	0	0	0	0	0	85
07:45	5	17	0	0	4	0	6	0	0	35	0	0	0	0	0	0	67
08:00	3	18	0	0	6	0	9	0	0	11	4	0	0	0	0	0	51
08:15	5	22	0	0	3	0	10	0	0	34	7	0	0	0	0	0	81
Hr Total	20	86	0	0	20	0	37	0	0	109	12	0	0	0	0	0	284
TOTAL	33	158	0	0	32	0	104	0	0	251	23	0	0	0	0	0	601

Peak Hour Analysis By Individual Approach for the Period: 06:30 to 08:30 on 09/29/94

	SB Left	SB Thru	SB Right	SB Other	WB Left	WB Thru	WB Right	WB Other	NB Left	NB Thru	NB Right	NB Other	EB Left	EB Thru	EB Right	EB Other
Peak start	07:00				06:30				07:00				07:30			
Volume	19	88	0	0	12	0	67	0	0	146	7	0	0	0	0	0
Percent	18%	82%	0%	0%	15%	0%	85%	0%	0%	95%	5%	0%	0%	0%	0%	0%
Pk total	107				79				153				0			
Highest	07:30				07:15				07:15				06:30			
Volume	7	29	0	0	3	0	23	0	0	45	2	0	0	0	0	0
Hi total	36				26				47				0			
PHF	.74				.76				.81				.0			

Peak Hour Analysis By Entire Intersection for the Period: 06:30 to 08:30 on 09/29/94

	SB Left	SB Thru	SB Right	SB Other	WB Left	WB Thru	WB Right	WB Other	NB Left	NB Thru	NB Right	NB Other	EB Left	EB Thru	EB Right	EB Other
Peak start	07:00				07:00				07:00				07:00			
Volume	19	88	0	0	17	0	53	0	0	146	7	0	0	0	0	0
Percent	18%	82%	0%	0%	24%	0%	76%	0%	0%	95%	5%	0%	0%	0%	0%	0%
Pk total	107				70				153				0			
Highest	07:30				07:15				07:15				06:30			
Volume	7	29	0	0	3	0	23	0	0	45	2	0	0	0	0	0
Hi total	36				26				47				0			
PHF	.74				.67				.81				.0			

KEKAULIKE RD
PM

JAMAR Technologies, Inc.
Traffic Counting Equipment & Supplies
2031 Stout Drive, Suite 4
Ivyland, PA 18974

Weather :
Counter :
Counted by:

Site Code : 00000005
Start Date: 09/28/94
File I.D. : KULKEKP
Page : 1

Vehicle group 1

	Southbound				Westbound				Northbound				Eastbound				
Date 09/28/94	Left	Thru	Right	Other	Left	Thru	Right	Other	Left	Thru	Right	Other	Left	Thru	Right	Other	Total
16:00	12	37	0	0	8	0	14	0	0	26	7	0	0	0	0	0	104
16:15	12	26	0	0	5	0	8	0	0	37	7	0	0	0	0	0	95
16:30	12	31	0	0	2	0	2	0	0	36	5	0	0	0	0	0	88
16:45	13	20	0	0	4	0	9	0	0	27	4	0	0	0	0	0	77
Hr Total	49	114	0	0	19	0	33	0	0	126	23	0	0	0	0	0	364
17:00	17	30	0	0	7	0	7	0	0	28	1	0	0	0	0	0	90
17:15	16	18	0	0	2	0	11	0	0	32	7	0	0	0	0	0	86
17:30	13	29	0	0	0	1	3	0	0	31	3	0	0	0	0	0	80
17:45	8	34	0	0	2	0	9	0	0	25	3	0	0	0	0	0	81
Hr Total	54	111	0	0	11	1	30	0	0	116	14	0	0	0	0	0	337
TOTAL	103	225	0	0	30	1	63	0	0	242	37	0	0	0	0	0	701

Peak Hour Analysis By Entire Intersection for the Period: 16:00 to 18:00 on 09/28/94

Peak start	16:00				16:00				16:00				16:00			
Volume	49	114	0	0	19	0	33	0	0	126	23	0	0	0	0	0
Percent	30%	70%	0%	0%	37%	0%	63%	0%	0%	85%	15%	0%	0%	0%	0%	0%
Pk total	163				52				149				0			
Highest	16:00				16:00				16:15				16:00			
Volume	12	37	0	0	8	0	14	0	0	37	7	0	0	0	0	0
Hi total	49				22				44				0			
PHF	.83				.59				.85				.0			

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

APPENDIX B

LEVEL OF SERVICE CALCULATIONS

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

EXISTING 1994 LOS CALCULATIONS

KULA RESIDENT LOTS
EXISTING 1994
AM

02/27/95
10:04:08

SIGNAL94/TEAPAC[V1 L1.0] - Summary of Parameter Values

Intersection Parameters for Int # 1 - HANA HWY & HALEAKALA HWY

METROAREA	NONCBD	
LOSTTIME	2.0	
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	LOW	LOW	LOW	LOW
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	9	782	15	1	87	2031	342	274	57	9	26	25
WIDTHS	12.0	22.0	11.0	12.0	11.0	11.0	12.0	22.0	11.0	12.0	11.0	.0
LANES	1	2	1	1	1	1	1	2	1	1	1	0
UTILIZATIONS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRUCKPERCENTS	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	YES	NO	YES	YES	NO	NO	YES	NO	YES	YES
REQCLEARANCES	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	FFLW	NORM	NORM	FFLW	NORM	DOPT	FFLW	NORM	NORM	FFLW	NORM	NORM
SATURATIONFLOWS	0	3601	1711	0	1721	1711	0	3601	1711	0	724	0

Phasing Parameters

SEQUENCES	67				
PERMISSIVES	YES	YES	YES	YES	
OVERLAPS	YES	YES	YES	YES	
CYCLES	60	180	10		
GREENTIMES	5.42	.00	11.95	21.21	5.42
YELLOWTIMES	4.00	.00	4.00	4.00	4.00
CRITICALS	9	0	2	6	11
EXCESS	0				

LEADLAGS	NONE	NONE
OFFSET	.00	1
PEDTIME	.0	0

KULA RESIDENT LOTS   02/27/95
EXISTING 1994   10:04:14
AM

SIGNAL94/TEAPAC[V1 L1.0] - Capacity Analysis Summary

Intersection Averages for Int # 1 - HANA HWY & HALEAKALA HWY
Degree of Saturation (v/c) 1.29 Vehicle Delay 33.6 Level of Service D

```
       ---------------------------------------------------------
Sq 67 ¦ Phase 1  ¦ Phase 2  ¦ Phase 3  ¦ Phase 4  ¦ Phase 5  ¦
**/** ---------------------------------------------------------
      ¦    +     ¦ .        ¦  * +     ¦          ¦          ¦
  .   ¦    +     ¦          ¦  * +     ¦          ¦          ¦
 /¦\  ¦    +>    ¦          ¦  * +>    ¦    <++++¦          ¦
  ¦   ¦          ¦          ¦  v       ¦     ****¦    ^     ¦
  ¦   ¦          ¦       ^  ¦       ^  ¦    v    ¦****      ¦
North ¦   <*     ¦     <+ + ¦    <+ +  ¦         ¦****>     ¦
  ¦   ¦    *     ¦      + + ¦     + +  ¦         ¦          ¦
      ¦    *     ¦      + + ¦     + +  ¦         ¦          ¦
      ---------------------------------------------------------
      ¦ G/C= .090 ¦ G/C= .000 ¦ G/C= .199 ¦ G/C= .353 ¦ G/C= .090 ¦
      ¦ G=   5.4" ¦ G=    .0" ¦ G=  12.0" ¦ G=  21.2" ¦ G=   5.4" ¦
      ¦ Y+R= 4.0" ¦ Y+R=  .0" ¦ Y+R= 4.0" ¦ Y+R= 4.0" ¦ Y+R= 4.0" ¦
      ¦ OFF= -.0% ¦ OFF=15.7% ¦ OFF=15.7% ¦ OFF=42.3% ¦ OFF=84.3% ¦
      ---------------------------------------------------------
      C= 60 sec   G= 44.0 sec = 73.3%  Y=16.0 sec = 26.7%  Ped=  .0 sec =   .0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								29.2	D+	
TH	22/2	.243	.233	744	838	782	.933	29.6	*D+	253 ft
LT	11/1	.000	.124	352	397	15	.038	8.1	B+	25 ft
NB Approach								13.5	B	
TH	22/2	.103	.233	744	838	274	.327	14.6	B	89 ft
LT	11/1	.000	.124	290	331	57	.172	8.3	*B+	42 ft
WB Approach								38.7	D	
TH	11/1-	.639	.387	617	666	1086	1.631	38.7	D	562 ft
LT	11/1+	.614	.387	613	662	1032	1.559	38.8	*D	534 ft
EB Approach								22.1	C	
LT+TH	11/1	.114	.124	56	80	51	.573	22.1	*C	38 ft

KULA RESIDENT LOTS 02/27/95
EXISTING 1994 10:06:45
PM

SIGNAL94/TEAPAC[V1 L1.0] - Summary of Parameter Values

Intersection Parameters for Int # 1 - HANA HWY & HALEAKALA HWY

METROAREA	NONCBD	
LOSTTIME	2.0	
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	LOW	LOW	LOW	LOW
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	29	423	32	100	31	492	1588	809	13	25	116	44
WIDTHS	12.0	22.0	11.0	12.0	11.0	11.0	12.0	22.0	11.0	12.0	11.0	.0
LANES	1	2	1	1	1	1	1	2	1	1	1	0
UTILIZATIONS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRUCKPERCENTS	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	YES	NO	YES	YES	NO	NO	YES	NO	YES	YES
REQCLEARANCES	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	FFLW	NORM	NORM	FFLW	NORM	DOPT	FFLW	NORM	NORM	FFLW	NORM	NORM
SATURATIONFLOWS	0	3601	1711	0	1724	1711	0	3601	1711	0	1316	0

Phasing Parameters

SEQUENCES	57							
PERMISSIVES	YES	YES	YES	YES		LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES		OFFSET	.00	1
CYCLES	60	180	10			PEDTIME	.0	0
GREENTIMES	6.44	.00	16.08	11.78	9.70			
YELLOWTIMES	4.00	.00	4.00	4.00	4.00			
CRITICALS	3	0	8	5	11			
EXCESS	0							

KULA RESIDENT LOTS
EXISTING 1994
PM

02/27/95
10:07:17

SIGNAL94/TEAPAC[V1 L1.0] - Capacity Analysis Summary

Intersection Averages for Int # 1 - HANA HWY & HALEAKALA HWY
Degree of Saturation (v/c) .62 Vehicle Delay 15.5 Level of Service C+

```
       -----------------------------------------------------------
Sq 57 ¦ Phase 1  ¦ Phase 2  ¦ Phase 3  ¦ Phase 4  ¦ Phase 5  ¦
**/** -----------------------------------------------------------
      ¦    *     ¦   + +    ¦   + +    ¦          ¦          ¦
  .   ¦    *     ¦   + +    ¦   + +    ¦          ¦          ¦
 /¦\  ¦    *>    ¦   + +>   ¦   + +>   ¦     <****¦          ¦
  ¦   ¦          ¦   v      ¦   v      ¦      ++++¦   ^      ¦
  ¦   ¦          ¦          ¦       ^  ¦     v    ¦****      ¦
North ¦   <+     ¦          ¦    <+ *  ¦          ¦****>     ¦
  ¦   ¦    +     ¦          ¦     + *  ¦          ¦          ¦
      ¦    +     ¦          ¦     + *  ¦          ¦          ¦
      -----------------------------------------------------------
      ¦ G/C= .107 ¦ G/C= .000 ¦ G/C= .268 ¦ G/C= .196 ¦ G/C= .162 ¦
      ¦ G=  6.4"  ¦ G=    .0" ¦ G=  16.1" ¦ G=  11.8" ¦ G=   9.7" ¦
      ¦ Y+R= 4.0" ¦ Y+R=  .0" ¦ Y+R= 4.0" ¦ Y+R= 4.0" ¦ Y+R= 4.0" ¦
      ¦ OFF= -.0% ¦ OFF=17.4% ¦ OFF=17.4% ¦ OFF=50.9% ¦ OFF=77.2% ¦
      -----------------------------------------------------------
      C= 60 sec  G= 44.0 sec = 73.3%  Y=16.0 sec = 26.7%  Ped= .0 sec =  .0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								12.3	B	
TH	22/2	.146	.301	1005	1085	423	.390	12.7	B	125 ft
LT	11/1	.000	.141	325	361	32	.089	6.3	*B+	25 ft
NB Approach								16.2	C+	
TH	22/2	.250	.301	1005	1085	809	.746	16.4	*C+	238 ft
LT	11/1	.000	.141	375	412	13	.032	6.2	B+	25 ft
WB Approach								16.5	C+	
TH	11/1-	.191	.230	336	396	268	.677	16.8	*C+	174 ft
LT	11/1+	.184	.230	333	393	255	.649	16.1	C+	166 ft
EB Approach								17.5	C+	
LT+TH	11/1	.161	.195	203	257	160	.623	17.5	*C+	109 ft

```
ATA Inc.        TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS            1994 HCM
==================================================================================================
Major Street:  PUKALAINI BYPASS                                                   DATE:    23-Feb-95
Minor Street:  MAKAWAO AV                                                      Analyst:    BC
    Scenario:  EXISTING                                                      File Name:    BYPMAK-A
   Peak Hour:      AM                                                     Intesection #:        2
--------------------------------------------------------------------------------------------------
                                  |           V12      V11       V10
      Peak Hour Factor:     1.00  |
                                  |           396      228       112          <--- NORTH
 ---------MAJOR STREET---------   |            |        |         |
     Num of Lanes - V2:        2  |            |        |         |
    Excl LT - V1 (Y/N):        Y  |           /         |          \
    Excl RT - V3 (Y/N):        Y  |          <          v           >
  Stop/Yield - V3 (Y/N):       N  |
     Grade - V1,V2,V3:         2  |        ^                              ^
                                  |       /                                \
     Num of Lanes - V5:        1  | V1   9 -----                           ----   113 V6
    Excl LT - V4 (Y/N):        Y  |
    Excl RT - V6 (Y/N):        Y  | V2  30 ------->                       <----   481 V5
  Stop/Yield - V6 (Y/N):       N  |
     Grade - V4,V5,V6:        -2  | V3  70 -----                           ----     8 V4
                                  |           \                           /
 ---------MINOR STREET---------   |            v                         v     MAJOR STREET
     Num of Lanes - V8:        1  |                                            PUKALAINI BYPASS
     Grade - V7,V8,V9:         0  |             <          ^          >
   Shared Lane-V7,8,9:         0  |              \         |         /
 (0=N,1=LT,2=TR,3=LTR)            |               |        |        |
                                  |               |        |        |
     Num of Lanes - V11:       1  |              14       175       5
   Grade - V10,V11,V12:        0  |
 Shared Lane-V10,11,12:        0  |              V7        V8       V9
 (0=N,1=LT,2=TR,3=LTR)            |
                                  |          MINOR STREET - MAKAWAO AV
--------------------------------------------------------------------------------------------------
```

VOLUME ADJUSTMENTS

MOVEMENT NO.	1	2	3	4	5	6	7	8	9	10	11	12
HOURLY FLOW RATE, V(vph)	9	30	70	8	481	113	14	175	5	112	228	396
VOLUME, v (pcph)	13	30	70	8	481	113	15	193	6	123	251	436

```
STEP 1: RT FROM MINOR STREET |                                |
  Conflicting Flows:         |Vc9 = 1/2 V3 + V2 =    15 vhp   | Vc12 = 1/2 V6 + V5 =    481 vhp
  Potential Capacity:        |Cp,9 =               1361 pcph  | Cp,12 =                 790 pcph
  Movement Capacity:         |Cm,9=Cp,9=           1361 pcph  | Cm,12=Cp,12=            790 pcph
  Prb. of Queu-free State:   |po,9=1-v9/Cm,9=      1.00       | po,12=1-v12/Cm,12=     0.45
--------------------------------------------------------------------------------------------------
STEP 2: LT FROM MAJOR STREET |                                |
  Conflicting Flows:         |Vc,4 = V2 + V3 =      100 vhp   | Vc,1 = V5 + V6 =        594 vhp
  Potential Capacity:        |Cp,4 =               1515 pcph  | Cp,1 =                  823 pcph
  Movement Capacity:         |Cm,4=Cp,4=           1515 pcph  | Cm,1=Cp,1=              823 pcph
  Prb. of Queu-free State:   |po,4=1-v4/Cm4=       0.99       | po,1=1-v1/Cm1=         0.98
  Major Left Shared Lane     |                                |
   Prob. of Queue-free State |p*o,4=                NA        | p*o,1=                  NA
--------------------------------------------------------------------------------------------------
```


----continued ----

Major Street: PUKALAINI BYPASS
Minor Street: MAKAWAO AV
Scenario: EXISTING
Peak Hour: AM

DATE: 23-Feb-95
Analyst: BC
File Name: BYPMAK-A
Intesection Intesection #: 2

STEP 3: TH FROM MINOR STREET

Conflicting Flows:	Vc.,8 = 1/2V3+V2+V1+V6+V5+V4 : 528 vph	Vc.,11 = 1/2V6+V5+V4+V3+V2+V1 : 528 vph
Potential Capacity:	Cp,8 : 536 pcph	Cp,11 = 536 pcph
Capacity Adj Factor:	*f8 = po,4*po,1 = 0.98*	*f11 = po,4*po,1 = 0.98*
Movement Capacity:	Cm,8 = Cp,8*f8 = 524 pcph	Cm,11 = Cp,11*f11 = 524 pcph
Prob. of Queue-free State:	po,8 = 1-v8/Cm,8 = 0.63	po,11 = 1-v11/Cm,11 = 0.52

STEP 4: LT FROM MINOR STREET

Conflicting Flows:	Vc,7 = 1/2V3+V2+V1+1/2V6+V5+V4+ 1/2(V11+V12) = 840 vph	Vc,10 = 1/2V6+V5+V4+1/2V3+V2+V1+ 1/2(V8+V9) = 616 vph
Potential Capacity:	Cp7 = 307 pcph	Cp10 = 428 pcph
Major Left, Minor Through Impedance Factor:	P''7=po,11*f11 = 0.51	P''10=po,8*f8 = 0.62
Major Left, Minor Through Adjusted Impedance Factor:	p'7 = 0.62	p'10 = 0.70
Capacity Adjustment Factor:	f7 = p'7*po,12 = 0.28	f10 = p'10*po,9 = 0.70
Movement Capacity:	Cm,7 = f7*Cp,7 = 85 pcph	Cm,10 = f10*Cp,10 = 299 pcph

DELAY AND LEVEL OF SERVICE SUMMARY

MOVEMENT	v(pcph)	cm(pcph)	csh(pcph)	AVG TOTAL DELAY	LOS
MINOR LEFT TURN (7)	15	85	--NA--	51.4	F
MINOR THROUGH (8)	193	524	--NA--	10.8	C
MINOR RIGHT TURN (9)	6	1361	--NA--	2.7	A
MINOR LEFT TURN (10)	123	299	--NA--	20.1	D
MINOR THROUGH (11)	251	524	--NA--	13.0	C
MINOR RIGHT TURN (12)	436	790	--NA--	10.0	B
MAJOR LEFT (1)	13	823	--NA--	4.4	A
MAJOR LEFT (4)	8	1515	--NA--	2.4	A
MINOR APPROACH (7)(8)(9)	-	-	-	13.4	C
MINOR APPROACH (10)(11)(12)	-	-	-	12.5	C
MAJOR APPROACH (1)(2)(3)	-	-	-	0.5	A
MAJOR APPROACH (4)(5)(6)	-	-	-	0.0	A
TOTAL INTERSECTION (1-12)	-	-	-	8.0	B

LEVEL OF SERVICE CRITERIA

LEVEL OF SERVICE	AVG TOTAL DELAY (SEC/VEH)
A	<=5
B	>5&<=10
C	>10&<=20
D	>20&<=30
E	>30&<=45
F	>45

ATA Inc. TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS 1994 HCM

Major Street:	PUKALANI BYPASS		
Minor Street:	MAKAWAO AV	DATE:	23-Feb-95
Scenario:	EXISTING	Analyst:	BC
Peak Hour:	PM	File Name:	BYPMAK-P
		Intesection #:	2

Peak Hour Factor: 1.00

---------MAJOR STREET---------

Num of Lanes - V2:	2
Excl LT - V1 (Y/N):	Y
Excl RT - V3 (Y/N):	Y
Stop/Yield - V3 (Y/N):	N
Grade - V1,V2,V3:	2
Num of Lanes - V5:	1
Excl LT - V4 (Y/N):	Y
Excl RT - V6 (Y/N):	Y
Stop/Yield - V6 (Y/N):	N
Grade - V4,V5,V6:	-2

---------MINOR STREET---------

Num of Lanes - V8:	1
Grade - V7,V8,V9:	0
Shared Lane-V7,8,9:	0
(0=N,1=LT,2=TR,3=LTR)	
Num of Lanes - V11:	1
Grade - V10,V11,V12:	0
Shared Lane-V10,11,12:	0
(0=N,1=LT,2=TR,3=LTR)	

```
        V12     V11     V10
        100     266      98          <--- NORTH

V1  314 -----                 ----  107 V6
V2  299 ------->             <----  172 V5
V3   59 -----                 ----    8 V4
                                   MAJOR STREET
                                   PUKALANI BYPASS
         10     224      14
         V7      V8      V9
      MINOR STREET - MAKAWAO AV
```

VOLUME ADJUSTMENTS

MOVEMENT NO.	1	2	3	4	5	6	7	8	9	10	11	12
HOURLY FLOW RATE, V(vph)	314	299	59	8	172	107	10	224	14	98	266	100
VOLUME, v (pcph)	440	299	59	8	172	107	11	246	15	108	293	110

STEP 1: RT FROM MINOR STREET

Conflicting Flows:	Vc9 = 1/2 V3 + V2 =	150 vhp	Vc12 = 1/2 V6 + V5 :	172 vhp
Potential Capacity:	Cp,9 =	1163 pcph	Cp,12 =	1133 pcph
Movement Capacity:	Cm,9=Cp,9=	1163 pcph	Cm,12=Cp,12=	1133 pcph
Prb. of Queu-free State:	po,9=1-v9/Cm,9=	0.99	po,12=1-v12/Cm,12=	0.90

STEP 2: LT FROM MAJOR STREET

Conflicting Flows:	Vc,4 = V2 + V3 =	358 vhp	Vc,1 = V5 + V6 =	279 vhp
Potential Capacity:	Cp,4 =	1101 pcph	Cp,1 =	1214 pcph
Movement Capacity:	Cm,4=Cp,4=	1101 pcph	Cm,1=Cp,1=	1214 pcph
Prb. of Queu-free State:	po,4=1-v4/Cm4=	0.99	po,1=1-v1/Cm1=	0.64
Major Left Shared Lane				
Prob. of Queue-free State	p*o,4=	NA	p*o,1=	NA

----continued ----

Major Street:	PUKALANI BYPASS	DATE:	23-Feb-95
Minor Street:	MAKAWAO AV	Analyst:	BC
Scenario:	EXISTING	File Name:	BYPMAK-P
Peak Hour:	PM	Intesection # Intesection #:	2

STEP 3: TH FROM MINOR STREET

Conflicting Flows:	Vc.,8 = 1/2V3+V2+V1+V6+V5+V4 =	793 vph	Vc.,11 = 1/2V6+V5+V4+V3+V2+V1 =	793 vph
Potential Capacity:	*Cp,8 =*	*375 pcph*	*Cp,11 =*	*375 pcph*
Capacity Adj Factor:	f8 = po,4*po,1 =	0.63	f11 = po,4*po,1 =	0.63
Movement Capacity:	Cm,8 = Cp,8*f8 =	237 pcph	Cm,11 = Cp,11*f11 =	237 pcph
Prob. of Queue-free State:	po,8 = 1-v8/Cm,8 =	0.01	po,11 = 1-v11/Cm,11 =	0.01

STEP 4: LT FROM MINOR STREET

Conflicting Flows:	Vc,7 = 1/2V3+V2+V1+1/2V6+V5+V4+ 1/2(V11+V12) =	976 vph	Vc,10 = 1/2V6+V5+V4+1/2V3+V2+V1+ 1/2(V8+V9) =	905 vph
Potential Capacity:	Cp7 =	252 pcph	Cp10 =	279 pcph
Major Left, Minor Through Impedance Factor:	P''7=po,11*f11 =	0.01	P''10=po,8*f8 =	0.01
Major Left, Minor Through Adjusted Impedance Factor:	p'7 =	0.05	p'10 =	0.05
Capacity Adjustment Factor:	f7 = p'7*po,12 =	0.04	f10 = p'10*po,9 =	0.05
Movement Capacity:	Cm,7 = f7*Cp,7 =	11 pcph	Cm,10 = f10*Cp,10 =	14 pcph

DELAY AND LEVEL OF SERVICE SUMMARY

MOVEMENT	v(pcph)	cm(pcph)	csh(pcph)	AVG TOTAL DELAY	LOS
MINOR LEFT TURN (7)	11	11	--NA--	686.0	F
MINOR THROUGH (8)	246	237	--NA--	108.0	F
MINOR RIGHT TURN (9)	15	1163	--NA--	3.1	A
MINOR LEFT TURN (10)	108	14	--NA--	3631.1	F
MINOR THROUGH (11)	293	237	--NA--	174.0	F
MINOR RIGHT TURN (12)	110	1133	--NA--	3.5	A
MAJOR LEFT (1)	440	1214	--NA--	4.6	A
MAJOR LEFT (4)	8	1101	--NA--	3.3	A
MINOR APPROACH (7)(8)(9)	-	-	-	125.6	F
MINOR APPROACH (10)(11)(12)	-	-	-	868.0	F
MAJOR APPROACH (1)(2)(3)	-	-	-	2.6	A
MAJOR APPROACH (4)(5)(6)	-	-	-	0.1	A
TOTAL INTERSECTION (1-12)	-	-	-	287.1	F

LEVEL OF SERVICE CRITERIA

LEVEL OF SERVICE	AVG TOTAL DELAY (SEC/VEH)
A	<=5
B	>5&<=10
C	>10&<=20
D	>20&<=30
E	>30&<=45
F	>45

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ATA Inc.        TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS                1994 HCM
==========================================================================================================
                                                                                    DATE:     23-Feb-95
Major Street:   KULA HWY                                                        Analyst:     BC
Minor Street:   HALEAKALA HWY                                                 File Name:      HALKUL-A
   Scenario:    EXISTING                                                   Intesection #:            3
  Peak Hour:         AM
----------------------------------------------------------------------------------------------------------
                                 |              V12        V11        V10
    Peak Hour Factor:      1.00  |                                                     <--- NORTH
                                 |              132         37         39
 ---------MAJOR STREET---------  |                |          |          |
      Num of Lanes - V2:      1  |                |          |          |
     Excl LT - V1 (Y/N):      Y  |               /           |           \
     Excl RT - V3 (Y/N):      Y  |              <            v            >
  Stop/Yield - V3 (Y/N):      N  |
      Grade - V1,V2,V3:       2  |           ^                                   ^
                                 |          /                                     \
                                 |                                                 ----    48 V6
      Num of Lanes - V5:      1  | V1   20 -----
     Excl LT - V4 (Y/N):      Y  |                                                <----   503 V5
     Excl RT - V6 (Y/N):      Y  | V2  128 ------->
  Stop/Yield - V6 (Y/N):      N  |                                                 ----   122 V4
      Grade - V4,V5,V6:      -2  | V3    2 -----                                  /
                                 |          \                                    v      MAJOR STREET
 ---------MINOR STREET---------  |           v                                          KULA HWY
      Num of Lanes - V8:      1  |
      Grade - V7,V8,V9:       0  |              <            ^            >
   Shared Lane-V7,8,9:        1  |               \           |           /
  (0=N,1=LT,2=TR,3=LTR)          |                |          |          |
                                 |                |          |          |
      Num of Lanes - V11:     1  |                3         55        144
    Grade - V10,V11,V12:      0  |
  Shared Lane-V10,11,12:      1  |               V7         V8         V9
  (0=N,1=LT,2=TR,3=LTR)          |
                                 |              MINOR STREET - HALEAKALA HWY
----------------------------------------------------------------------------------------------------------
VOLUME ADJUSTMENTS               |
   MOVEMENT NO.                  |      1    2   3    4    5    6      7   8   9     10     11    12
   HOURLY FLOW RATE, V(vph)      |     20  128   2  122  503   48      3  55 144     39     37   132
   VOLUME, v (pcph)              |     28  128   2  122  503   48      3  61 158     43     41   145
----------------------------------------------------------------------------------------------------------
STEP 1: RT FROM MINOR STREET     |                                   |
   Conflicting Flows:            |Vc9 = 1/2 V3 + V2 =      128  vhp  |  Vc12 = 1/2 V6 + V5 =      503 vhp
   Potential Capacity:           |Cp,9 =                  1193 pcph  |  Cp,12 =                   770 pcph
   Movement Capacity:            |Cm,9=Cp,9=              1193 pcph  |  Cm,12=Cp,12=              770 pcph
   Prb. of Queu-free State:      |po,9=1-v9/Cm,9=         0.87       |  po,12=1-v12/Cm,12=       0.81
----------------------------------------------------------------------------------------------------------
STEP 2: LT FROM MAJOR STREET     |                                   |
   Conflicting Flows:            |Vc,4 = V2 + V3 =         130  vhp  |  Vc,1 = V5 + V6 =          551 vhp
   Potential Capacity:           |Cp,4 =                  1486 pcph  |  Cp,1 =                    937 pcph
   Movement Capacity:            |Cm,4=Cp,4=              1486 pcph  |  Cm,1=Cp,1=                937 pcph
   Prb. of Queu-free State:      |po,4=1-v4/Cm4=          0.92       |  po,1=1-v1/Cm1=           0.97
   Major Left Shared Lane        |                                   |
     Prob. of Queue-free State   |p*o,4=                    NA       |  p*o,1=                    NA
----------------------------------------------------------------------------------------------------------
                                                                                    ----continued ----
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ATA Inc. TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS 1994 HCM

Major Street:	KULA HWY	DATE:	23-Feb-95
Minor Street:	HALEAKALA HWY	Analyst:	BC
Scenario:	EXISTING	File Name:	HALKUL-A
Peak Hour:	AM	Intesection # Intesection #:	3

STEP 3: TH FROM MINOR STREET

Conflicting Flows:	Vc.,8 = 1/2V3+V2+V1+V6+V5+V4 =	773 vph	Vc.,11 = 1/2V6+V5+V4+V3+V2+V1 =	773 vph
Potential Capacity:	Cp,8 =	429 pcph	Cp,11 =	429 pcph
Capacity Adj Factor:	f8 = po,4*po,1 =	0.89	f11 = po,4*po,1 =	0.89
Movement Capacity:	Cm,8 = Cp,8*f8 =	382 pcph	Cm,11 = Cp,11*f11 =	382 pcph
Prob. of Queue-free State:	po,8 = 1-v8/Cm,8 =	0.84	po,11 = 1-v11/Cm,11 =	0.89

STEP 4: LT FROM MINOR STREET

Conflicting Flows:	Vc,7 = 1/2V3+V2+V1+1/2V6+V5+V4+ 1/2(V11+V12) =	858 vph	Vc,10 = 1/2V6+V5+V4+1/2V3+V2+V1+ 1/2(V8+V9) =	873 vph
Potential Capacity:	Cp7 =	338 pcph	Cp10 =	331 pcph
Major Left, Minor Through Impedance Factor:	P''7=po,11*f11 =	0.79	P''10=po,8*f8 =	0.75
Major Left, Minor Through Adjusted Impedance Factor:	p'7 =	0.84	p'10 =	0.81
Capacity Adjustment Factor:	f7 = p'7*po,12 =	0.68	f10 = p'10*po,9 =	0.70
Movement Capacity:	Cm,7 = f7*Cp,7 =	231 pcph	Cm,10 = f10*Cp,10 =	231 pcph

DELAY AND LEVEL OF SERVICE SUMMARY

MOVEMENT	v(pcph)	cm(pcph)	csh(pcph)	AVG TOTAL DELAY	LOS
MINOR LEFT TURN (7)	3	231	SHRD	SHRD	--
MINOR THROUGH (8)	61	382	370	11.7	C
MINOR RIGHT TURN (9)	158	1193	--NA--	3.5	A
MINOR LEFT TURN (10)	43	231	SHRD	SHRD	--
MINOR THROUGH (11)	41	382	286	17.7	C
MINOR RIGHT TURN (12)	145	770	--NA--	5.8	B
MAJOR LEFT (1)	28	937	--NA--	4.0	A
MAJOR LEFT (4)	122	1486	--NA--	2.6	A
MINOR APPROACH (7)(8)(9)	-	-	-	5.9	B
MINOR APPROACH (10)(11)(12)	-	-	-	10.1	C
MAJOR APPROACH (1)(2)(3)	-	-	-	0.7	A
MAJOR APPROACH (4)(5)(6)	-	-	-	0.5	A
TOTAL INTERSECTION (1-12)	-	-	-	3.3	A

LEVEL OF SERVICE CRITERIA

LEVEL OF SERVICE	AVG TOTAL DELAY (SEC/VEH)
A	<=5
B	>5&<=10
C	>10&<=20
D	>20&<=30
E	>30&<=45
F	>45

ATA Inc. TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS 1994 HCM

Major Street:	KULA HWY	DATE:	23-Feb-95
Minor Street:	HALEAKALA HWY	Analyst:	BC
Scenario:	EXISTING	File Name:	HALKUL-P
Peak Hour:	PM	Intesection #:	3

```
                                  |         V12        V11        V10
    Peak Hour Factor:     1.00    |
                                  |          64         30         23          <--- NORTH
---------MAJOR STREET---------    |           |          |          |
   Num of Lanes - V2:        1    |           |          |          |
   Excl LT - V1 (Y/N):       Y    |          /           |           \
   Excl RT - V3 (Y/N):       Y    |         <            v            >
Stop/Yield - V3 (Y/N):       N    |
     Grade - V1,V2,V3:       2    |      ^                                 ^
                                  |     /                                   \
   Num of Lanes - V5:        1    | V1   63 -----                            ----    5 V6
   Excl LT - V4 (Y/N):       Y    |
   Excl RT - V6 (Y/N):       Y    | V2  327 ------->                        <----  214 V5
Stop/Yield - V6 (Y/N):       N    |
     Grade - V4,V5,V6:      -2    | V3    4 -----                            ----  107 V4
                                  |             \                          /
---------MINOR STREET---------    |              v                        v   MAJOR STREET
   Num of Lanes - V8:        1    |                                           KULA HWY
     Grade - V7,V8,V9:       0    |          <            ^            >
   Shared Lane-V7,8,9:       1    |           \           |           /
(0=N,1=LT,2=TR,3=LTR)             |            |          |          |
                                  |            |          |          |
   Num of Lanes - V11:       1    |            6         34        166
 Grade - V10,V11,V12:        0    |
Shared Lane-V10,11,12:       1    |           V7         V8         V9
(0=N,1=LT,2=TR,3=LTR)             |
                                  |        MINOR STREET - HALEAKALA HWY
```

VOLUME ADJUSTMENTS												
MOVEMENT NO.	1	2	3	4	5	6	7	8	9	10	11	12
HOURLY FLOW RATE, V(vph)	63	327	4	107	214	5	6	34	166	23	30	64
VOLUME, v (pcph)	88	327	4	107	214	5	7	37	183	25	33	70

STEP 1: RT FROM MINOR STREET				
Conflicting Flows:	Vc9 = 1/2 V3 + V2 =	327 vhp	Vc12 = 1/2 V6 + V5 =	214 vhp
Potential Capacity:	Cp,9 =	945 pcph	Cp,12 =	1079 pcph
Movement Capacity:	Cm,9=Cp,9=	945 pcph	Cm,12=Cp,12=	1079 pcph
Prb. of Queu-free State:	po,9=1-v9/Cm,9=	0.81	po,12=1-v12/Cm,12=	0.94

STEP 2: LT FROM MAJOR STREET				
Conflicting Flows:	Vc,4 = V2 + V3 =	331 vhp	Vc,1 = V5 + V6 =	219 vhp
Potential Capacity:	Cp,4 =	1192 pcph	Cp,1 =	1348 pcph
Movement Capacity:	Cm,4=Cp,4=	1192 pcph	Cm,1=Cp,1=	1348 pcph
Prb. of Queu-free State:	po,4=1-v4/Cm4=	0.91	po,1=1-v1/Cm1=	0.93
Major Left Shared Lane				
Prob. of Queue-free State	p*o,4=	NA	p*o,1=	NA

----continued ----

Major Street: KULA HWY
Minor Street: HALEAKALA HWY
Scenario: EXISTING
Peak Hour: PM

DATE: 23-Feb-95
Analyst: BC
File Name: HALKUL-P
Intesection # Intesection #: 3

STEP 3: TH FROM MINOR STREET

Conflicting Flows:	Vc.,8 = 1/2V3+V2+V1+V6+V5+V4 = 711 vph	Vc.,11 = 1/2V6+V5+V4+V3+V2+V1 = 711 vph
Potential Capacity:	Cp,8 = 462 pcph	Cp,11 = 462 pcph
Capacity Adj Factor:	f8 = po,4*po,1 = 0.85	f11 = po,4*po,1 = 0.85
Movement Capacity:	Cm,8 = Cp,8*f8 = 393 pcph	Cm,11 = Cp,11*f11 = 393 pcph
Prob. of Queue-free State:	*po,8 = 1-v8/Cm,8 = 0.91*	po,11 = 1-v11/Cm,11 = 0.92

STEP 4: LT FROM MINOR STREET

Conflicting Flows:	Vc,7 = 1/2V3+V2+V1+1/2V6+V5+V4+ 1/2(V11+V12) = 758 vph	Vc,10 = 1/2V6+V5+V4+1/2V3+V2+V1+ 1/2(V8+V9) = 811 vph
Potential Capacity:	Cp7 = 385 pcph	Cp10 = 359 pcph
Major Left, Minor Through Impedance Factor:	P''7=po,11*f11 = 0.78	P''10=po,8*f8 = 0.77
Major Left, Minor Through Adjusted Impedance Factor:	p'7 = 0.83	p'10 = 0.82
Capacity Adjustment Factor:	f7 = p'7*po,12 = 0.78	f10 = p'10*po,9 = 0.66
Movement Capacity:	Cm,7 = f7*Cp,7 = 299 pcph	Cm,10 = f10*Cp,10 = 238 pcph

DELAY AND LEVEL OF SERVICE SUMMARY

MOVEMENT	v(pcph)	cm(pcph)	csh(pcph)	AVG TOTAL DELAY	LOS
MINOR LEFT TURN (7)	7	299	SHRD	SHRD	--
MINOR THROUGH (8)	37	393	374	10.9	C
MINOR RIGHT TURN (9)	183	945	--NA--	4.7	A
MINOR LEFT TURN (10)	25	238	SHRD	SHRD	--
MINOR THROUGH (11)	33	393	307	14.4	C
MINOR RIGHT TURN (12)	70	1079	--NA--	3.6	A
MAJOR LEFT (1)	88	1348	--NA--	2.9	A
MAJOR LEFT (4)	107	1192	--NA--	3.3	A
MINOR APPROACH (7)(8)(9)	-	-	-	5.9	B
MINOR APPROACH (10)(11)(12)	-	-	-	8.5	B
MAJOR APPROACH (1)(2)(3)	-	-	-	0.6	A
MAJOR APPROACH (4)(5)(6)	-	-	-	1.1	A
TOTAL INTERSECTION (1-12)	-	-	-	2.9	A

LEVEL OF SERVICE CRITERIA

LEVEL OF SERVICE	AVG TOTAL DELAY (SEC/VEH)
A	<=5
B	>5&<=10
C	>10&<=20
D	>20&<=30
E	>30&<=45
F	>45

```
ATA Inc.        TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS                    1994 HCM
==========================================================================================================
Major Street:  KULA HWY
Minor Street:  OMAOPIO RD                                                              DATE:    27-Jun-95
    Scenario:  EXISTING                                                            Analyst:    BC
   Peak Hour:      AM                                                            File Name:    KULOMA-A
-----------------------------------------------------------------------------  Intesection #:          4
----------------------------------------------------------------------------------------------------------
                               !
    Peak Hour Factor:     1.00 !            V12        V11        V10
                               !
---------MAJOR STREET--------- !            150        22          8             <--- NORTH
       Num of Lanes - V2:    1 !             !          !          !
      Excl LT - V1 (Y/N):    N !             !          !          !
      Excl RT - V3 (Y/N):    N !            /           !           \
    Stop/Yield - V3 (Y/N):   N !           <            v            >
       Grade - V1,V2,V3:     2 !         ^                               ^
                               !        /                                 \
       Num of Lanes - V5:    1 ! V1   33 -----                             ----      6 V6
      Excl LT - V4 (Y/N):    N !
      Excl RT - V6 (Y/N):    N ! V2  192 ------->                         <----    380 V5
    Stop/Yield - V6 (Y/N):   N !
       Grade - V4,V5,V6:    -2 ! V3   15 -----                             ----      8 V4
                               !             \                            /
---------MINOR STREET--------- !              v                          v     MAJOR STREET
       Num of Lanes - V8:    1 !                                               KULA HWY
       Grade - V7,V8,V9:     0 !            <           ^          >
     Shared Lane-V7,8,9:     3 !             \          !         /
  (0=N,1=LT,2=TR,3=LTR)        !              !         !        !
                               !              !         !        !
       Num of Lanes - V11:   1 !             23          2        11
     Grade - V10,V11,V12:    0 !
    Shared Lane-V10,11,12:   3 !             V7         V8        V9
  (0=N,1=LT,2=TR,3=LTR)        !
                               !            MINOR STREET - OMAOPIO RD
----------------------------------------------------------------------------------------------------------
VOLUME ADJUSTMENTS             !
   MOVEMENT NO.                !    1   2   3    4   5    6    7    8   9    10     11    12
   HOURLY FLOW RATE, V(vph)    !   33 192  15    8 380    6   23    2  11     8     22   150
   VOLUME, v (pcph)            !   46 192  15    8 380    6   25    2  12     9     24   165
----------------------------------------------------------------------------------------------------------
STEP 1: RT FROM MINOR STREET   !                               !
   Conflicting Flows:          !Vc9 = 1/2 V3 + V2 =   200  vhp  !  Vc12 = 1/2 V6 + V5 =    383 vhp
   Potential Capacity:         !Cp,9 =                1097 pcph !  Cp,12 =                 886 pcph
   Movement Capacity:          !Cm,9=Cp,9=            1097 pcph !  Cm,12=Cp,12=            886 pcph
   Prb. of Queu-free State:    !po,9=1-v9/Cm,9=       0.99      !  po,12=1-v12/Cm,12=      0.81
----------------------------------------------------------------------------------------------------------
STEP 2: LT FROM MAJOR STREET   !                               !
   Conflicting Flows:          !Vc,4 = V2 + V3 =       207 vhp  !  Vc,1 = V5 + V6 =        386 vhp
   Potential Capacity:         !Cp,4 =                1366 pcph !  Cp,1 =                 1122 pcph
   Movement Capacity:          !Cm,4=Cp,4=            1366 pcph !  Cm,1=Cp,1=             1122 pcph
   Prb. of Queu-free State:    !po,4=1-v4/Cm4=        0.99      !  po,1=1-v1/Cm1=          0.96
   Major Left Shared Lane      !                               !
   Prob. of Queue-free State   !p*o,4=                0.99      !  p*o,1=                  0.95
----------------------------------------------------------------------------------------------------------
PAGE 1 OF 2
                                                                              ----continued ----
```

Major Street: KULA HWY
Minor Street: OMAOPIO RD
Scenario: EXISTING
Peak Hour: AM

DATE: 27-Jun-95
Analyst: BC
File Name: KULOMA-A
Intesection Intesection #: 4

STEP 3: TH FROM MINOR STREET		
Conflicting Flows:	Vc.,8 = 1/2V3+V2+V1+V6+V5+V4 : 627 vph	Vc.,11 = 1/2V6+V5+V4+V3+V2+V1 : 631 vph
Potential Capacity:	Cp,8 = 512 pcph	Cp,11 = 509 pcph
Capacity Adj Factor:	f8 = po,4*po,1 = 0.95	f11 = po,4*po,1 = 0.95
Movement Capacity:	Cm,8 = Cp,8*f8 = 484 pcph	Cm,11 = Cp,11*f11 = 482 pcph
Prob. of Queue-free State:	po,8 = 1-v8/Cm,8 = 1.00	po,11 = 1-v11/Cm,11 = 0.95

STEP 4: LT FROM MINOR STREET		
Conflicting Flows:	Vc,7 = 1/2V3+V2+V1+1/2V6+V5+V4+ 1/2(V11+V12) = 710 vph	Vc,10 = 1/2V6+V5+V4+1/2V3+V2+V1+ 1/2(V8+V9) = 630 vph
Potential Capacity:	Cp7 = 411 pcph	Cp10 = 457 pcph
Major Left, Minor Through Impedance Factor:	P''7=po,11*f11 = 0.90	P''10=po,8*f8 = 0.94
Major Left, Minor Through Adjusted Impedance Factor:	p'7 = 0.92	p'10 = 0.96
Capacity Adjustment Factor:	f7 = p'7*po,12 = 0.75	f10 = p'10*po,9 = 0.95
Movement Capacity:	Cm,7 = f7*Cp,7 = 309 pcph	Cm,10 = f10*Cp,10 = 432 pcph

DELAY AND LEVEL OF SERVICE SUMMARY

MOVEMENT	v(pcph)	cm(pcph)	csh(pcph)	AVG TOTAL DELAY	LOS
MINOR LEFT TURN (7)	25	309	SHRD	SHRD	--
MINOR THROUGH (8)	2	484	406	9.8	B
MINOR RIGHT TURN (9)	12	1097	SHRD	SHRD	----
MINOR LEFT TURN (10)	9	432	SHRD	SHRD	--
MINOR THROUGH (11)	24	482	771	6.3	B
MINOR RIGHT TURN (12)	165	886	SHRD	SHRD	--
MAJOR LEFT (1)	46	1122	--NA--	3.3	A
MAJOR LEFT (4)	8	1366	--NA--	2.7	A
MINOR APPROACH (7)(8)(9)	-	-	-	9.8	B
MINOR APPROACH (10)(11)(12)	-	-	-	6.3	B
MAJOR APPROACH (1)(2)(3)	-	-	-	0.6	A
MAJOR APPROACH (4)(5)(6)	-	-	-	0.1	A
TOTAL INTERSECTION (1-12)	-	-	-	2.1	A

LEVEL OF SERVICE CRITERIA

LEVEL OF SERVICE	AVG TOTAL DELAY (SEC/VEH)
A	<=5
B	>5&<=10
C	>10&<=20
D	>20&<=30
E	>30&<=45
F	>45

Major Street:	KULA HWY	DATE:	27-Jun-95
Minor Street:	OMAOPIO RD	Analyst:	BC
Scenario:	EXISTING	File Name:	KULOMA-P
Peak Hour:	PM	Intesection #:	4

```
                                     |        V12      V11      V10
       Peak Hour Factor:       1.00  |
                                     |        46       12        4        <--- NORTH
---------MAJOR STREET---------       |         |        |        |
    Num of Lanes - V2:            1  |         |        |        |
    Excl LT - V1 (Y/N):           N  |        /         |        \
    Excl RT - V3 (Y/N):           N  |       <          v         >
  Stop/Yield - V3 (Y/N):          N  |
      Grade - V1,V2,V3:           2  |    ^                              ^
                                     |   /                                \
    Num of Lanes - V5:            1  | V1  122 -----                       ----      3 V6
    Excl LT - V4 (Y/N):           N  |
    Excl RT - V6 (Y/N):           N  | V2  319 ------->                   <----    245 V5
  Stop/Yield - V6 (Y/N):          N  |
      Grade - V4,V5,V6:          -2  | V3   20 -----                       ----     11 V4
                                     |           \                        /
---------MINOR STREET---------       |            v                      v   MAJOR STREET
    Num of Lanes - V8:            1  |                                       KULA HWY
    Grade - V7,V8,V9:             0  |        <          ^        >
   Shared Lane-V7,8,9:            3  |         \         |       /
(0=N,1=LT,2=TR,3=LTR)                |          |        |       |
                                     |          |        |       |
    Num of Lanes - V11:           1  |          20       19      12
   Grade - V10,V11,V12:           0  |
  Shared Lane-V10,11,12:          3  |          V7       V8      V9
(0=N,1=LT,2=TR,3=LTR)                |
                                     |          MINOR STREET - OMAOPIO RD
```

VOLUME ADJUSTMENTS

MOVEMENT NO.	1	2	3	4	5	6	7	8	9	10	11	12
HOURLY FLOW RATE, V(vph)	122	319	20	11	245	3	20	19	12	4	12	46
VOLUME, v (pcph)	171	319	20	11	245	3	22	21	13	4	13	51

STEP 1: RT FROM MINOR STREET

Conflicting Flows:	Vc9 = 1/2 V3 + V2 =	329 vhp	Vc12 = 1/2 V6 + V5 =	247 vhp
Potential Capacity:	Cp,9 =	943 pcph	Cp,12 =	1039 pcph
Movement Capacity:	Cm,9=Cp,9=	943 pcph	Cm,12=Cp,12=	1039 pcph
Prb. of Queu-free State:	po,9=1-v9/Cm,9=	0.99	po,12=1-v12/Cm,12=	0.95

STEP 2: LT FROM MAJOR STREET

Conflicting Flows:	Vc,4 = V2 + V3 =	339 vhp	Vc,1 = V5 + V6 =	248 vhp
Potential Capacity:	Cp,4 =	1182 pcph	Cp,1 =	1306 pcph
Movement Capacity:	Cm,4=Cp,4=	1182 pcph	Cm,1=Cp,1=	1306 pcph
Prb. of Queu-free State:	po,4=1-v4/Cm4=	0.99	po,1=1-v1/Cm1=	0.87
Major Left Shared Lane Prob. of Queue-free State	p*o,4=	0.99	p*o,1=	0.84

----continued ----

Major Street: KULA HWY
Minor Street: OMAOPIO RD
Scenario: EXISTING
Peak Hour: PM

DATE: 27-Jun-95
Analyst: BC
File Name: KULOMA-P
Intesection Intesection #: 4

STEP 3: TH FROM MINOR STREET				
Conflicting Flows:	Vc.,8 = 1/2V3+V2+V1+V6+V5+V4 =	710 vph	Vc.,11 = 1/2V6+V5+V4+V3+V2+V1 =	719 vph
Potential Capacity:	Cp,8 =	463 pcph	Cp,11 =	458 pcph
Capacity Adj Factor:	f8 = po,4*po,1 =	0.83	f11 = po,4*po,1 =	0.83
Movement Capacity:	Cm,8 = Cp,8*f8 =	384 pcph	Cm,11 = Cp,11*f11 =	380 pcph
Prob. of Queue-free State:	po,8 = 1-v8/Cm,8 =	0.95	po,11 = 1-v11/Cm,11 =	0.97

STEP 4: LT FROM MINOR STREET				
Conflicting Flows:	Vc,7 = 1/2V3+V2+V1+1/2V6+V5+V4+ 1/2(V11+V12) =	738 vph	Vc,10 = 1/2V6+V5+V4+1/2V3+V2+V1+ 1/2(V8+V9) =	724 vph
Potential Capacity:	Cp7 =	396 pcph	Cp10 =	403 pcph
Major Left, Minor Through Impedance Factor:	P''7=po,11*f11 =	0.80	P''10=po,8*f8 =	0.79
Major Left, Minor Through Adjusted Impedance Factor:	p'7 =	0.85	p'10 =	0.83
Capacity Adjustment Factor:	f7 = p'7*po,12 =	0.81	f10 = p'10*po,9 =	0.82
Movement Capacity:	Cm,7 = f7*Cp,7 =	319 pcph	Cm,10 = f10*Cp,10 =	332 pcph

DELAY AND LEVEL OF SERVICE SUMMARY

MOVEMENT	v(pcph)	cm(pcph)	csh(pcph)	AVG TOTAL DELAY	LOS
MINOR LEFT TURN (7)	22	319	SHRD	SHRD	--
MINOR THROUGH (8)	21	384	408	10.2	C
MINOR RIGHT TURN (9)	13	943	SHRD	SHRD	----
MINOR LEFT TURN (10)	4	332	SHRD	SHRD	--
MINOR THROUGH (11)	13	380	713	5.6	B
MINOR RIGHT TURN (12)	51	1039	SHRD	SHRD	--
MAJOR LEFT (1)	171	1306	--NA--	3.2	A
MAJOR LEFT (4)	11	1182	--NA--	3.1	A
MINOR APPROACH (7)(8)(9)	-	-	-	10.2	C
MINOR APPROACH (10)(11)(12)	-	-	-	5.6	B
MAJOR APPROACH (1)(2)(3)	-	-	-	1.1	A
MAJOR APPROACH (4)(5)(6)	-	-	-	0.1	A
TOTAL INTERSECTION (1-12)	-	-	-	1.8	A

LEVEL OF SERVICE CRITERIA

LEVEL OF SERVICE	AVG TOTAL DELAY (SEC/VEH)
A	<=5
B	>5&<=10
C	>10&<=20
D	>20&<=30
E	>30&<=45
F	>45

ATA Inc. STOP CONTROLLED T-INTERSECTION LEVEL OF SERVICE ANALYSIS 1994 HCM

Major Street:	KULA HWY	Date:	27-Jun
Minor Street:	KEKAULIKE AV	Analyst:	BC
Peak Hour:	AM	File Name:	KULKEK-A
Scenario:	EXISTING	Intersection:	5

```
Peak Hour Factor:          1.00 |
--------MAJOR STREET--------    | V2    88 ----------->            <--------- 146    V5
   Num of Lanes - V2:         1 |
   Excl RT - V3 (Y/N):        N | V3    20 -----                         ----- 11     V4
   Stop/Yield - V3 (Y/N):     N |              \                      /
   % Grade - V2,V3:           2 |               v                    v     MAJOR STREET:
                                |                                          KULA HWY
   Num of Lanes - V5:         1 |                      <          >
   Excl LT - V4 (Y/N):        N |                      \         /
   % Grade - V4,V5:          -2 |                       |        |
                                |                       |        |
--------MINOR STREET--------    |                       17       53               NORTH--->
   Num of Lanes - V7,V9:      1 |
   Shared Lane (Y/N):         y |                      V7        V9
   % Grade - V7&V9:          -2 |           MINOR STREET: KEKAULIKE AV
```

VOLUME ADJUSTMENTS

MOVEMENT NO.	2	3	4	5	7	9
VOLUME, V (vph)	88	20	11	146	17	53
VOLUME, v (pcph)	88	20	11	146	17	53

STEP 1: RT FROM MINOR STREET - V9

Conflicting Flows:	Vc,9 = 1/2*V3+V2 =	10 + 88 =	98 vph
Potential Capacity:	Cp,9 =		1235 pcph
Movement Capacity:	Cm,p = Cp,9 =		1235 pcph

STEP 2: LT FROM MAJOR STREET - V4

Conflicting Flows:	Vc,4 = V3+V2 =	20 + 88 =	108 vph
Potential Capacity:	Cp,4 =		1523 pcph
Movement Capacity:	Cm,4 = Cp,4 =		1523 pcph
Prob. of Queue-free State:	po,4 = 1-v4/Cm,4 =		0.99
Major Left Shared Lane Prob. of Queue-free State:	p*o,4 =		0.99

STEP 3: LT FROM MINOR STREET - V7

Conflicting Flows:	Vc,7 = 1/2V3+V2+V5+V4 =	255 vph
Potential Capacity:	Cp,7 =	754 pcph
Capacity Adjustment Factor Due To Impeding Movements:	f7=po,4=	0.99
Movement Capacity:	Cm,7 = Cp,7 =	748 pcph

DELAY AND LEVEL OF SERVICE SUMMARY

Movement	v(vcph)	cm(pcph)	csh (pcph)	AVG TOTAL DELAY	LOS
MINOR LEFT TURN (7)	17	748	SHRD	SHRD	SHRD
MINOR RIGHT TURN (9)	53	1235	1066	3.6	A
MAJOR LEFT TURN (4)	11	1523	------	2.4	A

AVERAGE MINOR APPROACH DELAY = 3.6 sec/veh | AVERAGE TOTAL INTERSECTION DELAY = 0.8 sec/veh
LEVEL OF SERVICE = A | LEVEL OF SERVICE = A

```
ATA Inc.                  STOP CONTROLLED T-INTERSECTION LEVEL OF SERVICE ANALYSIS                    1994 HCM
=====================================================================================================================
Major Street: KULA HWY
Minor Street: KEKAULIKE AV                                                                   Date:    27-Jun
  Peak Hour:        PM                                                                    Analyst:       BC
   Scenario: EXISTING                                                                   File Name:  KULKEK-P
                                                                                     Intersection:        5
---------------------------------------------------------------------------------------------------------------------
Peak Hour Factor:       1.00 |
--------MAJOR STREET-------- | V2    114 ----------->                 <---------  126      V5
    Num of Lanes - V2:     1 |
   Excl RT - V3 (Y/N):     N | V3     20 -----                              -----  11      V4
 Stop/Yield - V3 (Y/N):    N |               \                         /
       % Grade - V2,V3:    2 |                v                       v      MAJOR STREET:
                             |                                                KULA HWY
    Num of Lanes - V5:     1 |                          <          >
   Excl LT - V4 (Y/N):     N |                           \        /
      % Grade - V4,V5:    -2 |                            |       |
                             |                            |       |
--------MINOR STREET-------- |                            19      33                        NORTH-->
Num of Lanes - V7,V9:      1 |
   Shared Lane (Y/N):      y |                          V7       V9
      % Grade - V7&V9:    -2 |                  MINOR STREET: KEKAULIKE AV
---------------------------------------------------------------------------------------------------------------------
VOLUME ADJUSTMENTS
 MOVEMENT NO.                    2          3            4            5          7          9
 VOLUME, V (vph)               114         20           11          126         19         33
 VOLUME, v (pcph)              114         20           11          126         19         33
---------------------------------------------------------------------------------------------------------------------
STEP 1: RT FROM MINOR STREET - V9
  Conflicting Flows:      | Vc,9 = 1/2*V3+V2 =          10  +   114      =        124   vph
  Potential Capacity:     | Cp,9 =                                               1198   pcph
  Movement Capacity:      | Cm,p = Cp,9 =                                        1198   pcph
---------------------------------------------------------------------------------------------------------------------
STEP 2: LT FROM MAJOR STREET - V4
  Conflicting Flows:              |  Vc,4 = V3+V2 =          20  +  114  =         134   vph
  Potential Capacity:             |  Cp,4 =                                        1480  pcph
  Movement Capacity:              |  Cm,4 = Cp,4 =                                 1480  pcph
  Prob. of Queue-free State:      |  po,4 = 1-v4/Cm,4 =                            0.99
  Major Left Shared Lane          |
   Prob. of Queue-free State:     |  p*o,4 =                                       0.99
---------------------------------------------------------------------------------------------------------------------
STEP 3: LT FROM MINOR STREET - V7
  Conflicting Flows:              |  Vc,7 = 1/2V3+V2+V5+V4 =                        261   vph
  Potential Capacity:             |  Cp,7 =                                         748  pcph
  Capacity Adjustment Factor      |
   Due To Impeding Movements:     |  f7=po,4=                                      0.99
  Movement Capacity:              |  Cm,7 = Cp,7 =                                  742  pcph
---------------------------------------------------------------------------------------------------------------------
DELAY AND LEVEL OF SERVICE SUMMARY
     Movement                 v(vcph)        cm(pcph)       csh     AVG TOTAL
                                                          (pcph)     DELAY       LOS
  ------------              -----------     --------      ------     -----      ------
  MINOR LEFT TURN   (7)          19            742         SHRD       SHRD       SHRD
  MINOR RIGHT TURN  (9)          33           1198          978        3.9         A
  MAJOR LEFT TURN   (4)          11           1480        ------       2.5         A
---------------------------------------------------------------------------------------------------------------------
     AVERAGE MINOR APPROACH DELAY :   3.9 sec/veh  |  AVERAGE TOTAL INTERSECTION DELAY :   0.7 sec/veh
                 LEVEL OF SERVICE :    A           |                  LEVEL OF SERVICE :   A
=====================================================================================================================
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ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

YEAR 2005 BASE LOS CALCULATIONS

KULA RESIDENT LOTS 02/27/95
YEAR 2005 BASE 09:59:06
AM PEAK HOUR

SIGNAL94/TEAPAC[V1 L1.0] - Summary of Parameter Values

Intersection Parameters for Int # 1 - HANA HWY & HALEAKALA HWY

METROAREA	NONCBD	
LOSTTIME	2.0	
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	LOW	LOW	LOW	LOW
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	10	902	17	115	100	2344	395	316	66	10	30	29
WIDTHS	12.0	22.0	11.0	12.0	11.0	11.0	12.0	22.0	11.0	12.0	11.0	.0
LANES	1	2	1	1	1	1	1	2	1	1	1	0
UTILIZATIONS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	YES	NO	YES	YES	NO	NO	YES	NO	YES	YES
REQCLEARANCES	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	FFLW	NORM	NORM	FFLW	NORM	DOPT	FFLW	NORM	NORM	FFLW	NORM	NORM
SATURATIONFLOWS	0	3601	763	0	1721	1711	0	3601	390	0	624	0

Phasing Parameters

SEQUENCES	17	ALL					
PERMISSIVES	YES	YES	YES	YES	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	.00	1
CYCLES	60	180	10		PEDTIME	.0	0
GREENTIMES	16.48	24.92	6.60				
YELLOWTIMES	4.00	4.00	4.00				
CRITICALS	2	6	11				
EXCESS	0						

KULA RESIDENT LOTS   02/27/95
YEAR 2005 BASE   09:59:13
AM PEAK HOUR

SIGNAL94/TEAPAC[V1 L1.0] - Capacity Analysis Summary

Intersection Averages for Int # 1 - HANA HWY & HALEAKALA HWY
Degree of Saturation (v/c) 1.26 Vehicle Delay 28.8 Level of Service D+

```
        ------------------------------------
Sq 17 ¦  Phase 1  ¦  Phase 2  ¦  Phase 3  ¦
**/** ------------------------------------
      ¦   * +     ¦           ¦           ¦
  .   ¦   * +     ¦           ¦           ¦
 /¦\  ¦   * +>    ¦    <++++¦ ¦           ¦
  ¦   ¦   v       ¦     ****¦ ¦  ^        ¦
  ¦   ¦      ^    ¦      v    ¦****       ¦
North ¦    <+ +   ¦           ¦****>      ¦
  ¦   ¦     + +   ¦           ¦           ¦
      ¦     + +   ¦           ¦           ¦
      ------------------------------------
      ¦ G/C= .275 ¦ G/C= .415 ¦ G/C= .110 ¦
      ¦ G= 16.5"  ¦ G= 24.9"  ¦ G=   6.6" ¦
      ¦ Y+R= 4.0" ¦ Y+R= 4.0" ¦ Y+R= 4.0" ¦
      ¦ OFF=  .0% ¦ OFF=34.1% ¦ OFF=82.3% ¦
      ------------------------------------
```

C= 60 sec   G= 48.0 sec = 80.0%   Y=12.0 sec = 20.0%   Ped= .0 sec = .0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								17.7	C+	
TH	22/2	.274	.308	1031	1109	902	.813	17.9	*C+	263 ft
LT	11/1	.000	.308	191	235	17	.072	9.5	B+	25 ft
NB Approach								12.5	B	
TH	22/2	.116	.308	1031	1109	316	.285	12.0	B	92 ft
LT	11/1	.000	.308	88	114	66	.550	15.1	C+	39 ft
WB Approach								35.6	D	
TH	11/1-	.722	.449	730	772	1253	1.623	35.6	D	583 ft
LT	11/1+	.699	.449	725	767	1191	1.553	35.7	*D	554 ft
EB Approach								26.1	D+	
LT+TH	11/1	.147	.143	58	81	59	.656	26.1	*D+	43 ft

KULA RESIDENT LOTS
YEAR 2005 BASE
PM PEAK HOUR

02/27/95
10:15:23

SIGNAL94/TEAPAC[V1 L1.0] - Summary of Parameter Values

Intersection Parameters for Int # 1 - HANA HWY & HALEAKALA HWY

METROAREA	NONCBD	
LOSTTIME	2.0	
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	LOW	LOW	LOW	LOW
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	33	488	37	58	36	568	1833	934	15	29	134	51
WIDTHS	12.0	22.0	11.0	12.0	11.0	11.0	12.0	22.0	11.0	12.0	11.0	.0
LANES	1	2	1	1	1	1	1	2	1	1	1	0
UTILIZATIONS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	YES	NO	YES	YES	NO	NO	YES	NO	YES	YES
REQCLEARANCES	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	FFLW	NORM	NORM	FFLW	NORM	DOPT	FFLW	NORM	NORM	FFLW	NORM	NORM
SATURATIONFLOWS	0	3601	320	0	1724	1711	0	3601	509	0	1258	0

Phasing Parameters

SEQUENCES	17	ALL					
PERMISSIVES	YES	YES	YES	YES	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	.00	1
CYCLES	60	180	10		PEDTIME	.0	0
GREENTIMES	20.54	15.17	12.30				
YELLOWTIMES	4.00	4.00	4.00				
CRITICALS	8	5	11				
EXCESS	0						

KULA RESIDENT LOTS 02/27/95
YEAR 2005 BASE 10:15:28
PM PEAK HOUR

SIGNAL94/TEAPAC[V1 L1.0] - Capacity Analysis Summary

Intersection Averages for Int # 1 - HANA HWY & HALEAKALA HWY
Degree of Saturation (v/c) .58 Vehicle Delay 12.8 Level of Service B

```
      ------------------------------------
Sq 17 | Phase 1  | Phase 2  | Phase 3  |
**/** ------------------------------------
      |   + +    |          |          |
  *   |   + +    |          |          |
 /|\  |   + +>   |    <****|          |
  |   |   v      |     ++++|  ^       |
  |   |      ^   |     v   |****      |
North |    <+ *  |          |****>     |
  |   |     + *  |          |          |
      |     + *  |          |          |
      ------------------------------------
      | G/C= .342 | G/C= .253 | G/C= .205 |
      | G=  20.5" | G=  15.2" | G=  12.3" |
      | Y+R= 4.0" | Y+R= 4.0" | Y+R= 4.0" |
      | OFF=  .0% | OFF=40.9% | OFF=72.8% |
      ------------------------------------
      C= 60 sec  G= 48.0 sec = 80.0%  Y=12.0 sec = 20.0%  Ped=  .0 sec =   .0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								10.3	B	
TH	22/2	.164	.376	1293	1353	488	.361	10.4	B	128 ft
LT	11/1	.000	.376	90	114	37	.308	9.0	B+	25 ft
NB Approach								13.0	B	
TH	22/2	.283	.376	1293	1353	934	.690	13.1	*B	246 ft
LT	11/1	.000	.376	154	190	15	.079	7.8	B+	25 ft
WB Approach								13.6	B	
TH	11/1-	.215	.286	435	493	310	.629	13.9	*B	187 ft
LT	11/1+	.207	.286	431	489	294	.601	13.4	B	177 ft
EB Approach								15.9	C+	
LT+TH	11/1	.190	.238	246	300	185	.617	15.9	*C+	119 ft

KULA RESIDENT LOTS
YEAR 2005 BASE
AM PEAK HOUR

02/27/95
10:35:48

SIGNAL94/TEAPAC[V1 L1.0] - Summary of Parameter Values

Intersection Parameters for Int # 2 - PUKALANI BYPASS & MAKAWAO AV

METROAREA	NONCBD	
LOSTTIME	2.0	
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	2.0	.0	-2.0	.0
PEDLEVELS	LOW	LOW	LOW	LOW
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	10	45	20	5

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	81	52	10	457	263	349	210	909	9	6	202	16
WIDTHS	12.0	24.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
LANES	1	2	1	1	1	1	1	1	1	1	1	1
UTILIZATIONS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	YES	YES	YES	YES	NO	NO	YES	YES	YES	YES
REQCLEARANCES	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1524	3688	237	1539	1863	1770	1554	1881	1543	1539	1863	863

Phasing Parameters

SEQUENCES	12	ALL					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	.00	1
CYCLES	60	120	30		PEDTIME	.0	0
GREENTIMES	29.10	12.27	6.63				
YELLOWTIMES	4.00	4.00	4.00				
CRITICALS	8	6	11				
EXCESS	0						

KULA RESIDENT LOTS
YEAR 2005 BASE
AM PEAK HOUR

02/27/95
10:35:58

SIGNAL94/TEAPAC[V1 L1.0] - Capacity Analysis Summary

Intersection Averages for Int # 2 - PUKALANI BYPASS & MAKAWAO AV
Degree of Saturation (v/c) .68 Vehicle Delay 16.0 Level of Service C+

```
       -------------------------------------
Sq 12 | Phase 1  |  Phase 2  |  Phase 3  |
**/** -------------------------------------
      | + + +    |        ^  |        ^  |
   .  | + + +    |     ++++|     ++++|
  /|\ |<+ + +>   |    <++++|    <++++|
   |  |   v      |     ****|   ^       |
   |  |      ^   |     v   |++++       |
North |    <+ * +>|      +>|****>      |
   |  |     + * +|       + |++++       |
      |     + * +|       + |  v        |
       -------------------------------------
      | G/C= .485 | G/C= .204 | G/C= .111 |
      | G=  29.1" | G=  12.3" | G=   6.6" |
      | Y+R= 4.0" | Y+R= 4.0" | Y+R= 4.0" |
      | OFF=  .0% | OFF=55.2% | OFF=82.3% |
       -------------------------------------
      C= 60 sec   G= 48.0 sec = 80.0%  Y=12.0 sec = 20.0%  Ped=  .0 sec =   .0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								5.4	B+	
RT	12/1	.080	.518	748	790	71	.090	5.5	B+	29 ft
TH	24/2	.028	.518	1896	1912	52	.027	5.4	B+	25 ft
LT	12/1	.000	.518	96	119	10	.081	4.7	A	25 ft
NB Approach								17.7	C+	
RT	12/1	.166	.789	1227	1227	190	.155	1.2	A	34 ft
TH	12/1	.506	.518	936	975	909	.932	21.3	*C	369 ft
LT	12/1	.000	.518	766	800	9	.011	4.5	A	25 ft
WB Approach								14.1	B	
RT	12/1	.304	.415	593	639	412	.645	10.6	B	203 ft
TH	12/1	.175	.415	728	773	263	.340	7.8	B+	130 ft
LT	12/1	.232	.238	360	421	349	.829	23.0	*C	224 ft
EB Approach								23.0	C	
RT	12/1	.002	.144	167	219	1	.005	14.2	B	25 ft
TH	12/1	.140	.144	208	268	202	.754	23.7	*C	146 ft
LT	12/1	.000	.144	85	116	16	.129	14.5	B	25 ft

KULA RESIDENT LOTS 02/27/95
YEAR 2005 BASE 10:46:33
PM PEAK HOUR

SIGNAL94/TEAPAC[V1 L1.0] - Summary of Parameter Values

Intersection Parameters for Int # 2 - PUKALANI BYPASS & MAKAWAO AV

METROAREA	NONCBD	
LOSTTIME	2.0	
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	2.0	.0	-2.0	.0
PEDLEVELS	LOW	LOW	LOW	LOW
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	5	10	30	5

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	67	351	362	115	307	192	279	213	9	16	258	12
WIDTHS	12.0	24.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
LANES	1	2	1	1	1	1	1	1	1	1	1	1
UTILIZATIONS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	YES	YES	YES	YES	NO	NO	YES	YES	YES	YES
REQCLEARANCES	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1524	3688	993	1539	1863	788	1554	1881	888	1539	1863	658

Phasing Parameters

SEQUENCES	11	ALL					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	.00	1
CYCLES	60	120	30		PEDTIME	.0	0
GREENTIMES	30.23	21.77					
YELLOWTIMES	4.00	4.00					
CRITICALS	3	6					
EXCESS	0						

KULA RESIDENT LOTS
YEAR 2005 BASE
PM PEAK HOUR

02/27/95
10:46:42

SIGNAL94/TEAPAC[V1 L1.0] - Capacity Analysis Summary

Intersection Averages for Int # 2 - PUKALANI BYPASS & MAKAWAO AV
Degree of Saturation (v/c) .37 Vehicle Delay 7.6 Level of Service B+

```
      -------------------------
Sq 11 |  Phase 1  |  Phase 2  |
**/** -------------------------
      | + + *     |       ^   |
  .   | + + *     |      ++++ |
 /|\  |<+ + *>    |     <++++ |
  |   |  v        |    ^  ****|
  |   |       ^   |++++   v   |
North |   <+ + +> |++++>      |
  |   |    + + +  |++++       |
      |    + + +  |  v        |
      -------------------------
      | G/C= .504 | G/C= .363 |
      | G=  30.2" | G=  21.8" |
      | Y+R= 4.0" | Y+R= 4.0" |
      | OFF=  .0% | OFF=57.1% |
      -------------------------
      C= 60 sec   G= 52.0 sec = 86.7%  Y= 8.0 sec = 13.3%  Ped=  .0 sec =   .0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								7.0	B+	
RT	12/1	.073	.537	778	818	62	.076	5.1	B+	25 ft
TH	24/2	.123	.537	1971	1981	351	.177	5.4	B+	68 ft
LT	12/1	.411	.537	496	533	362	.679	9.0	*B+	141 ft
NB Approach								5.7	B+	
RT	12/1	.206	.537	796	835	249	.298	5.9	B+	97 ft
TH	12/1	.153	.537	975	1011	213	.211	5.5	B+	83 ft
LT	12/1	.000	.537	440	477	9	.019	4.2	A	25 ft
WB Approach								9.5	B+	
RT	12/1	.099	.396	562	610	105	.172	7.6	B+	53 ft
TH	12/1	.198	.396	690	738	307	.416	8.7	B+	156 ft
LT	12/1	.302	.396	269	312	192	.615	11.9	*B	98 ft
EB Approach								8.2	B+	
RT	12/1	.017	.396	562	610	11	.018	7.1	B+	25 ft
TH	12/1	.172	.396	690	738	258	.350	8.3	B+	131 ft
LT	12/1	.000	.396	220	261	12	.046	7.2	B+	25 ft

KULA RESIDENT LOTS
YEAR 2005 BASE 02/27/95
AM PEAK HOUR 11:09:50

SIGNAL94/TEAPAC[V1 L1.0] - Summary of Parameter Values

Intersection Parameters for Int # 3 - BYPASS/KULA HWY & HALEAKALA

METROAREA	NONCBD	
LOSTTIME	2.0	
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	2.0	.0	-2.0	.0
PEDLEVELS	LOW	LOW	LOW	LOW
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	15	5	25

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	2	342	66	171	46	60	71	649	160	257	72	3
WIDTHS	12.0	12.0	12.0	12.0	12.0	.0	12.0	12.0	12.0	12.0	12.0	.0
LANES	1	1	1	1	1	0	1	1	1	1	1	0
UTILIZATIONS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
REQCLEARANCES	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1524	1844	301	1539	1557	0	1554	1881	1787	1539	1846	0

Phasing Parameters

SEQUENCES	31	ALL		
PERMISSIVES	NO	NO	NO	NO
OVERLAPS	YES	YES	YES	YES
CYCLES	60	120	30	
GREENTIMES	11.87	22.51	13.62	
YELLOWTIMES	4.00	4.00	4.00	
CRITICALS	9	2	4	
EXCESS	0			

LEADLAGS	NONE	NONE
OFFSET	.00	1
PEDTIME	.0	0

KULA RESIDENT LOTS
YEAR 2005 BASE
AM PEAK HOUR

02/27/95
11:09:59

SIGNAL94/TEAPAC[V1 L1.0] - Capacity Analysis Summary

Intersection Averages for Int # 3 - BYPASS/KULA HWY & HALEAKALA
Degree of Saturation (v/c) .41 Vehicle Delay 8.4 Level of Service B+

```
       ----------------------------------
Sq 31 | Phase 1  | Phase 2  | Phase 3  |
**/** ----------------------------------
      |          | + * +    |        ^ |
  .   |          | + * +    |     ****|
 /|\  |          |<+ * +>   |    <++++|
  |   |          |   v      |   ^  ++++|
  |   |        ^ |       ^  |++++   v  |
North |   <* + +>|     + +> |++++>     |
  |   |++++ * + +|      + + |++++      |
      |   v * + +|      + + |  v       |
      ----------------------------------
      | G/C= .198 | G/C= .375 | G/C= .227 |
      | G=  11.9" | G=  22.5" | G=  13.6" |
      | Y+R= 4.0" | Y+R= 4.0" | Y+R= 4.0" |
      | OFF=  .0% | OFF=26.5% | OFF=70.6% |
      ----------------------------------
```

C= 60 sec G= 48.0 sec = 80.0% Y=12.0 sec = 20.0% Ped= .0 sec = .0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								10.7	B	
RT	12/1	.006	.409	565	622	2	.003	8.0	B+	25 ft
TH	12/1	.227	.409	695	753	342	.454	10.1	*B	171 ft
LT	12/1	.053	.409	91	117	66	.537	13.7	B	33 ft
NB Approach								5.9	B+	
RT	12/1	.075	.673	1028	1046	66	.063	2.5	A	25 ft
TH	12/1	.378	.673	1256	1266	649	.513	4.0	A	179 ft
LT	12/1	.128	.231	338	413	160	.387	15.1	*C+	104 ft
WB Approach								13.9	B	
RT	12/1	.145	.260	332	401	156	.389	14.2	*B	97 ft
LT+TH	12/1	.106	.260	335	405	106	.262	13.5	B	66 ft
EB Approach								7.8	B+	
RT	12/1	.197	.525	767	808	232	.287	6.1	B+	93 ft
LT+TH	12/1	.070	.260	407	481	75	.156	13.0	B	47 ft

KULA RESIDENT LOTS
YEAR 2005 BASE
PM PEAK HOUR

02/27/95
11:12:44

SIGNAL94/TEAPAC[V1 L1.0] - Summary of Parameter Values

Intersection Parameters for Int # 3 - BYPASS/KULA HWY & HALEAKALA

METROAREA	NONCBD	
LOSTTIME	2.0	
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters.

APPLABELS	SB	WB	NB	EB
GRADES	2.0	.0	-2.0	.0
PEDLEVELS	LOW	LOW	LOW	LOW
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	10	5	25

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	5	447	88	111	41	42	17	381	184	225	42	7
WIDTHS	12.0	12.0	12.0	12.0	12.0	.0	12.0	12.0	12.0	12.0	12.0	.0
LANES	1	1	1	1	1	0	1	1	1	1	1	0
UTILIZATIONS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
REQCLEARANCES	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1524	1844	584	1539	1661	0	1554	1881	1787	1539	1799	0

Phasing Parameters

SEQUENCES	31	ALL					
PERMISSIVES	NO	NO	NO	NO	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	.00	1
CYCLES	60	120	30		PEDTIME	.0	0
GREENTIMES	12.25	26.12	9.62				
YELLOWTIMES	4.00	4.00	4.00				
CRITICALS	9	2	5				
EXCESS	0						

KULA RESIDENT LOTS
YEAR 2005 BASE
PM PEAK HOUR

02/27/95
11:12:53

SIGNAL94/TEAPAC[V1 L1.0] - Capacity Analysis Summary

Intersection Averages for Int # 3 - BYPASS/KULA HWY & HALEAKALA
Degree of Saturation (v/c) .36 Vehicle Delay 8.7 Level of Service B+

```
      ------------------------------------
Sq 31 | Phase 1  | Phase 2  | Phase 3  |
**/** ------------------------------------
      |          | + * +    |        ^ |
  .   |          | + * +    |      ++++|
 /|\  |          |(+ * +>   |     (****|
  |   |          |   v      |   ^  ****|
  |   |       ^  |       ^  |++++   v  |
North |   <* + +>|     + +> |++++>     |
  |   |++++ * + +|     + +  |++++      |
      |   v * + +|     + +  |  v       |
      ------------------------------------
      | G/C= .204 | G/C= .435 | G/C= .160 |
      | G=  12.3" | G=  26.1" | G=   9.6" |
      | Y+R= 4.0" | Y+R= 4.0" | Y+R= 4.0" |
      | OFF=  .0% | OFF=27.1% | OFF=77.3% |
      ------------------------------------
      C= 60 sec  G= 48.0 sec = 80.0%  Y=12.0 sec = 20.0%  Ped:  .0 sec =   .0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								8.7	B+	
RT	12/1	.011	.469	665	714	5	.007	6.5	B+	25 ft
TH	12/1	.282	.469	816	864	447	.517	9.0	*B+	200 ft
LT	12/1	.222	.469	232	274	88	.321	7.8	B+	39 ft
NB Approach								6.2	B+	
RT	12/1	.021	.740	1144	1150	12	.010	1.6	A	25 ft
TH	12/1	.243	.740	1391	1391	381	.274	2.0	A	84 ft
LT	12/1	.143	.238	350	425	184	.433	15.2	*C+	118 ft
WB Approach								15.9	C+	
RT	12/1	.104	.194	228	298	101	.339	16.1	C+	69 ft
LT+TH	12/1	.083	.194	250	322	83	.258	15.7	*C+	56 ft
EB Approach								9.1	B+	
RT	12/1	.175	.465	665	715	200	.280	7.6	B+	90 ft
LT+TH	12/1	.053	.194	274	349	49	.140	15.2	C+	33 ft

Major Street:	KULA HWY	DATE:	27-Jun-95
Minor Street:	OMAOPIO RD	Analyst:	BC
Scenario:	YEAR 2005 BASE	File Name:	KULOMA-A
Peak Hour:	AM	Intesection #:	4

```
                                   !          V12      V11      V10
     Peak Hour Factor:      1.00   !
                                   !          173       25        9         <--- NORTH
---------MAJOR STREET---------     !           !         !        !
     Num of Lanes - V2:        1   !           !         !        !
     Excl LT - V1 (Y/N):       N   !           /         !        \
     Excl RT - V3 (Y/N):       N   !          <          v         >
  Stop/Yield - V3 (Y/N):       N   !
     Grade - V1,V2,V3:         2   !       ^                              ^
                                   !      /                                \
     Num of Lanes - V5:        1   ! V1   38 -----                     ----       7 V6
     Excl LT - V4 (Y/N):       N   !
     Excl RT - V6 (Y/N):       N   ! V2  222 ------->                 <----     439 V5
  Stop/Yield - V6 (Y/N):       N   !
     Grade - V4,V5,V6:        -2   ! V3   17 -----                     ----       9 V4
                                   !           \                       /
---------MINOR STREET---------     !            v                     v    MAJOR STREET
     Num of Lanes - V8:        1   !                                        KULA HWY
     Grade - V7,V8,V9:         0   !          <          ^         >
     Shared Lane-V7,8,9:       3   !           \         !        /
(0=N,1=LT,2=TR,3=LTR)              !           !         !        !
                                   !           !         !        !
     Num of Lanes - V11:       1   !           27        2        13
     Grade - V10,V11,V12:      0   !
Shared Lane-V10,11,12:         3   !           V7        V8       V9
(0=N,1=LT,2=TR,3=LTR)              !
                                   !        MINOR STREET - OMAOPIO RD
```

VOLUME ADJUSTMENTS												
MOVEMENT NO.	1	2	3	4	5	6	7	8	9	10	11	12
HOURLY FLOW RATE, V(vph)	38	222	17	9	439	7	27	2	13	9	25	173
VOLUME, v (pcph)	53	222	17	9	439	7	30	2	14	10	28	190

STEP 1: RT FROM MINOR STREET				
Conflicting Flows:	Vc9 = 1/2 V3 + V2 =	231 vhp	Vc12 = 1/2 V6 + V5 =	443 vhp
Potential Capacity:	Cp,9 =	1058 pcph	Cp,12 =	826 pcph
Movement Capacity:	Cm,9=Cp,9=	1058 pcph	Cm,12=Cp,12=	826 pcph
Prb. of Queu-free State:	po,9=1-v9/Cm,9=	0.99	po,12=1-v12/Cm,12=	0.77

STEP 2: LT FROM MAJOR STREET				
Conflicting Flows:	Vc,4 = V2 + V3 =	239 vhp	Vc,1 = V5 + V6 =	446 vhp
Potential Capacity:	Cp,4 =	1319 pcph	Cp,1 =	1051 pcph
Movement Capacity:	Cm,4=Cp,4=	1319 pcph	Cm,1=Cp,1=	1051 pcph
Prb. of Queu-free State:	po,4=1-v4/Cm4=	0.99	po,1=1-v1/Cm1=	0.95
Major Left Shared Lane Prob. of Queue-free State	p*o,4=	0.99	p*o,1=	0.94

----continued ----

Major Street: KULA HWY
Minor Street: OMAOPIO RD
Scenario: YEAR 2005 BASE
Peak Hour: AM

DATE: 27-Jun-95
Analyst: BC
File Name: KULOMA-A
Intesection Intesection #: 4

STEP 3: TH FROM MINOR STREET		
Conflicting Flows:	Vc.,8 = 1/2V3+V2+V1+V6+V5+V4 = 724 vph	Vc.,11 = 1/2V6+V5+V4+V3+V2+V1 = 729 vph
Potential Capacity:	Cp,8 = 455 pcph	Cp,11 = 452 pcph
Capacity Adj Factor:	f8 = po,4*po,1 = 0.93	f11 = po,4*po,1 = 0.93
Movement Capacity:	Cm,8 = Cp,8*f8 = 425 pcph	Cm,11 = Cp,11*f11 = 422 pcph
Prob. of Queue-free State:	po,8 = 1-v8/Cm,8 = 1.00	po,11 = 1-v11/Cm,11 = 0.93

STEP 4: LT FROM MINOR STREET		
Conflicting Flows:	Vc,7 = 1/2V3+V2+V1+1/2V6+V5+V4+ 1/2(V11+V12) = 819 vph	Vc,10 = 1/2V6+V5+V4+1/2V3+V2+V1+ 1/2(V8+V9) = 728 vph
Potential Capacity:	Cp7 = 355 pcph	Cp10 = 401 pcph
Major Left, Minor Through Impedance Factor:	p''7=po,11*f11 = 0.87	p''10=po,8*f8 = 0.93
Major Left, Minor Through Adjusted Impedance Factor:	p'7 = 0.90	p'10 = 0.95
Capacity Adjustment Factor:	f7 = p'7*po,12 = 0.69	f10 = p'10*po,9 = 0.93
Movement Capacity:	Cm,7 = f7*Cp,7 = 247 pcph	Cm,10 = f10*Cp,10 = 375 pcph

DELAY AND LEVEL OF SERVICE SUMMARY

MOVEMENT	v(pcph)	cm(pcph)	csh(pcph)	AVG TOTAL DELAY	LOS
MINOR LEFT TURN (7)	30	247	SHRD	SHRD	--
MINOR THROUGH (8)	2	425	330	12.7	C
MINOR RIGHT TURN (9)	14	1058	SHRD	SHRD	----
MINOR LEFT TURN (10)	10	375	SHRD	SHRD	--
MINOR THROUGH (11)	28	422	706	7.5	B
MINOR RIGHT TURN (12)	190	826	SHRD	SHRD	--
MAJOR LEFT (1)	53	1051	--NA--	3.6	A
MAJOR LEFT (4)	9	1319	--NA--	2.7	A
MINOR APPROACH (7)(8)(9)	-	-	-	12.7	C
MINOR APPROACH (10)(11)(12)	-	-	-	7.5	B
MAJOR APPROACH (1)(2)(3)	-	-	-	0.7	A
MAJOR APPROACH (4)(5)(6)	-	-	-	0.1	A
TOTAL INTERSECTION (1-12)	-	-	-	2.6	A

LEVEL OF SERVICE CRITERIA

LEVEL OF SERVICE	AVG TOTAL DELAY (SEC/VEH)
A	<=5
B	>5&<=10
C	>10&<=20
D	>20&<=30
E	>30&<=45
F	>45

Major Street:	KULA HWY	DATE:	27-Jun-95
Minor Street:	OMAOPIO RD	Analyst:	BC
Scenario:	YEAR 2005 BASE	File Name:	KULOMA-P
Peak Hour:	PM	Intesection #:	4

```
                                  |          V12      V11       V10
     Peak Hour Factor:      1.00  |
                                  |           53       14         5          <--- NORTH
---------MAJOR STREET---------    |            |        |         |
   Num of Lanes - V2:          1  |            |        |         |
   Excl LT - V1 (Y/N):         N  |           /         |          \
   Excl RT - V3 (Y/N):         N  |          <          v           >
 Stop/Yield - V3 (Y/N):        N  |
     Grade - V1,V2,V3:         2  |       ^                             ^
                                  |      /                               \
   Num of Lanes - V5:          1  | V1  141 -----                       ----      3 V6
   Excl LT - V4 (Y/N):         N  |
   Excl RT - V6 (Y/N):         N  | V2  368 ------->                  <----    283 V5
 Stop/Yield - V6 (Y/N):        N  |
     Grade - V4,V5,V6:        -2  | V3   23 -----                       ----     13 V4
                                  |              \                     /
---------MINOR STREET---------    |               v                   v     MAJOR STREET
   Num of Lanes - V8:          1  |                                         KULA HWY
     Grade - V7,V8,V9:         0  |           <         ^          >
   Shared Lane-V7,8,9:         3  |            \        |         /
(0=N,1=LT,2=TR,3=LTR)             |             |       |        |
                                  |             |       |        |
   Num of Lanes - V11:         1  |            23      22       14
  Grade - V10,V11,V12:         0  |
Shared Lane-V10,11,12:         3  |            V7      V8       V9
(0=N,1=LT,2=TR,3=LTR)             |
                                  |        MINOR STREET - OMAOPIO RD
```

VOLUME ADJUSTMENTS												
MOVEMENT NO.	1	2	3	4	5	6	7	8	9	10	11	12
HOURLY FLOW RATE, V(vph)	141	368	23	13	283	3	23	22	14	5	14	53
VOLUME, v (pcph)	197	368	23	13	283	3	25	24	15	6	15	58

STEP 1: RT FROM MINOR STREET				
Conflicting Flows:	Vc9 = 1/2 V3 + V2 =	380 vhp	Vc12 = 1/2 V6 + V5 =	285 vhp
Potential Capacity:	Cp,9 =	889 pcph	Cp,12 =	994 pcph
Movement Capacity:	Cm,9=Cp,9=	889 pcph	Cm,12=Cp,12=	994 pcph
Prb. of Queu-free State:	po,9=1-v9/Cm,9=	0.98	po,12=1-v12/Cm,12=	0.94

STEP 2: LT FROM MAJOR STREET				
Conflicting Flows:	Vc,4 = V2 + V3 =	391 vhp	Vc,1 = V5 + V6 =	286 vhp
Potential Capacity:	Cp,4 =	1116 pcph	Cp,1 =	1253 pcph
Movement Capacity:	Cm,4=Cp,4=	1116 pcph	Cm,1=Cp,1=	1253 pcph
Prb. of Queu-free State:	po,4=1-v4/Cm4=	0.99	po,1=1-v1/Cm1=	0.84
Major Left Shared Lane				
Prob. of Queue-free State	p*o,4=	0.99	p*o,1=	0.80

----continued ----

ATA Inc. TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS 1994 HCM

Major Street: KULA HWY
Minor Street: OMAOPIO RD
Scenario: YEAR 2005 BASE
Peak Hour: PM

DATE: 27-Jun-95
Analyst: BC
File Name: KULOMA-P
Intesection Intesection #: 4

STEP 3: TH FROM MINOR STREET		
Conflicting Flows:	Vc.,8 = 1/2V3+V2+V1+V6+V5+V4 = 820 vph	Vc.,11 = 1/2V6+V5+V4+V3+V2+V1 = 830 vph
Potential Capacity:	Cp,8 = 405 pcph	Cp,11 = 400 pcph
Capacity Adj Factor:	f8 = po,4*po,1 = 0.79	f11 = po,4*po,1 = 0.79
Movement Capacity:	Cm,8 = Cp,8*f8 = 320 pcph	Cm,11 = Cp,11*f11 = 316 pcph
Prob. of Queue-free State:	po,8 = 1-v8/Cm,8 = 0.92	po,11 = 1-v11/Cm,11 = 0.95

STEP 4: LT FROM MINOR STREET		
Conflicting Flows:	Vc,7 = 1/2V3+V2+V1+1/2V6+V5+V4+ 1/2(V11+V12) = 852 vph	Vc,10 = 1/2V6+V5+V4+1/2V3+V2+V1+ 1/2(V8+V9) = 836 vph
Potential Capacity:	Cp7 = 340 pcph	Cp10 = 347 pcph
Major Left, Minor Through Impedance Factor:	P''7=po,11*f11 = 0.75	P''10=po,8*f8 = 0.73
Major Left, Minor Through Adjusted Impedance Factor:	p'7 = 0.81	p'10 = 0.79
Capacity Adjustment Factor:	f7 = p'7*po,12 = 0.76	f10 = p'10*po,9 = 0.78
Movement Capacity:	Cm,7 = f7*Cp,7 = 259 pcph	Cm,10 = f10*Cp,10 = 270 pcph

DELAY AND LEVEL OF SERVICE SUMMARY

MOVEMENT	v(pcph)	cm(pcph)	csh(pcph)	AVG TOTAL DELAY	LOS
MINOR LEFT TURN (7)	25	259	SHRD	SHRD	--
MINOR THROUGH (8)	24	320	340	13.0	C
MINOR RIGHT TURN (9)	15	889	SHRD	SHRD	----
MINOR LEFT TURN (10)	6	270	SHRD	SHRD	--
MINOR THROUGH (11)	15	316	617	6.7	B
MINOR RIGHT TURN (12)	58	994	SHRD	SHRD	--
MAJOR LEFT (1)	197	1253	--NA--	3.4	A
MAJOR LEFT (4)	13	1116	--NA--	3.3	A
MINOR APPROACH (7)(8)(9)	-	-	-	13.0	C
MINOR APPROACH (10)(11)(12)	-	-	-	6.7	B
MAJOR APPROACH (1)(2)(3)	-	-	-	1.1	A
MAJOR APPROACH (4)(5)(6)	-	-	-	0.1	A
TOTAL INTERSECTION (1-12)	-	-	-	2.2	A

LEVEL OF SERVICE CRITERIA

LEVEL OF SERVICE	AVG TOTAL DELAY (SEC/VEH)
A	<=5
B	>5&<=10
C	>10&<=20
D	>20&<=30
E	>30&<=45
F	>45

ATA Inc. STOP CONTROLLED T-INTERSECTION LEVEL OF SERVICE ANALYSIS 1994 HCM

Major Street: KULA HWY	Date: 27-Jun
Minor Street: KEKAULIKE AV	Analyst: BC
Peak Hour: AM	File Name: KULKEK-A
Scenario: YEAR 2005 BASE	Intersection: 5

```
Peak Hour Factor:        1.00 |
--------MAJOR STREET-------- | V2    168 ----------->            <--------- 102     V5
   Num of Lanes - V2:     1  |
  Excl RT - V3 (Y/N):     N  | V3      8 -----                        ----- 22      V4
Stop/Yield - V3 (Y/N):    N  |                \                    /
     % Grade - V2,V3:     2  |                 v                  v      MAJOR STREET:
                             |                                            KULA HWY
   Num of Lanes - V5:     1  |                       <          >
  Excl LT - V4 (Y/N):     N  |                        \        /
     % Grade - V4,V5:    -2  |                         |       |
                             |                         |       |
--------MINOR STREET-------- |                        20       61                NORTH--->
Num of Lanes - V7,V9:     1  |
  Shared Lane (Y/N):      Y  |                     V7        V9
     % Grade - V7&V9:    -2  |            MINOR STREET: KEKAULIKE AV
```

VOLUME ADJUSTMENTS

MOVEMENT NO.	2	3	4	5	7	9
VOLUME, V (vph)	168	8	22	102	20	61
VOLUME, v (pcph)	168	8	22	102	20	61

STEP 1: RT FROM MINOR STREET - V9

Conflicting Flows:	Vc,9 = 1/2*V3+V2 = 4 + 168 =	172	vph
Potential Capacity:	Cp,9 =	1133	pcph
Movement Capacity:	Cm,p = Cp,9 =	1133	pcph

STEP 2: LT FROM MAJOR STREET - V4

Conflicting Flows:	Vc,4 = V3+V2 = 8 + 168 =	176	vph
Potential Capacity:	Cp,4 =	1413	pcph
Movement Capacity:	Cm,4 = Cp,4 =	1413	pcph
Prob. of Queue-free State:	po,4 = 1-v4/Cm,4 =	0.98	
Major Left Shared Lane			
Prob. of Queue-free State:	p*o,4 =	0.98	

STEP 3: LT FROM MINOR STREET - V7

Conflicting Flows:	Vc,7 = 1/2V3+V2+V5+V4 =	296	vph
Potential Capacity:	Cp,7 =	714	pcph
Capacity Adjustment Factor			
Due To Impeding Movements:	f7=po,4=	0.98	
Movement Capacity:	Cm,7 = Cp,7 =	702	pcph

DELAY AND LEVEL OF SERVICE SUMMARY

Movement	v(vcph)	cm(pcph)	csh (pcph)	AVG TOTAL DELAY	LOS
MINOR LEFT TURN (7)	20	702	SHRD	SHRD	SHRD
MINOR RIGHT TURN (9)	61	1133	984	4.0	A
MAJOR LEFT TURN (4)	22	1413	------	2.6	A

AVERAGE MINOR APPROACH DELAY = 4.0 sec/veh | AVERAGE TOTAL INTERSECTION DELAY = 1.0 sec/veh
LEVEL OF SERVICE = A | LEVEL OF SERVICE = A

```
ATA Inc.            STOP CONTROLLED T-INTERSECTION LEVEL OF SERVICE ANALYSIS              1994 HCM
==================================================================================================
Major Street: KULA HWY                                                          Date:    27-Jun
Minor Street: KEKAULIKE AV                                                   Analyst:        BC
   Peak Hour:      PM                                                      File Name:  KULKEK-P
    Scenario: YEAR 2005 BASE                                            Intersection:         5
--------------------------------------------------------------------------------------------------
Peak Hour Factor:       1.00 |
--------MAJOR STREET-------- | V2     145 ----------->               <--------- 132       V5
    Num of Lanes - V2:     1 |
    Excl RT - V3 (Y/N):    N | V3      27 -----                            ----- 57        V4
 Stop/Yield - V3 (Y/N):    N |               \                           /
       % Grade - V2,V3:    2 |                v                         v    MAJOR STREET:
                             |                                               KULA HWY
     Num of Lanes - V5:    1 |                        <          >
    Excl LT - V4 (Y/N):    N |                         \        /
       % Grade - V4,V5:   -2 |                          |      |
                             |                          |      |
--------MINOR STREET-------- |                          22     38                  NORTH--->
 Num of Lanes - V7,V9:     1 |
    Shared Lane (Y/N):     Y |                         V7      V9
       % Grade - V7&V9:   -2 |                  MINOR STREET: KEKAULIKE AV
--------------------------------------------------------------------------------------------------
VOLUME ADJUSTMENTS
 MOVEMENT NO.                  2         3          4          5          7          9
 VOLUME, V (vph)             145        27         57        132         22         38
 VOLUME, v (pcph)            145        27         57        132         22         38
--------------------------------------------------------------------------------------------------
STEP 1: RT FROM MINOR STREET - V9
 Conflicting Flows:    | Vc,9 = 1/2*V3+V2 =         14  +   145       =         159   vph
 Potential Capacity:   | Cp,9 =                                                1151   pcph
 Movement Capacity:    | Cm,p = Cp,9 =                                         1151   pcph
--------------------------------------------------------------------------------------------------
STEP 2: LT FROM MAJOR STREET - V4
 Conflicting Flows:              |  Vc,4 = V3+V2 =        27  +   145   =      172   vph
 Potential Capacity:             |  Cp,4 =                                    1419   pcph
 Movement Capacity:              |  Cm,4 = Cp,4 =                             1419   pcph
 Prob. of Queue-free State:      |  po,4 = 1-v4/Cm,4 =                        0.96
 Major Left Shared Lane          |
  Prob. of Queue-free State:     |  p*o,4 =                                   0.96
--------------------------------------------------------------------------------------------------
STEP 3: LT FROM MINOR STREET - V7
 Conflicting Flows:              |  Vc,7 = 1/2V3+V2+V5+V4 =                    348   vph
 Potential Capacity:             |  Cp,7 =                                     666   pcph
 Capacity Adjustment Factor      |
  Due To Impeding Movements:     |  f7=po,4=                                  0.96
 Movement Capacity:              |  Cm,7 = Cp,7 =                              637   pcph
--------------------------------------------------------------------------------------------------
DELAY AND LEVEL OF SERVICE SUMMARY                       csh     AVG TOTAL
  Movement                 v(vcph)       cm(pcph)     (pcph)     DELAY      LOS
 ------------            -----------    ---------     ------     -----     ------
 MINOR LEFT TURN   (7)        22            637        SHRD       SHRD      SHRD
 MINOR RIGHT TURN  (9)        38           1151         888        4.3        A
 MAJOR LEFT TURN   (4)        57           1419       ------       2.6        A
--------------------------------------------------------------------------------------------------
     AVERAGE MINOR APPROACH DELAY =   4.3 sec/veh   |  AVERAGE TOTAL INTERSECTION DELAY =   1.0 sec/veh
                 LEVEL OF SERVICE =   A             |                  LEVEL OF SERVICE =   A
==================================================================================================
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AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

YEAR 2005 WITH PROJECT LOS CALCULATIONS

KULA RESIDENT LOTS (386) 06/27/95
YEAR 2005 + PROJECT 10:44:21
AM PEAK HOUR

SIGNAL94/TEAPAC(V1 L1.2) - Summary of Parameter Values

Intersection Parameters for Int # 1 - HANA HWY & KALEAKALA HWY

METROAREA	NONCBD	
LOSTTIME	2.0	
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	LOW	LOW	LOW	LOW
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	10	902	20	123	100	2532	461	316	66	10	30	29
WIDTHS	12.0	22.0	11.0	12.0	11.0	11.0	12.0	22.0	11.0	12.0	11.0	.0
LANES	1	2	1	1	1	1	1	2	1	1	1	0
UTILIZATIONS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
REQCLEARANCES	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	FFLW	NORM	NORM	FFLW	NORM	DOPT	FFLW	NORM	NORM	FFLW	NORM	NORM
SATURATIONFLOWS	0	3601	689	0	1721	1711	0	3601	478	0	545	0

Phasing Parameters

SEQUENCES	17	ALL					
PERMISSIVES	YES	YES	YES	YES	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	.00	1
CYCLES	60	180	10		PEDTIME	.0	0
GREENTIMES	13.07	25.07	9.87				
YELLOWTIMES	4.00	4.00	4.00				
CRITICALS	2	6	11				
EXCESS	0						

KULA RESIDENT LOTS (386) 06/27/95
YEAR 2005 + PROJECT 10:44:28
AM PEAK HOUR

SIGNAL94/TEAPAC[V1 L1.2] - Capacity Analysis Summary

Intersection Averages for Int # 1 - HANA HWY & KALEAKALA HWY
Degree of Saturation (v/c) 1.46 Vehicle Delay 46.7 Level of Service E+

```
        -----------------------------------
Sq 17 ¦  Phase 1  ¦  Phase 2  ¦  Phase 3  ¦
**/** -----------------------------------
      ¦   * +     ¦           ¦           ¦
  .   ¦   * +     ¦           ¦           ¦
 /|\  ¦   * +>    ¦    <++++¦           ¦
  |   ¦   v       ¦     ****¦    ^      ¦
  |   ¦       ^   ¦     v   ¦****       ¦
North ¦   <+ +    ¦         ¦****>      ¦
  |   ¦    + +    ¦         ¦           ¦
      ¦    + +    ¦         ¦           ¦
      -----------------------------------
      ¦ G/C= .218 ¦ G/C= .418 ¦ G/C= .164 ¦
      ¦ G= 13.1"  ¦ G= 25.1"  ¦ G=   9.9" ¦
      ¦ Y+R= 4.0" ¦ Y+R= 4.0" ¦ Y+R= 4.0" ¦
      ¦ OFF=  .0% ¦ OFF=28.4% ¦ OFF=76.9% ¦
      -----------------------------------
```

C= 60 sec G= 48.0 sec = 80.0% Y=12.0 sec = 20.0% Ped= .0 sec = .0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								50.8	E	
TH	22/2	.281	.251	837	904	949	1.050	51.7	*E	300 ft
LT	11/1	.000	.251	132	169	21	.121	11.2	B	25 ft
NB Approach								13.0	B	
TH	22/2	.114	.251	837	904	333	.368	12.1	B	105 ft
LT	11/1	.000	.251	86	113	69	.575	17.4	C+	44 ft
WB Approach								50.7	E	
TH	11/1-	.816	.451	735	776	1421	1.831	50.7	E	658 ft
LT	11/1+	.782	.451	731	772	1349	1.747	50.8	*E	624 ft
EB Approach								19.6	C+	
LT+TH	11/1	.175	.198	74	100	63	.583	19.6	*C+	43 ft

KULA RESIDENT LOTS (386) 06/27/95
YEAR 2005 + PROJECT 10:54:44
PM PEAK HOUR

SIGNAL94/TEAPAC[V1 L1.2] - Summary of Parameter Values

Intersection Parameters for Int # 1 - HANA HWY & KALEAKALA HWY

METROAREA	NONCBD	
LOSTTIME	2.0	
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	.0	.0	.0	.0
PEDLEVELS	LOW	LOW	LOW	LOW
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	0	0	0

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	33	488	47	63	36	690	2059	934	15	29	134	51
WIDTHS	12.0	22.0	11.0	12.0	11.0	11.0	12.0	22.0	11.0	12.0	11.0	.0
LANES	1	2	1	1	1	1	1	2	1	1	1	0
UTILIZATIONS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
REQCLEARANCES	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	FFLW	NORM	NORM	FFLW	NORM	DOPT	FFLW	NORM	NORM	FFLW	NORM	NORM
SATURATIONFLOWS	0	3601	353	0	1723	1711	0	3601	452	0	1150	0

Phasing Parameters

SEQUENCES	17	ALL					
PERMISSIVES	YES	YES	YES	YES	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	.00	1
CYCLES	60	120	10		PEDTIME	.0	0
GREENTIMES	18.41	16.46	13.14				
YELLOWTIMES	4.00	4.00	4.00				
CRITICALS	8	5	11				
EXCESS	0						

KULA RESIDENT LOTS (386)　　　　　　　　　　　　　　06/27/95
YEAR 2005 + PROJECT　　　　　　　　　　　　　　　　10:54:50
PM PEAK HOUR

SIGNAL94/TEAPAC[V1 L1.2] - Capacity Analysis Summary

Intersection Averages for Int # 1 - HANA HWY & KALEAKALA HWY
Degree of Saturation (v/c) .68 Vehicle Delay 13.9 Level of Service B

```
        ------------------------------------
Sq 17 ¦  Phase 1  ¦  Phase 2  ¦  Phase 3  ¦
**/** ------------------------------------
      ¦   + +     ¦           ¦           ¦
  .   ¦   + +     ¦           ¦           ¦
 /¦\  ¦   + +>    ¦    <****¦            ¦
  ¦   ¦   v       ¦     ++++¦    ^       ¦
  ¦   ¦       ^   ¦      v  ¦****        ¦
North ¦    <+ *   ¦         ¦****>       ¦
  ¦   ¦     + *   ¦         ¦            ¦
      ¦     + *   ¦         ¦            ¦
        ------------------------------------
      ¦ G/C= .307 ¦ G/C= .274 ¦ G/C= .219 ¦
      ¦ G= 18.4"  ¦ G= 16.5"  ¦ G= 13.1"  ¦
      ¦ Y+R= 4.0" ¦ Y+R= 4.0" ¦ Y+R= 4.0" ¦
      ¦ OFF= .0%  ¦ OFF=37.3% ¦ OFF=71.4% ¦
        ------------------------------------
```

C= 60 sec　G= 48.0 sec = 80.0%　Y=12.0 sec = 20.0%　Ped= .0 sec = .0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								10.1	B	
TH	22/2	.164	.340	1176	1225	514	.420	10.0	B+	143 ft
LT	11/1	.000	.340	89	114	49	.408	11.1	B	27 ft
NB Approach								14.3	B	
TH	22/2	.290	.340	1176	1225	983	.802	14.4	*B	274 ft
LT	11/1	.000	.340	119	150	16	.104	8.8	B+	25 ft
WB Approach								15.3	C+	
TH	11/1-	.262	.308	473	530	392	.740	15.8	*C+	229 ft
LT	11/1+	.253	.308	469	526	372	.707	14.9	B	217 ft
EB Approach								17.1	C+	
LT+TH	11/1	.215	.252	238	290	195	.672	17.1	*C+	123 ft

KULA RESIDENT LOTS (386) 06/27/95
YEAR 2005 + PROJECT 11:27:22
AM PEAK HOUR

SIGNAL94/TEAPAC[V1 L1.2] - Summary of Parameter Values

Intersection Parameters for Int # 2 - PUKALANI BYPASS & MAKAWAO AV

METROAREA	NONCBD	
LOSTTIME		2.0
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	2.0	.0	-2.0	.0
PEDLEVELS	LOW	LOW	LOW	LOW
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	10	45	20	5

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	81	52	10	457	263	350	213	1105	9	19	202	16
WIDTHS	12.0	24.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
LANES	1	2	1	1	1	1	1	1	1	1	1	1
UTILIZATIONS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
REQCLEARANCES	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1524	3688	199	1539	1863	1770	1554	1881	1531	1539	1863	940

Phasing Parameters

SEQUENCES	12	ALL					
PERMISSIVES	YES	YES	YES	YES	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	.00	1
CYCLES	60	120	10		PEDTIME	.0	0
GREENTIMES	35.03	7.05	5.92				
YELLOWTIMES	4.00	4.00	4.00				
CRITICALS	8	6	11				
EXCESS	0						

KULA RESIDENT LOTS (386) 06/27/95
YEAR 2005 + PROJECT 11:27:27
AM PEAK HOUR

SIGNAL94/TEAPAC[V1 L1.2] - Capacity Analysis Summary

Intersection Averages for Int # 2 - PUKALANI BYPASS & MAKAWAO AV
Degree of Saturation (v/c) .79 Vehicle Delay 23.9 Level of Service C

```
       --------------------------------------
Sq 12 | Phase 1    | Phase 2    | Phase 3    |
**/** --------------------------------------
      | + + +      |          ^ |          ^ |
  .   | + + +      |       ++++|       ++++|
 /|\  |<+ + +>     |      <++++|      <++++|
  |   |   v        |       ****|    ^   ++++|
  |   |        ^   |         v |++++   v    |
North |    <+ * +>|         +>|****>       |
  |   |      + * + |          + |++++        |
      |      + * + |          + |  v         |
       --------------------------------------
      | G/C= .584 | G/C= .117 | G/C= .099 |
      | G=  35.0" | G=   7.0" | G=   5.9" |
      | Y+R= 4.0" | Y+R= 4.0" | Y+R= 4.0" |
      | OFF=  .0% | OFF=65.1% | OFF=83.5% |
       --------------------------------------
```

C= 60 sec G= 48.0 sec = 80.0% Y=12.0 sec = 20.0% Ped= .0 sec = .0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								2.9	A	
RT	12/1	.076	.617	919	940	75	.080	3.0	A	25 ft
TH	24/2	.025	.617	2276	2276	55	.024	2.9	A	25 ft
LT	12/1	.000	.617	98	120	11	.089	3.0	A	25 ft
NB Approach								23.9	C	
RT	12/1	.168	.801	1245	1245	203	.163	.9	A	34 ft
TH	12/1	.625	.617	1147	1161	1163	1.002	28.1	*D+	375 ft
LT	12/1	.000	.617	924	945	9	.010	2.9	A	25 ft
WB Approach								24.9	C	
RT	12/1	.318	.316	432	487	434	.891	25.5	D+	250 ft
TH	12/1	.182	.316	532	589	277	.470	11.1	B	160 ft
LT	12/1	.165	.151	342	391	368	.941	34.6	*D	212 ft
EB Approach								31.9	D+	
RT	12/1	.021	.132	150	200	15	.074	14.7	B	25 ft
TH	12/1	.147	.132	188	246	213	.866	34.4	*D	156 ft
LT	12/1	.000	.132	84	116	17	.137	14.9	B	25 ft

KULA RESIDENT LOTS (386) 06/27/95
YEAR 2005 + PROJECT 11:49:49
PM PEAK HOUR

SIGNAL94/TEAPAC[V1 L1.2] - Summary of Parameter Values

Intersection Parameters for Int # 2 - PUKALANI BYPASS & MAKAWAO AV

METROAREA	NONCBD	
LOSTTIME	2.0	
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	2.0	.0	-2.0	.0
PEDLEVELS	LOW	LOW	LOW	LOW
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	5	10	30	5

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	67	587	362	115	307	196	281	340	9	16	258	12
WIDTHS	12.0	24.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
LANES	1	2	1	1	1	1	1	1	1	1	1	1
UTILIZATIONS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
REQCLEARANCES	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1524	3688	1752	1539	1863	1770	1554	1881	1787	1539	1863	684

Phasing Parameters

SEQUENCES	42	ALL					
PERMISSIVES	YES	YES	YES	YES	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	.00	1
CYCLES	60	120	10		PEDTIME	.0	0
GREENTIMES	10.69	14.91	6.82	11.58			
YELLOWTIMES	4.00	4.00	4.00	4.00			
CRITICALS	3	8	6	11			
EXCESS	0						

KULA RESIDENT LOTS (386)   06/27/95
YEAR 2005 + PROJECT   11:49:57
PM PEAK HOUR

SIGNAL94/TEAPAC[V1 L1.2] - Capacity Analysis Summary

Intersection Averages for Int # 2 - PUKALANI BYPASS & MAKAWAO AV
Degree of Saturation (v/c) .55 Vehicle Delay 11.3 Level of Service B

```
       -------------------------------------------------
Sq 42 | Phase 1 | Phase 2  | Phase 3  | Phase 4  |
**/** -------------------------------------------------
      |    * ^  | + + +    |        ^ |        ^ |
  .   |    * ++++| + + +   |     ++++|     ++++|
 /|\  |    *>   |<+ + +>   |    <++++|    <++++|
  |   |         |   v      |     ****|  ^  ++++|
  |   |         |       ^  |     v   |++++  v  |
North |   <+    |   <+ * +>|      +>|****>     |
  |   |++++ +   |    + * + |       + |++++     |
      |  v +    |    + * + |       + |  v      |
       -------------------------------------------------
      | G/C= .178 | G/C= .248 | G/C= .114 | G/C= .193 |
      | G=  10.7" | G=  14.9" | G=   6.8" | G=  11.6" |
      | Y+R= 4.0" | Y+R= 4.0" | Y+R= 4.0" | Y+R= 4.0" |
      | OFF=  .0% | OFF=24.5% | OFF=56.0% | OFF=74.0% |
       -------------------------------------------------
      C= 60 sec  G= 44.0 sec = 73.3%  Y=16.0 sec = 26.7%  Ped: .0 sec =  .0%
```

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								12.2	B	
RT	12/1	.069	.282	372	429	65	.152	10.5	B	39 ft
TH	24/2	.188	.282	977	1039	618	.595	12.7	B	187 ft
LT	12/1	.168	.211	456	493	381	.773	11.8	*B	152 ft
NB Approach								11.3	B	
RT	12/1	.207	.462	677	718	264	.368	6.9	B+	120 ft
TH	12/1	.224	.282	471	530	358	.675	14.7	*B	217 ft
LT	12/1	.000	.211	467	503	9	.018	4.8	A	25 ft
WB Approach								7.7	B+	
RT	12/1	.104	.652	987	1003	111	.111	2.5	A	33 ft
TH	12/1	.207	.407	712	758	323	.426	8.5	B+	162 ft
LT	12/1	.070	.147	344	384	206	.536	9.4	*B+	103 ft
EB Approach								15.3	C+	
RT	12/1	.018	.471	685	725	12	.017	5.5	B+	25 ft
TH	12/1	.180	.226	360	422	272	.645	15.9	*C+	177 ft
LT	12/1	.000	.226	115	150	13	.084	11.8	B	25 ft

KULA RESIDENT LOTS (386)
YEAR 2005 + PROJECT
AM PEAK HOUR

06/27/95
12:03:16

SIGNAL94/TEAPAC[V1 L1.2] - Summary of Parameter Values

Intersection Parameters for Int # 3 - BYPASS/KULA HWY & HALEAKALA

METROAREA	NONCBD	
LOSTTIME		2.0
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	2.0	.0	-2.0	.0
PEDLEVELS	LOW	LOW	LOW	LOW
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	15	5	25

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	2	356	66	171	46	60	71	848	163	314	72	3
WIDTHS	12.0	12.0	12.0	12.0	12.0	.0	12.0	12.0	12.0	12.0	12.0	.0
LANES	1	1	1	1	1	0	1	1	1	1	1	0
UTILIZATIONS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
REQCLEARANCES	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1524	1844	240	1539	1523	0	1554	1881	1787	1539	1844	0

Phasing Parameters

SEQUENCES	31	ALL			LEADLAGS	NONE	NONE
PERMISSIVES	YES	YES	YES	YES	OFFSET	.00	1
OVERLAPS	YES	YES	YES	YES	PEDTIME	.0	0
CYCLES	60	120	10				
GREENTIMES	8.47	28.79	10.74				
YELLOWTIMES	4.00	4.00	4.00				
CRITICALS	9	8	4				
EXCESS	0						

KULA RESIDENT LOTS (386)
YEAR 2005 + PROJECT
AM PEAK HOUR

06/27/95
12:03:24

SIGNAL94/TEAPAC[V1 L1.2] - Capacity Analysis Summary

Intersection Averages for Int # 3 - BYPASS/KULA HWY & HALEAKALA
Degree of Saturation (v/c) .50 Vehicle Delay 6.3 Level of Service B+

```
       ------------------------------------
Sq 31 | Phase 1  | Phase 2  | Phase 3  |
**/** ------------------------------------
      |          | + + +    |      ^   |
  .   |          | + + +    |     ****|
 /|\  |          |<+ + +>   |    <++++|
  |   |          |   v      |  ^  ++++|
  |   |      ^   |      ^   |++++  v   |
North |   <* + +>|   <+ * +>|++++>     |
  |   |++++ * + +|    + * + |++++      |
      |   v * + +|    + * + |  v       |
       ------------------------------------
      | G/C= .141 | G/C= .480 | G/C= .179 |
      | G=   8.5" | G=  28.8" | G=  10.7" |
      | Y+R= 4.0" | Y+R= 4.0" | Y+R= 4.0" |
      | OFF=  .0% | OFF=20.8% | OFF=75.4% |
       ------------------------------------
```

C= 60 sec G= 48.0 sec = 80.0% Y=12.0 sec = 20.0% Ped= .0 sec = .0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								6.6	B+	
RT	12/1	.004	.513	747	782	2	.003	4.6	A	25 ft
TH	12/1	.237	.513	914	946	375	.396	5.9	B+	154 ft
LT	12/1	.000	.513	96	119	69	.561	10.6	B	28 ft
NB Approach								3.4	A	
RT	12/1	.070	.721	1116	1121	69	.062	1.6	A	25 ft
TH	12/1	.493	.721	1356	1356	893	.659	3.7	*A	210 ft
LT	12/1	.000	.175	539	565	172	.304	2.2	*A	40 ft
WB Approach								14.0	B	
RT	12/1	.142	.212	269	327	164	.502	14.5	*B	109 ft
LT+TH	12/1	.105	.212	266	324	111	.343	13.2	B	74 ft
EB Approach								9.4	B+	
RT	12/1	.236	.420	601	647	304	.470	8.5	B+	149 ft
LT+TH	12/1	.066	.212	330	392	79	.202	12.6	B	52 ft

KULA RESIDENT LOTS (386)
YEAR 2005 + PROJECT
PM PEAK HOUR

06/27/95
13:41:01

SIGNAL94/TEAPAC[V1 L1.2] - Summary of Parameter Values

Intersection Parameters for Int # 3 - BYPASS/KULA HWY & HALEAKALA

METROAREA	NONCBD	
LOSTTIME	2.0	
LEVELOFSERVICE	C	S
NODELOCATION	0	0

Approach Parameters

APPLABELS	SB	WB	NB	EB
GRADES	2.0	.0	-2.0	.0
PEDLEVELS	LOW	LOW	LOW	LOW
PARKINGSIDES	NONE	NONE	NONE	NONE
PARKVOLUMES	20	20	20	20
BUSVOLUMES	0	0	0	0
RIGHTTURNONREDS	0	10	5	25

Movement Parameters

MOVLABELS	RT	TH	LT	RT	TH	LT	RT	TH	LT	RT	TH	LT
VOLUMES	5	687	88	111	41	42	17	510	186	7	42	229
WIDTHS	12.0	12.0	12.0	12.0	12.0	.0	12.0	12.0	12.0	12.0	12.0	.0
LANES	1	1	1	1	1	0	1	1	1	1	1	0
UTILIZATIONS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
TRUCKPERCENTS	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
PEAKHOURFACTORS	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95	.95
ARRIVALTYPES	3	3	3	3	3	3	3	3	3	3	3	3
ACTUATIONS	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
REQCLEARANCES	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
MINIMUMS	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
IDEALSATFLOWS	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
FACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DELAYFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NSTOPFACTORS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GROUPTYPES	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM	NORM
SATURATIONFLOWS	1524	1844	1752	1539	1207	0	1554	1881	1787	1539	1262	0

Phasing Parameters

SEQUENCES	41	ALL					
PERMISSIVES	YES	YES	YES	YES	LEADLAGS	NONE	NONE
OVERLAPS	YES	YES	YES	YES	OFFSET	.00	1
CYCLES	60	120	10		PEDTIME	.0	0
GREENTIMES	5.85	26.04	16.10				
YELLOWTIMES	4.00	4.00	4.00				
CRITICALS	3	2	11				
EXCESS	0						

KULA RESIDENT LOTS (386) 06/27/95
YEAR 2005 + PROJECT 13:41:10
PM PEAK HOUR

SIGNAL94/TEAPAC[V1 L1.2] - Capacity Analysis Summary

Intersection Averages for Int # 3 - BYPASS/KULA HWY & HALEAKALA
Degree of Saturation (v/c) .64 Vehicle Delay 11.4 Level of Service B

```
      ------------------------------------
Sq 41 | Phase 1  | Phase 2  | Phase 3  |
**/** ------------------------------------
      |     * ^  | + * +    |        ^ |
  .   |     * ++++| + * +   |     ++++|
 /|\  |     *>   |<+ * +>   |    <++++|
  |   |          |   v      |   ^  ++++|
  |   |          |       ^  |****  v   |
North |    <+    |   <+ + +>|****>     |
  |   |++++ +    |    + + + |++++      |
      |   v +    |    + + + |  v       |
      ------------------------------------
      | G/C= .098 | G/C= .434 | G/C= .268 |
      | G=  5.9"  | G=  26.0" | G=  16.1" |
      | Y+R= 4.0" | Y+R= 4.0" | Y+R= 4.0" |
      | OFF=  .0% | OFF=16.4% | OFF=66.5% |
      ------------------------------------
```

C= 60 sec G= 48.0 sec = 80.0% Y=12.0 sec = 20.0% Ped= .0 sec = .0%

Lane Group	Width/ Lanes	g/C Reqd	g/C Used	Service Rate @C (vph)	Service Rate @E	Adj Volume	v/c	HCM Delay	L S	90% Max Queue
SB Approach								13.0	B	
RT	12/1	.009	.467	671	712	5	.007	5.5	B+	25 ft
TH	12/1	.417	.467	824	862	723	.839	14.2	*B	325 ft
LT	12/1	.002	.131	316	352	93	.264	4.1	*A	29 ft
NB Approach								8.3	B+	
RT	12/1	.019	.467	687	727	13	.018	5.5	B+	25 ft
TH	12/1	.316	.467	841	879	537	.611	8.6	B+	241 ft
LT	12/1	.058	.131	320	359	196	.546	7.5	B+	61 ft
WB Approach								7.9	B+	
RT	12/1	.100	.466	676	717	106	.148	5.9	B+	48 ft
LT+TH	12/1	.107	.302	312	364	87	.239	10.3	B	51 ft
EB Approach								17.6	C+	
RT	12/1	.002	.466	676	717	1	.001	5.5	B+	25 ft
LT+TH	12/1	.269	.302	328	381	285	.748	17.6	*C+	168 ft

```
ATA Inc.        TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS                 1994 HCM
=========================================================================================================
                                                                                    DATE:      27-Jun-95
Major Street:   KULA HWY                                                         Analyst:      BC
Minor Street:   OMAOPIO RD                                                      File Name:      KULOMA-A
   Scenario:    YEAR 2005 + PROJECT                                           Intesection #:         4
  Peak Hour:         AM
---------------------------------------------------------------------------------------------------------
                                  |               V12        V11        V10
   Peak Hour Factor:       1.00   |
                                  |               173        25          9            <--- NORTH
---------MAJOR STREET---------    |                |          |          |
     Num of Lanes - V2:       1   |                |          |          |
    Excl LT - V1 (Y/N):       N   |               /           |           \
    Excl RT - V3 (Y/N):       N   |              <            v            >
 Stop/Yield - V3 (Y/N):       Y   |
       Grade - V1,V2,V3:      2   |          ^                                    ^
                                  |         /                                      \
                                  |                                                 ----     7 V6
     Num of Lanes - V5:       1   | V1   38 -----
    Excl LT - V4 (Y/N):       N   |                                                 <----   641 V5
    Excl RT - V6 (Y/N):       N   | V2  293 ------->
 Stop/Yield - V6 (Y/N):       N   |                                                 ----    15 V4
      Grade - V4,V5,V6:      -2   | V3   17 -----                                   /
                                  |         \                                      v     MAJOR STREET
---------MINOR STREET---------    |          v                                           KULA HWY
     Num of Lanes - V8:       1   |
     Grade - V7,V8,V9:        0   |              <            ^            >
    Shared Lane-V7,8,9:       3   |               \           |           /
(0=N,1=LT,2=TR,3=LTR)             |                |          |          |
                                  |                |          |          |
     Num of Lanes - V11:      1   |               27          2          15
   Grade - V10,V11,V12:       0   |
  Shared Lane-V10,11,12:      3   |               V7         V8          V9
(0=N,1=LT,2=TR,3=LTR)             |
                                  |               MINOR STREET - OMAOPIO RD
---------------------------------------------------------------------------------------------------------
VOLUME ADJUSTMENTS                |
   MOVEMENT NO.                   |     1    2    3    4    5    6    7    8    9    10    11    12
   HOURLY FLOW RATE, V(vph)       |    38  293   17   15  641    7   27    2   15     9    25   173
   VOLUME, v (pcph)               |    53  293   17   15  641    7   30    2   17    10    28   190
---------------------------------------------------------------------------------------------------------
STEP 1: RT FROM MINOR STREET      |                                   |
   Conflicting Flows:             |Vc9 = 1/2 V3 + V2 =     293  vhp   |  Vc12 = 1/2 V6 + V5 =     645 vhp
   Potential Capacity:            |Cp,9 =                  984 pcph   |  Cp,12 =                  653 pcph
   Movement Capacity:             |Cm,9=Cp,9=              984 pcph   |  Cm,12=Cp,12=             653 pcph
   Prb. of Queu-free State:       |po,9=1-v9/Cm,9=        0.98        |  po,12=1-v12/Cm,12=      0.71
---------------------------------------------------------------------------------------------------------
STEP 2: LT FROM MAJOR STREET      |                                   |
   Conflicting Flows:             |Vc,4 = V2 + V3 =        293  vhp   |  Vc,1 = V5 + V6 =         648 vhp
   Potential Capacity:            |Cp,4 =                 1243 pcph   |  Cp,1 =                   842 pcph
   Movement Capacity:             |Cm,4=Cp,4=             1243 pcph   |  Cm,1=Cp,1=               842 pcph
   Prb. of Queu-free State:       |po,4=1-v4/Cm4=         0.99        |  po,1=1-v1/Cm1=          0.94
   Major Left Shared Lane         |                                   |
    Prob. of Queue-free State     |p*o,4=                 0.98        |  p*o,1=                  0.92
---------------------------------------------------------------------------------------------------------
                                                                                    ----continued ----
```

ATA Inc. TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS 1994 HCM

Major Street:	KULA HWY	DATE:	27-Jun-95
Minor Street:	OMAOPIO RD	Analyst:	BC
Scenario:	YEAR 2005 + PROJECT	File Name:	KULOMA-A
Peak Hour:	AM	Intesection Intesection #:	4

STEP 3: TH FROM MINOR STREET

Conflicting Flows:	Vc.,8 = 1/2V3+V2+V1+V6+V5+V4 =	994 vph	Vc.,11 = 1/2V6+V5+V4+V3+V2+V1 =	987 vph
Potential Capacity:	Cp,8 =	328 pcph	Cp,11 =	331 pcph
Capacity Adj Factor:	f8 = po,4*po,1 =	0.91	f11 = po,4*po,1 =	0.91
Movement Capacity:	Cm,8 = Cp,8*f8 =	298 pcph	Cm,11 = Cp,11*f11 =	300 pcph
Prob. of Queue-free State:	po,8 = 1-v8/Cm,8 =	0.99	po,11 = 1-v11/Cm,11 =	0.91

STEP 4: LT FROM MINOR STREET

Conflicting Flows:	Vc,7 = 1/2V3+V2+V1+1/2V6+V5+V4+ 1/2(V11+V12) =	1090 vph	Vc,10 = 1/2V6+V5+V4+1/2V3+V2+V1+ 1/2(V8+V9) =	999 vph
Potential Capacity:	Cp7 =	248 pcph	Cp10 =	279 pcph
Major Left, Minor Through Impedance Factor:	p''7=po,11*f11 =	0.82	p''10=po,8*f8 =	0.90
Major Left, Minor Through Adjusted Impedance Factor:	p'7 =	0.86	p'10 =	0.92
Capacity Adjustment Factor:	f7 = p'7*po,12 =	0.61	f10 = p'10*po,9 =	0.91
Movement Capacity:	Cm,7 = f7*Cp,7 =	152 pcph	Cm,10 = f10*Cp,10 =	254 pcph

DELAY AND LEVEL OF SERVICE SUMMARY

MOVEMENT	v(pcph)	cm(pcph)	csh(pcph)	AVG TOTAL DELAY	LOS
MINOR LEFT TURN (7)	30	152	SHRD	SHRD	--
MINOR THROUGH (8)	2	298	221	20.9	D
MINOR RIGHT TURN (9)	17	984	SHRD	SHRD	----
MINOR LEFT TURN (10)	10	254	SHRD	SHRD	--
MINOR THROUGH (11)	28	300	538	11.5	C
MINOR RIGHT TURN (12)	190	653	SHRD	SHRD	--
MAJOR LEFT (1)	53	842	--NA--	4.6	A
MAJOR LEFT (4)	15	1243	--NA--	2.9	A
MINOR APPROACH (7)(8)(9)	-	-	-	20.9	D
MINOR APPROACH (10)(11)(12)	-	-	-	11.5	C
MAJOR APPROACH (1)(2)(3)	-	-	-	0.7	A
MAJOR APPROACH (4)(5)(6)	-	-	-	0.1	A
TOTAL INTERSECTION (1-12)	-	-	-	3.1	A

LEVEL OF SERVICE CRITERIA

LEVEL OF SERVICE	AVG TOTAL DELAY (SEC/VEH)
A	<=5
B	>5&<=10
C	>10&<=20
D	>20&<=30
E	>30&<=45
F	>45

```
ATA Inc.        TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS                1994 HCM
==========================================================================================================
Major Street:   KULA HWY                                                             DATE:     27-Jun-95
Minor Street:   OMAOPIO RD                                                           Analyst:  BC
    Scenario:   YEAR 2005 + PROJECT                                                  File Name:  KULOMA-P
   Peak Hour:        PM                                                          Intesection #:          4
----------------------------------------------------------------------------------------------------------
                                   |              V12        V11        V10
    Peak Hour Factor:       1.00   |
                                   |               53         14          5           <--- NORTH
---------MAJOR STREET---------     |               |          |           |
    Num of Lanes - V2:          1  |               |          |           |
    Excl LT - V1 (Y/N):         N  |               /          |           \
    Excl RT - V3 (Y/N):         N  |              <           v            >
  Stop/Yield - V3 (Y/N):        Y  |
      Grade - V1,V2,V3:         2  |          ^                                   ^
                                   |         /                                     \
     Num of Lanes - V5:         1  | V1  141 -----                                  ----       3 V6
     Excl LT - V4 (Y/N):        N  |
     Excl RT - V6 (Y/N):        N  | V2  612 ------->                             <----      414 V5
  Stop/Yield - V6 (Y/N):        N  |
      Grade - V4,V5,V6:        -2  | V3   23 -----                                  ----      17 V4
                                   |          \                                    /
---------MINOR STREET---------     |           v                                  v      MAJOR STREET
    Num of Lanes - V8:          1  |                                                     KULA HWY
      Grade - V7,V8,V9:         0  |              <           ^            >
    Shared Lane-V7,8,9:         3  |               \          |           /
(0=N,1=LT,2=TR,3=LTR)              |               |          |           |
                                   |               |          |           |
     Num of Lanes - V11:        1  |               23         22          22
   Grade - V10,V11,V12:         0  |
Shared Lane-V10,11,12:          3  |              V7         V8          V9
(0=N,1=LT,2=TR,3=LTR)              |
                                   |             MINOR STREET - OMAOPIO RD
----------------------------------------------------------------------------------------------------------
VOLUME ADJUSTMENTS                 |
  MOVEMENT NO.                     |      1    2    3    4    5    6    7    8    9    10    11    12
  HOURLY FLOW RATE, V(vph)         |    141  612   23   17  414    3   23   22   22     5    14    53
  VOLUME, v (pcph)                 |    197  612   23   17  414    3   25   24   24     6    15    58
----------------------------------------------------------------------------------------------------------
STEP 1: RT FROM MINOR STREET       |                                  |
  Conflicting Flows:               |Vc9 = 1/2 V3 + V2 =     612  vhp  |  Vc12 = 1/2 V6 + V5 =     416 vhp
  Potential Capacity:              |Cp,9 =                  678 pcph  |  Cp,12 =                  853 pcph
  Movement Capacity:               |Cm,9=Cp,9=              678 pcph  |  Cm,12=Cp,12=             853 pcph
  Prb. of Queu-free State:         |po,9=1-v9/Cm,9=        0.96       |  po,12=1-v12/Cm,12=      0.93
----------------------------------------------------------------------------------------------------------
STEP 2: LT FROM MAJOR STREET       |                                  |
  Conflicting Flows:               |Vc,4 = V2 + V3 =        612  vhp  |  Vc,1 = V5 + V6 =         417 vhp
  Potential Capacity:              |Cp,4 =                  876 pcph  |  Cp,1 =                  1085 pcph
  Movement Capacity:               |Cm,4=Cp,4=              876 pcph  |  Cm,1=Cp,1=              1085 pcph
  Prb. of Queu-free State:         |po,4=1-v4/Cm4=         0.98       |  po,1=1-v1/Cm1=          0.82
  Major Left Shared Lane           |                                  |
    Prob. of Queue-free State      |p*o,4=                 0.97       |  p*o,1=                  0.72
----------------------------------------------------------------------------------------------------------
```


----continued ----

ATA Inc. TWO-WAY STOP CONTROLLED INTERSECTION LEVEL OF SERVICE ANALYSIS 1994 HCM

Major Street:	KULA HWY	DATE:	27-Jun-95
Minor Street:	OMAOPIO RD	Analyst:	BC
Scenario:	YEAR 2005 + PROJECT	File Name:	KULOMA-P
Peak Hour:	PM	Intesection Intesection #:	4

STEP 3: TH FROM MINOR STREET

Conflicting Flows:	Vc.,8 = 1/2V3+V2+V1+V6+V5+V4 :	1187 vph	Vc.,11 = 1/2V6+V5+V4+V3+V2+V1 :	1184 vph
Potential Capacity:	Cp,8 =	260 pcph	Cp,11 =	261 pcph
Capacity Adj Factor:	f8 = po,4*po,1 =	0.71	f11 = po,4*po,1 =	0.71
Movement Capacity:	Cm,8 = Cp,8*f8 =	183 pcph	Cm,11 = Cp,11*f11 =	184 pcph
Prob. of Queue-free State:	po,8 = 1-v8/Cm,8 =	0.87	po,11 = 1-v11/Cm,11 =	0.92

STEP 4: LT FROM MINOR STREET

Conflicting Flows:	Vc,7 = 1/2V3+V2+V1+1/2V6+V5+V4+ 1/2(V11+V12) =	1219 vph	Vc,10 = 1/2V6+V5+V4+1/2V3+V2+V1+ 1/2(V8+V9) =	1208 vph
Potential Capacity:	Cp7 =	208 pcph	Cp10 =	212 pcph
Major Left, Minor Through Impedance Factor:	p''7=po,11*f11 =	0.65	p''10=po,8*f8 =	0.61
Major Left, Minor Through Adjusted Impedance Factor:	p'7 =	0.73	p'10 =	0.70
Capacity Adjustment Factor:	f7 = p'7*po,12 =	0.68	f10 = p'10*po,9 =	0.67
Movement Capacity:	Cm,7 = f7*Cp,7 =	141 pcph	Cm,10 = f10*Cp,10 =	143 pcph

DELAY AND LEVEL OF SERVICE SUMMARY

MOVEMENT	v(pcph)	cm(pcph)	csh(pcph)	AVG TOTAL DELAY	LOS
MINOR LEFT TURN (7)	25	141	SHRD	SHRD	--
MINOR THROUGH (8)	24	183	213	25.5	D
MINOR RIGHT TURN (9)	24	678	SHRD	SHRD	----
MINOR LEFT TURN (10)	6	143	SHRD	SHRD	--
MINOR THROUGH (11)	15	184	412	10.8	C
MINOR RIGHT TURN (12)	58	853	SHRD	SHRD	--
MAJOR LEFT (1)	197	1085	--NA--	4.1	A
MAJOR LEFT (4)	17	876	--NA--	4.2	A
MINOR APPROACH (7)(8)(9)	-	-	-	25.5	D
MINOR APPROACH (10)(11)(12)	-	-	-	10.8	C
MAJOR APPROACH (1)(2)(3)	-	-	-	1.0	A
MAJOR APPROACH (4)(5)(6)	-	-	-	0.2	A
TOTAL INTERSECTION (1-12)	-	-	-	2.7	A

LEVEL OF SERVICE CRITERIA

LEVEL OF SERVICE	AVG TOTAL DELAY (SEC/VEH)
A	<=5
B	>5&<=10
C	>10&<=20
D	>20&<=30
E	>30&<=45
F	>45

ATA Inc. STOP CONTROLLED T-INTERSECTION LEVEL OF SERVICE ANALYSIS 1994 HCM

Major Street: KULA HWY		Date:	27-Jun
Minor Street: KEKAULIKE AV		Analyst:	BC
Peak Hour:	AM	File Name:	KULKEK-A
Scenario: YEAR 2005 + PROJECT		Intersection:	5

```
Peak Hour Factor:      1.00 |
--------MAJOR STREET--------| V2   376 ----------->          <--------- 175    V5
   Num of Lanes - V2:    1  |
   Excl RT - V3 (Y/N):   N  | V3     8 -----                      ----- 22      V4
 Stop/Yield - V3 (Y/N):  N  |              \                     /
      % Grade - V2,V3:   2  |               v                   v    MAJOR STREET:
                            |                                        KULA HWY
                            |                     <         >
   Num of Lanes - V5:    1  |                      \       /
   Excl LT - V4 (Y/N):   N  |                       |     |
     % Grade - V4,V5:   -2  |                       |     |
                            |                       20     61              NORTH--->
--------MINOR STREET--------|
  Num of Lanes - V7,V9:  1  |
    Shared Lane (Y/N):   Y  |                       V7     V9
      % Grade - V7&V9:  -2  |           MINOR STREET: KEKAULIKE AV
```

VOLUME ADJUSTMENTS						
MOVEMENT NO.	2	3	4	5	7	9
VOLUME, V (vph)	376	8	22	175	20	61
VOLUME, v (pcph)	376	8	22	175	20	61

STEP 1: RT FROM MINOR STREET - V9

Conflicting Flows:	Vc,9 = 1/2*V3+V2 =	4 + 376 =	380 vph
Potential Capacity:	Cp,9 =		889 pcph
Movement Capacity:	Cm,p = Cp,9 =		889 pcph

STEP 2: LT FROM MAJOR STREET - V4

Conflicting Flows:	Vc,4 = V3+V2 =	8 + 376 =	384 vph
Potential Capacity:	Cp,4 =		1125 pcph
Movement Capacity:	Cm,4 = Cp,4 =		1125 pcph
Prob. of Queue-free State:	po,4 = 1-v4/Cm,4 =		0.98
Major Left Shared Lane Prob. of Queue-free State:	p*o,4 =		0.98

STEP 3: LT FROM MINOR STREET - V7

Conflicting Flows:	Vc,7 = 1/2V3+V2+V5+V4 =	577 vph
Potential Capacity:	Cp,7 =	491 pcph
Capacity Adjustment Factor Due To Impeding Movements:	f7=po,4=	0.98
Movement Capacity:	Cm,7 = Cp,7 =	480 pcph

DELAY AND LEVEL OF SERVICE SUMMARY

Movement	v(vcph)	cm(pcph)	csh (pcph)	AVG TOTAL DELAY	LOS
MINOR LEFT TURN (7)	20	480	SHRD	SHRD	SHRD
MINOR RIGHT TURN (9)	61	889	734	5.5	B
MAJOR LEFT TURN (4)	22	1125	------	3.3	A

AVERAGE MINOR APPROACH DELAY = 5.5 sec/veh | AVERAGE TOTAL INTERSECTION DELAY = 0.8 sec/veh
LEVEL OF SERVICE = B | LEVEL OF SERVICE = A

ATA Inc. STOP CONTROLLED T-INTERSECTION LEVEL OF SERVICE ANALYSIS 1994 HCM

Major Street: KULA HWY
Minor Street: KEKAULIKE AV
Peak Hour: PM
Scenario: YEAR 2005 + PROJECT

Date: 27-Jun
Analyst: BC
File Name: KULKEK-P
Intersection: 5

```
Peak Hour Factor:          1.00 |
--------MAJOR STREET-------- | V2   280 ----------->            <--------- 384    V5
   Num of Lanes - V2:         1 |
   Excl RT - V3 (Y/N):        N | V3    27 -----                      ----- 57    V4
Stop/Yield - V3 (Y/N):        N |              \                  /
   % Grade - V2,V3:           2 |               v                v     MAJOR STREET:
                                |                                      KULA HWY
                                |                    <       >
   Num of Lanes - V5:         1 |                     \     /
   Excl LT - V4 (Y/N):        N |                      |    |
   % Grade - V4,V5:          -2 |                      |    |
                                |                      22   38              NORTH--->
--------MINOR STREET--------    |
 Num of Lanes - V7,V9:        1 |
   Shared Lane (Y/N):         Y |                     V7    V9
   % Grade - V7&V9:          -2 |        MINOR STREET: KEKAULIKE AV
```

VOLUME ADJUSTMENTS

MOVEMENT NO.	2	3	4	5	7	9
VOLUME, V (vph)	280	27	57	384	22	38
VOLUME, v (pcph)	280	27	57	384	22	38

STEP 1: RT FROM MINOR STREET - V9

Conflicting Flows:	Vc,9 = 1/2*V3+V2 = 14 + 280 =	294	vph
		983	pcph
Potential Capacity:	Cp,9 =	983	pcph
Movement Capacity:	Cm,p = Cp,9 =		

STEP 2: LT FROM MAJOR STREET - V4

Conflicting Flows:	Vc,4 = V3+V2 = 27 + 280 =	307	vph
Potential Capacity:	Cp,4 =	1224	pcph
Movement Capacity:	Cm,4 = Cp,4 =	1224	pcph
Prob. of Queue-free State:	po,4 = 1-v4/Cm,4 =	0.95	
Major Left Shared Lane Prob. of Queue-free State:	p*o,4 =	0.94	

STEP 3: LT FROM MINOR STREET - V7

Conflicting Flows:	Vc,7 = 1/2V3+V2+V5+V4 =	735	vph
Potential Capacity:	Cp,7 =	398	pcph
Capacity Adjustment Factor Due To Impeding Movements:	f7=po,4=	0.94	
Movement Capacity:	Cm,7 = Cp,7 =	373	pcph

DELAY AND LEVEL OF SERVICE SUMMARY

Movement	v(vcph)	cm(pcph)	csh (pcph)	AVG TOTAL DELAY	LOS
MINOR LEFT TURN (7)	22	373	SHRD	SHRD	SHRD
MINOR RIGHT TURN (9)	38	983	615	6.5	B
MAJOR LEFT TURN (4)	57	1224	------	3.1	A

AVERAGE MINOR APPROACH DELAY = 6.5 sec/veh
LEVEL OF SERVICE = B

AVERAGE TOTAL INTERSECTION DELAY = 0.7 sec/veh
LEVEL OF SERVICE = A

```
ATA Inc.          STOP CONTROLLED T-INTERSECTION LEVEL OF SERVICE ANALYSIS              1994 HCM
===============================================================================================
                                                                          Date:      27-Jun
Major Street: KULA HWY                                                    Analyst:       BC
Minor Street: ACCESS ROAD "A"                                             File Name:  KULRDA-A
   Peak Hour:      AM                                                     Intersection:    6
   Scenario: YEAR 2005 + PROJECT
-----------------------------------------------------------------------------------------------
Peak Hour Factor:        1.00 |
--------MAJOR STREET-------- | V2    170 ----------->              <---------   77     V5
    Num of Lanes - V2:      1 |
    Excl RT - V3 (Y/N):     N | V3    24 -----                          -----    5     V4
  Stop/Yield - V3 (Y/N):    N |             \                       /
         % Grade - V2,V3:   2 |              v                     v     MAJOR STREET:
                              |                                          KULA HWY
                              |
    Num of Lanes - V5:      1 |                     <          >
    Excl LT - V4 (Y/N):     N |                      \        /
         % Grade - V4,V5:  -2 |                       |      |
                              |                       |      |
                              |                       69     5                <--- NORTH
--------MINOR STREET-------- |
  Num of Lanes - V7,V9:     1 |
      Shared Lane (Y/N):    Y |                       V7     V9
       % Grade - V7&V9:    -2 |             MINOR STREET: ACCESS ROAD "A"
-----------------------------------------------------------------------------------------------
VOLUME ADJUSTMENTS
  MOVEMENT NO.                  2         3          4             5          7          9
  VOLUME, V (vph)             170        24          5            77         69          5
  VOLUME, v (pcph)            170        24          5            77         69          5
-----------------------------------------------------------------------------------------------
STEP 1: RT FROM MINOR STREET - V9
  Conflicting Flows:    | Vc,9 = 1/2*V3+V2 =          12   +   170      =       182   vph
  Potential Capacity:   | Cp,9 =                                                1120  pcph
  Movement Capacity:    | Cm,p = Cp,9 =                                         1120  pcph
-----------------------------------------------------------------------------------------------
STEP 2: LT FROM MAJOR STREET - V4
  Conflicting Flows:              |  Vc,4 = V3+V2 =          24   +   170   =      194   vph
  Potential Capacity:             |  Cp,4 =                                        1386  pcph
  Movement Capacity:              |  Cm,4 = Cp,4 =                                 1386  pcph
  Prob. of Queue-free State:      |  po,4 = 1-v4/Cm,4 =                            1.00
  Major Left Shared Lane          |
   Prob. of Queue-free State:     |  p*o,4 =                                       1.00
-----------------------------------------------------------------------------------------------
STEP 3: LT FROM MINOR STREET - V7
  Conflicting Flows:              |  Vc,7 = 1/2V3+V2+V5+V4 =                       264   vph
  Potential Capacity:             |  Cp,7 =                                        745  pcph
  Capacity Adjustment Factor      |
   Due To Impeding Movements:     |  f7=po,4=                                      1.00
  Movement Capacity:              |  Cm,7 = Cp,7 =                                 742  pcph
-----------------------------------------------------------------------------------------------
DELAY AND LEVEL OF SERVICE SUMMARY                          csh    AVG TOTAL
    Movement                   v(vcph)       cm(pcph)     (pcph)     DELAY      LOS
  ------------                ---------      --------     ------     -----     ------

  MINOR LEFT TURN   (7)          69            742         SHRD       SHRD      SHRD
  MINOR RIGHT TURN  (9)           5           1120          759        5.3        A
  MAJOR LEFT TURN   (4)           5           1386         ------      2.6        A
-----------------------------------------------------------------------------------------------
    AVERAGE MINOR APPROACH DELAY =   5.3 sec/veh  |  AVERAGE TOTAL INTERSECTION DELAY =   1.1 sec/veh
                LEVEL OF SERVICE =    A           |                  LEVEL OF SERVICE =   A
===============================================================================================
```

```
ATA Inc.            STOP CONTROLLED T-INTERSECTION LEVEL OF SERVICE ANALYSIS            1994 HCM
=====================================================================================================
Major Street: KULA HWY                                                          Date:     27-Jun
Minor Street: ACCESS ROAD "A"                                                   Analyst:      BC
   Peak Hour:      PM                                                           File Name: KULRDA-P
    Scenario: YEAR 2005 + PROJECT                                               Intersection:  6
-----------------------------------------------------------------------------------------------------
Peak Hour Factor:        1.00 |
--------MAJOR STREET-------- | V2    322 ----------->              <--------- 172      V5
     Num of Lanes - V2:     1 |
    Excl RT - V3 (Y/N):     N | V3     83 -----                      -----     5       V4
  Stop/Yield - V3 (Y/N):    N |              \                     /
      % Grade - V2,V3:      2 |               v                   v        MAJOR STREET:
                              |                                            KULA HWY
     Num of Lanes - V5:     1 |                     <        >
    Excl LT - V4 (Y/N):     N |                      \      /
      % Grade - V4,V5:     -2 |                       |     |
                              |                       |     |
--------MINOR STREET-------- |                      45     5            <--- NORTH
 Num of Lanes - V7,V9:      1 |
    Shared Lane (Y/N):      Y |                      V7     V9
     % Grade - V7&V9:      -2 |         MINOR STREET: ACCESS ROAD "A"
-----------------------------------------------------------------------------------------------------
VOLUME ADJUSTMENTS
 MOVEMENT NO.                    2        3         4          5        7        9
 VOLUME, V (vph)               322       83         5        172       45        5
 VOLUME, v (pcph)              322       83         5        172       45        5
-----------------------------------------------------------------------------------------------------
STEP 1: RT FROM MINOR STREET - V9
 Conflicting Flows:    | Vc,9 = 1/2*V3+V2 =        42  +  322      =        364  vph
 Potential Capacity:   | Cp,9 =                                             906  pcph
 Movement Capacity:    | Cm,p = Cp,9 =                                      906  pcph
-----------------------------------------------------------------------------------------------------
STEP 2: LT FROM MAJOR STREET - V4
 Conflicting Flows:                | Vc,4 = V3+V2 =          83  +  322  :      405   vph
 Potential Capacity:               | Cp,4 =                                    1099   pcph
 Movement Capacity:                | Cm,4 = Cp,4 =                             1099   pcph
 Prob. of Queue-free State:        | po,4 = 1-v4/Cm,4 =                        1.00
 Major Left Shared Lane            |
  Prob. of Queue-free State:       | p*o,4 =                                   0.99
-----------------------------------------------------------------------------------------------------
STEP 3: LT FROM MINOR STREET - V7
 Conflicting Flows:                | Vc,7 = 1/2V3+V2+V5+V4 =                    541   vph
 Potential Capacity:               | Cp,7 =                                     515   pcph
 Capacity Adjustment Factor        |
  Due To Impeding Movements:       | f7=po,4=                                  0.99
 Movement Capacity:                | Cm,7 = Cp,7 =                              512   pcph
-----------------------------------------------------------------------------------------------------
DELAY AND LEVEL OF SERVICE SUMMARY
  Movement                 v(vcph)      cm(pcph)     csh    AVG TOTAL
                                                   (pcph)     DELAY      LOS
  ------------             ---------    --------   ------     -----     ------
 MINOR LEFT TURN   (7)        45           512       SHRD      SHRD      SHRD
 MINOR RIGHT TURN  (9)         5           906       536        7.4        B
 MAJOR LEFT TURN   (4)         5          1099      ------      3.3        A
-----------------------------------------------------------------------------------------------------
  AVERAGE MINOR APPROACH DELAY =   7.4 sec/veh  |  AVERAGE TOTAL INTERSECTION DELAY =   0.6 sec/veh
              LEVEL OF SERVICE =   B            |                  LEVEL OF SERVICE =   A
=====================================================================================================
```

```
ATA Inc.              STOP CONTROLLED T-INTERSECTION LEVEL OF SERVICE ANALYSIS              1994 HCM
=====================================================================================================
Major Street: KULA HWY                                                          Date:      27-Jun
Minor Street: ACCESS ROAD "B"                                                   Analyst:       BC
   Peak Hour:       AM                                                          File Name:  KULRDB-A
   Scenario: YEAR 2005 + PROJECT                                                Intersection:     7
-----------------------------------------------------------------------------------------------------
Peak Hour Factor:     1.00 |
--------MAJOR STREET-------- | V2     121 ----------->             <--------- 182      V5
   Num of Lanes - V2:      1 |
   Excl RT - V3 (Y/N):     N | V3      49 -----                          -----   5      V4
 Stop/Yield - V3 (Y/N):    N |               \                          /
      % Grade - V2,V3:     2 |                v                        v     MAJOR STREET:
                             |                                               KULA HWY
                             |
   Num of Lanes - V5:      1 |                      <          >
   Excl LT - V4 (Y/N):     N |                       \        /
      % Grade - V4,V5:    -2 |                        |       |
                             |                        |       |
--------MINOR STREET-------- |                       139      5              <--- NORTH
 Num of Lanes - V7,V9:     1 |
   Shared Lane (Y/N):      Y |                      V7       V9
      % Grade - V7&V9:    -2 |              MINOR STREET: ACCESS ROAD "B"
-----------------------------------------------------------------------------------------------------
VOLUME ADJUSTMENTS
 MOVEMENT NO.                    2          3          4           5          7           9
 VOLUME, V (vph)               121         49          5         182        139           5
 VOLUME, v (pcph)              121         49          5         182        139           5
-----------------------------------------------------------------------------------------------------
STEP 1: RT FROM MINOR STREET - V9
 Conflicting Flows:    | Vc,9 = 1/2*V3+V2 =          25   +   121      :         146   vph
 Potential Capacity:   | Cp,9 =                                                 1168   pcph
 Movement Capacity:    | Cm,p = Cp,9 =                                          1168   pcph
-----------------------------------------------------------------------------------------------------
STEP 2: LT FROM MAJOR STREET - V4
 Conflicting Flows:             |  Vc,4 = V3+V2 =          49   +   121    :       170   vph
 Potential Capacity:            |  Cp,4 =                                         1423   pcph
 Movement Capacity:             |  Cm,4 = Cp,4 =                                  1423   pcph
 Prob. of Queue-free State:     |  po,4 = 1-v4/Cm,4 =                             1.00
 Major Left Shared Lane         |
  Prob. of Queue-free State:    |  p*o,4 =                                        1.00
-----------------------------------------------------------------------------------------------------
STEP 3: LT FROM MINOR STREET - V7
 Conflicting Flows:             |  Vc,7 = 1/2V3+V2+V5+V4 =                         333   vph
 Potential Capacity:            |  Cp,7 =                                          680   pcph
 Capacity Adjustment Factor     |
  Due To Impeding Movements:    |  f7=po,4=                                       1.00
 Movement Capacity:             |  Cm,7 = Cp,7 =                                   677   pcph
-----------------------------------------------------------------------------------------------------
DELAY AND LEVEL OF SERVICE SUMMARY                         csh    AVG TOTAL
   Movement                 v(vcph)        cm(pcph)       (pcph)    DELAY     LOS
 ------------              ----------      --------       ------    -----    ------
 MINOR LEFT TURN   (7)        139             677          SHRD      SHRD     SHRD
 MINOR RIGHT TURN  (9)          5            1168           687       6.6      B
 MAJOR LEFT TURN   (4)          5            1423          ------     2.5      A
-----------------------------------------------------------------------------------------------------
    AVERAGE MINOR APPROACH DELAY =   6.6 sec/veh  |  AVERAGE TOTAL INTERSECTION DELAY =    1.9 sec/veh
                LEVEL OF SERVICE =   B            |                  LEVEL OF SERVICE =    A
=====================================================================================================
```

```
ATA Inc.                STOP CONTROLLED T-INTERSECTION LEVEL OF SERVICE ANALYSIS                    1994 HCM
==========================================================================================================
Major Street: KULA HWY
Minor Street: ACCESS ROAD "B"                                                        Date:      27-Jun
   Peak Hour:      PM                                                            Analyst:         BC
    Scenario: YEAR 2005 + PROJECT                                              File Name:    KULRDB-P
                                                                            Intersection:          7
----------------------------------------------------------------------------------------------------------
Peak Hour Factor:        1.00  |
--------MAJOR STREET--------   | V2    153 ----------->                 <--------- 173      V5
     Num of Lanes - V2:     1  |
    Excl RT - V3 (Y/N):     N  | V3    169 -----                              -----  5      V4
 Stop/Yield - V3 (Y/N):     N  |                \                          /
       % Grade - V2,V3:     2  |                 v                        v      MAJOR STREET:
                               |                                                 KULA HWY
     Num of Lanes - V5:     1  |                        <           >
    Excl LT - V4 (Y/N):     N  |                         \         /
       % Grade - V4,V5:    -2  |                          |        |
                               |                          |        |
--------MINOR STREET--------   |                          90       5          <--- NORTH
  Num of Lanes - V7,V9:     1  |
     Shared Lane (Y/N):     Y  |                        V7         V9
       % Grade - V7&V9:    -2  |                  MINOR STREET: ACCESS ROAD "B"
----------------------------------------------------------------------------------------------------------
VOLUME ADJUSTMENTS
  MOVEMENT NO.                        2          3            4            5          7           9
  VOLUME, V (vph)                   153        169            5          173         90           5
  VOLUME, v (pcph)                  153        169            5          173         90           5
----------------------------------------------------------------------------------------------------------
STEP 1: RT FROM MINOR STREET - V9
  Conflicting Flows:       | Vc,9 = 1/2*V3+V2 =          85   +   153      :         238   vph
  Potential Capacity:      | Cp,9 =                                                 1050   pcph
  Movement Capacity:       | Cm,p = Cp,9 :                                          1050   pcph
----------------------------------------------------------------------------------------------------------
STEP 2: LT FROM MAJOR STREET - V4
  Conflicting Flows:            |  Vc,4 = V3+V2 =           169   +    153    :     322   vph
  Potential Capacity:           |  Cp,4 =                                          1204   pcph
  Movement Capacity:            |  Cm,4 = Cp,4 =                                   1204   pcph
  Prob. of Queue-free State:    |  po,4 = 1-v4/Cm,4 =                              1.00
  Major Left Shared Lane        |
   Prob. of Queue-free State:   |  p*o,4 =                                         1.00
----------------------------------------------------------------------------------------------------------
STEP 3: LT FROM MINOR STREET - V7
  Conflicting Flows:            |  Vc,7 = 1/2V3+V2+V5+V4 =                          416   vph
  Potential Capacity:           |  Cp,7 :                                           608   pcph
  Capacity Adjustment Factor    |
   Due To Impeding Movements:   |  f7=po,4=                                        1.00
  Movement Capacity:            |  Cm,7 : Cp,7 :                                    606   pcph
----------------------------------------------------------------------------------------------------------
DELAY AND LEVEL OF SERVICE SUMMARY                          csh    AVG TOTAL
    Movement               v(vcph)        cm(pcph)      (pcph)     DELAY      LOS
  ------------           -----------      --------      ------     -----     ------
  MINOR LEFT TURN   (7)      90              606         SHRD       SHRD      SHRD
  MINOR RIGHT TURN  (9)       5             1050          619        6.9        B
  MAJOR LEFT TURN   (4)       5             1204         ------      3.0        A
----------------------------------------------------------------------------------------------------------
     AVERAGE MINOR APPROACH DELAY :  6.9 sec/veh  |  AVERAGE TOTAL INTERSECTION DELAY :   1.1 sec/veh
                 LEVEL OF SERVICE :    B          |                 LEVEL OF SERVICE :    A
==========================================================================================================
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Appendix E

Preliminary Engineering Report

AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

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PRELIMINARY ENGINEERING REPORT
FOR THE
KULA RESIDENCE LOTS, UNIT 1
AT
WAIOHULI, KULA, MAKAWAO, MAUI, HAWAII
TAX MAP KEY: 2-2-02:56 AND 2-2-02:POR 14

I. INTRODUCTION

The purpose of this report is to summarize the basis of design used in the preparation of the grading and construction plans for the proposed 386-lot, single-family residential subdivision project. A description of the proposed project, the existing site conditions and the proposed grading, drainage and utility improvements are also provided in this report.

II. PROPOSED PROJECT

A. Location

The proposed project is located in the Waiohuli area of the Kula District on the island of Maui (refer to Exhibit 1). The site is located on the west side of Kula Highway, across from the Waiohuli-Keokea Homesteads. The total parcel area, designated by Tax Map Key Nos. 2-2-02:56 and 2-2-02:Por. 14, encompasses 668.25 acres (refer to Exhibit 2); however, the project will utilize approximately 460 acres of the total area. The project site is designated as "rural", as described in the Hawaii Revised Statutes, Section 205.

B. Land Ownership

The land owner and developer for this project is the State of Hawaii, Department of Hawaiian Home Lands.

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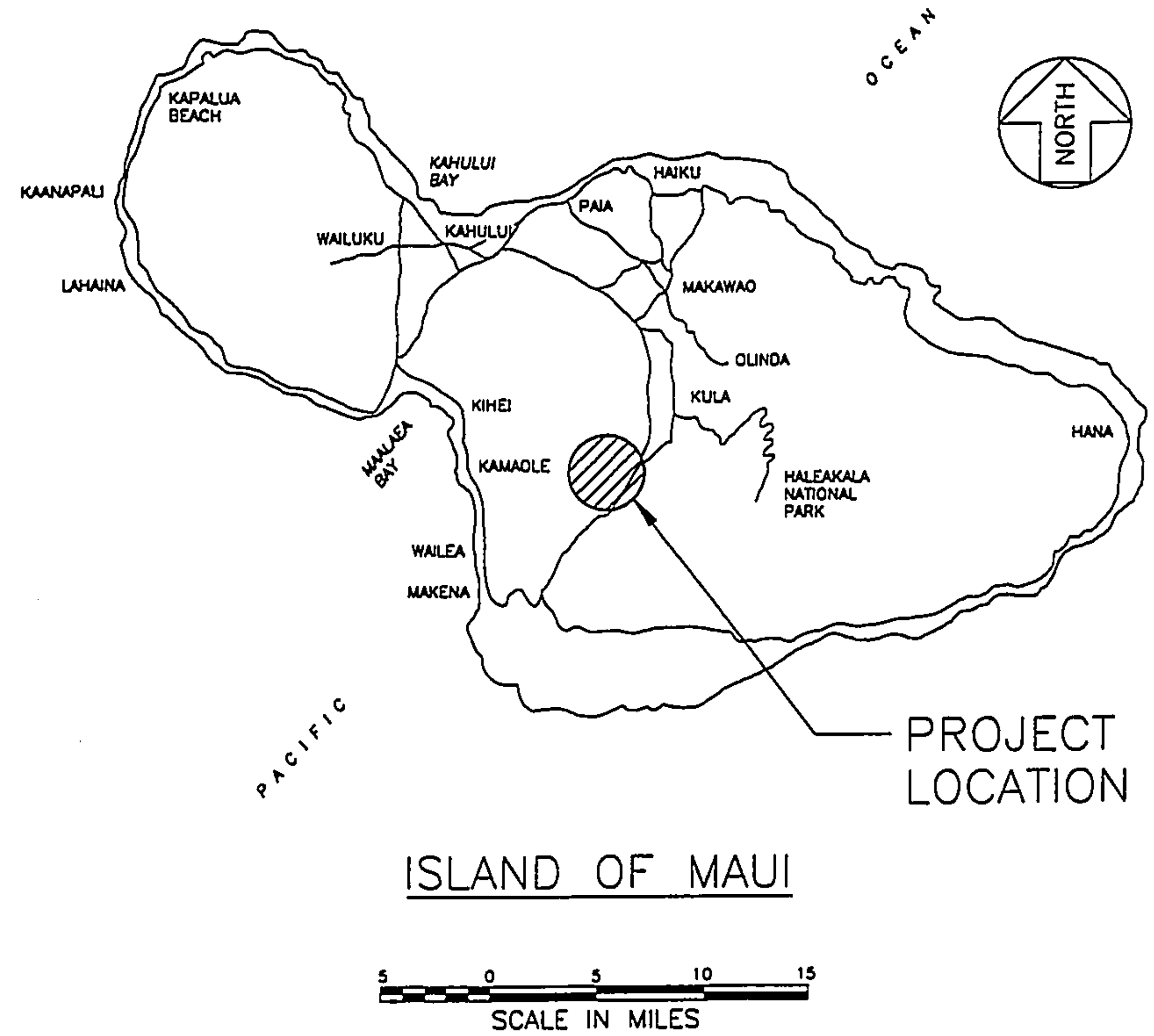

ENGINEERING REPORT KULA RESIDENCE LOTS, UNIT 1 WAIOHULI, KULA, MAKAWAO, MAUI, HAWAII	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS,SURVEYORS • HONOLULU,HAWAII LOCATION MAP	EXHIBIT 1

JOB NO. 93-610

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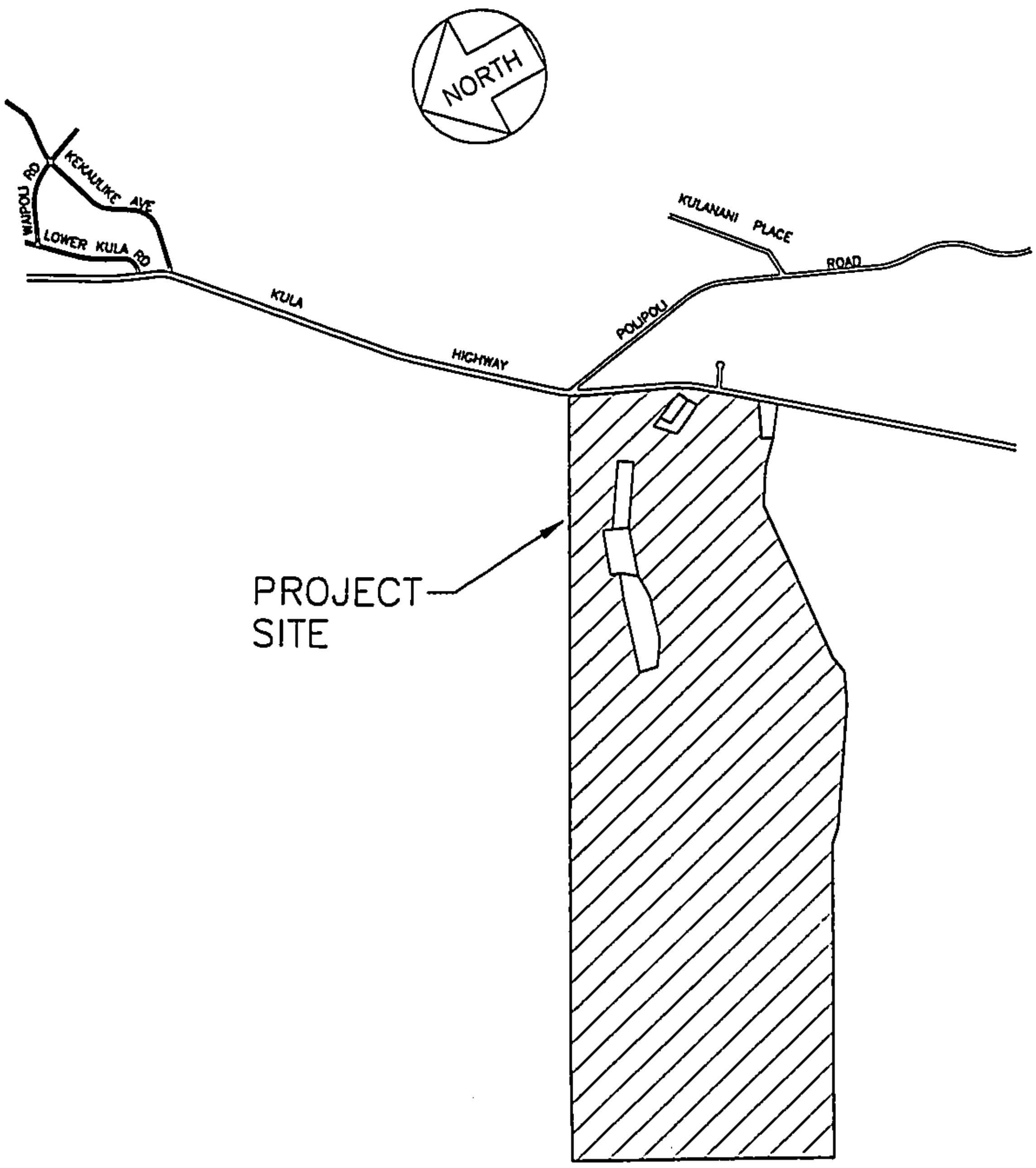

VICINITY MAP

NOT TO SCALE

ENGINEERING REPORT KULA RESIDENCE LOTS, UNIT 1 WAIOHULI, KULA, MAKAWAO, MAUI, HAWAII	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, HAWAII **VICINITY MAP**	EXHIBIT 2

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Five privately-owned kuleana parcels are located within the project site and are excluded from the proposed development. Access to these parcels will be maintained.

C. Project Description

The proposed Kula Residence Lots, Unit 1 rural subdivision will consist of 386 single-family residential lots, roadways and related infrastructure. Lot sizes will range from one-half acre to one acre. A 16-acre parcel will be set aside for park use. Additional parcels will be set aside to serve as water storage tank sites, electrical substations and other community needs. See schematic plat map (Exhibit 3).

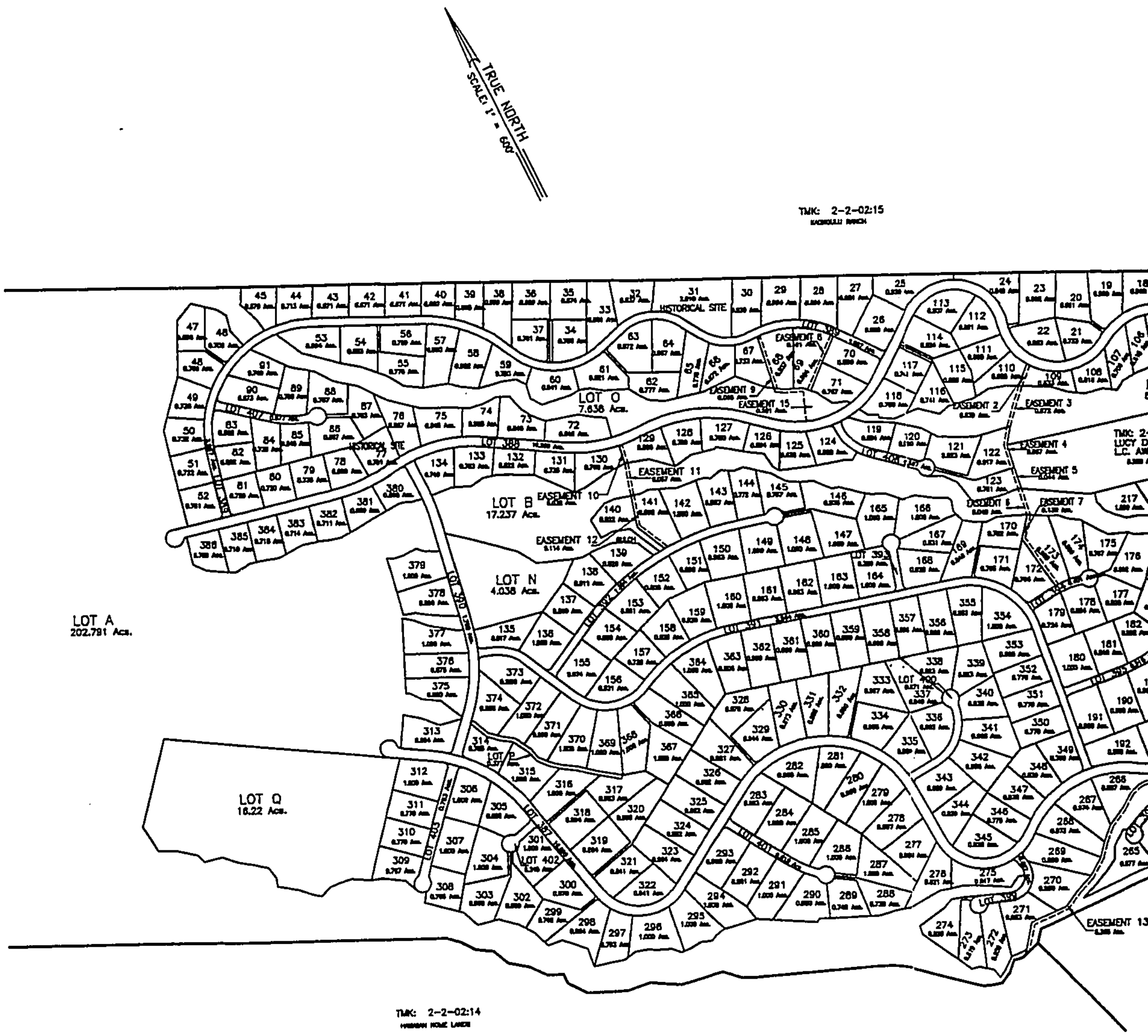
Drainage, water and individual wastewater systems will be provided, along with overhead electrical lines and a street lighting system. Catch basins, drain manholes, drain lines and water transmission lines will be provided within the proposed roadway right-of-way. Drainage culverts with inlet and outlet structures will be provided under sections of the roadway to accommodate drainage through the project site.

Archaeological sites on Lot 77 and the park parcel will be preserved and maintained. Other sites and features have been inventoried; the State Historic Preservation Division will investigate all finds and assess their significance. If data recovery is not completed before the commencement of construction, the sites will be protected by buffer zones.

III. EXISTING CONDITIONS

A. Topography and Soil Conditions

The project site slopes away from Kula Highway in a northwesterly direction at an average of 10 to 15 percent. The elevation ranges from 3,000 feet above Mean Sea Level (MSL) at Kula Highway to 1,800 feet (above MSL) at the outskirts of the site. The upper regions of the site are overgrown with trees, while the lower section is grassy, with lantana and



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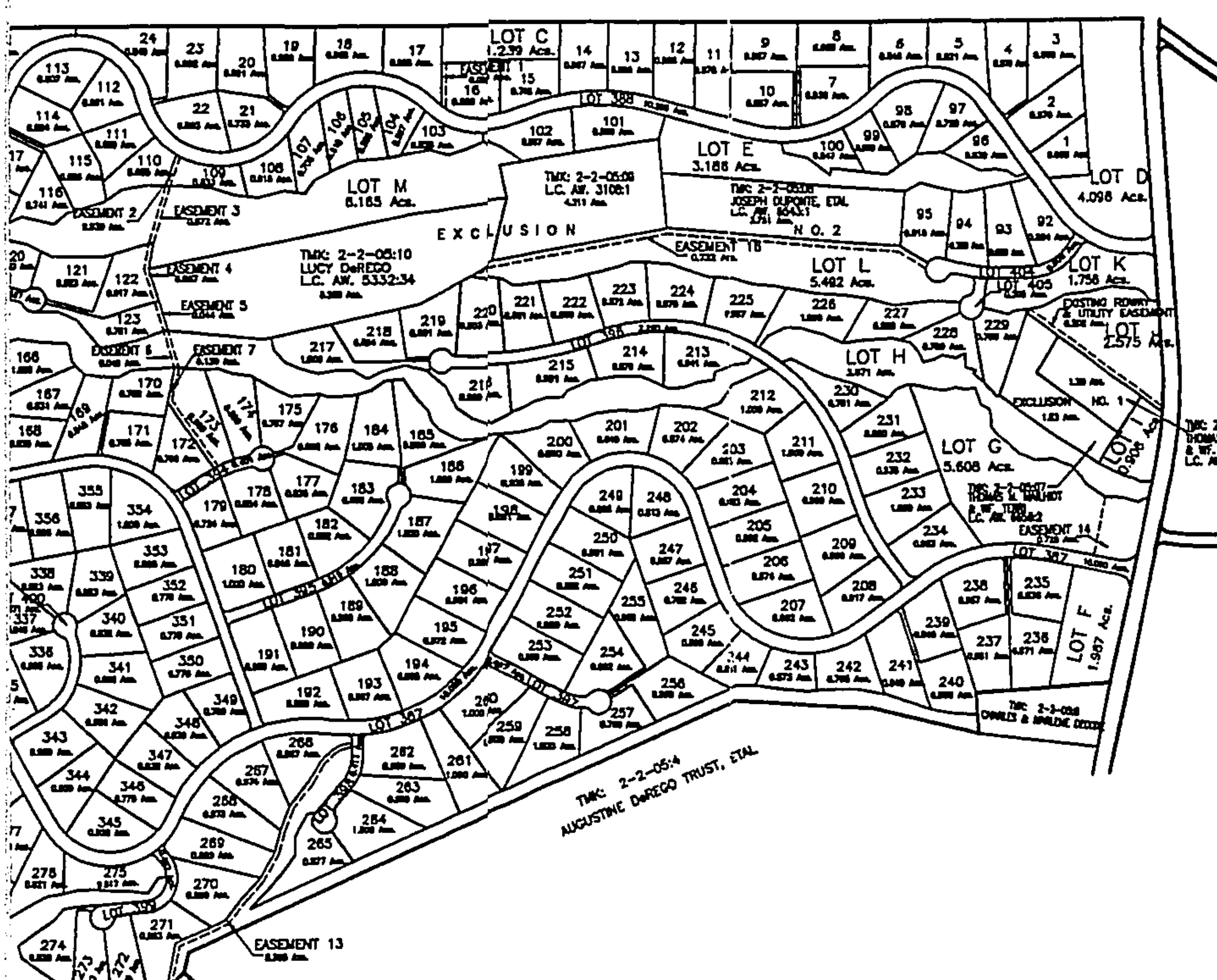

ENGINEERING REPORT KULA RESIDENCE LOTS, UNIT 1 WAIOHULI, KULA, MAKAWAO, MAUI, HAWAII	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS • SURVEYORS SCHEMATIC PLAT MAP	EXHIBIT 3

July 1995

cacti.

There are two types of soil classifications, as identified by the U.S. Department of Agriculture (USDA) Soil Conservation Service "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii", found on the project site. In the higher elevations, near Kula Highway, the soil series for the general area is Kula cobbly loam (KxaD), with 12 to 20 percent slopes. This soil is generally found on the intermediate uplands on the island of Maui. Permeability is moderately rapid. Runoff is medium, and the erosion hazard is moderate. At the lower elevations of the site, the soil classification is described as Kamaole very stony silt loam (KGKC), 3 to 15 percent slopes. This well-drained soil is found on the uplands of Maui. Permeability is moderate. Runoff is slow to medium, and the erosion hazard is slight to moderate.

A soils investigation has been conducted and a report will be prepared by Ernest K. Hirata and Associates, Inc.

B. Climate and Rainfall

The Kula area is generally sunny and cool throughout the year with temperatures averaging 75 degrees. The median annual rainfall amounts to 25 to 40 inches and is well distributed throughout the year. The Kula area has a climate typical of areas in the Hawaiian Islands exposed to prevailing northeasterly tradewinds. During the rainy season, October to April, the winds may vary with occasional strong, southerly winds accompanying cyclonic "Kona" storms.

C. Drainage

Presently, the offsite and onsite storm water runoff sheet flows in a northwesterly direction across the project site. Gullies and gulches located onsite convey the runoff through the site and towards two gulches bordering the site, Kaakaulua Gulch to the north and Waiohuli Gulch to the south. Downstream of the project site, Kaakaulua Gulch and Waiohuli Gulch will discharge runoff into Kulanihakoi Gulch and Waipuilani Gulch, respectively. See Offsite Hydrology Map (Exhibit 4). Ultimately, runoff from the gulches will be discharged into the Pacific Ocean.

D. Water

No water system exists within the project site. There are existing 6-inch waterlines that terminate at the intersection of Polipoli Road at Kula Highway and Lepelepe Place at Kula Highway, which are serviced from the Upper Kula Water Line. These waterlines are owned and maintained by the County of Maui, Department of Water Supply.

E. Wastewater

There is no County wastewater collection system or treatment facility in the vicinity. The project site is located in a "not critical" area, as shown on the State Department of Health "Critical Wastewater Disposal Areas" map.

IV. GRADING AND DRAINAGE PLAN

A. Grading

Grading for the project site will involve excavation and embankment within the roadway right-of-way and within some of the adjacent lots. Erosion control measures will be utilized during construction to minimize soil loss and erosion hazards.

B. Drainage

The drainage plan for the project will include grassed and paved swales along roadways, diversion ditches and swales, subsurface drainage system, roadway culverts, detention basins and realigning an existing gulch drainageway. The subsurface drainage system will include drain inlets, drain manholes, piping system and outlet structures.

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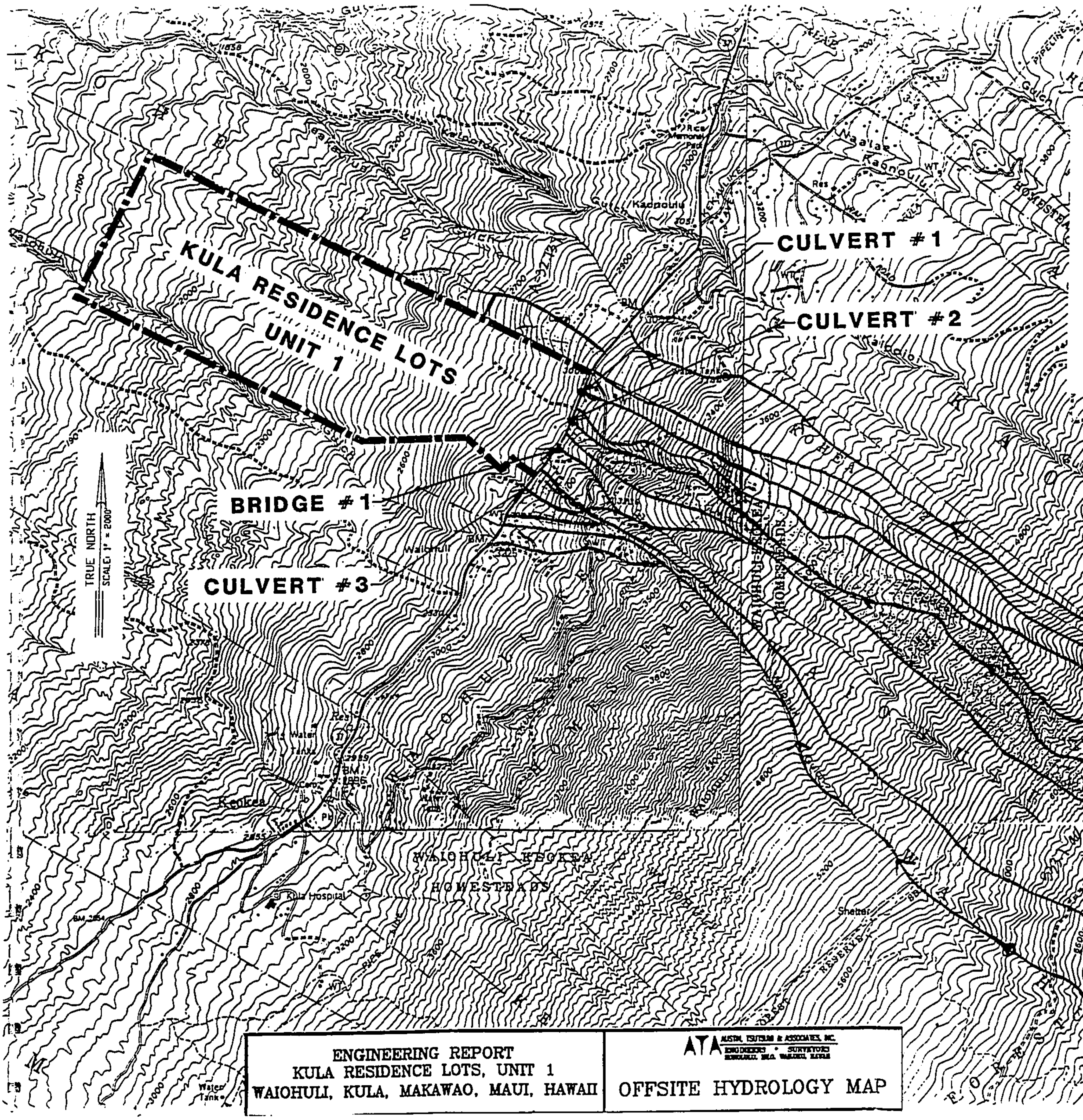

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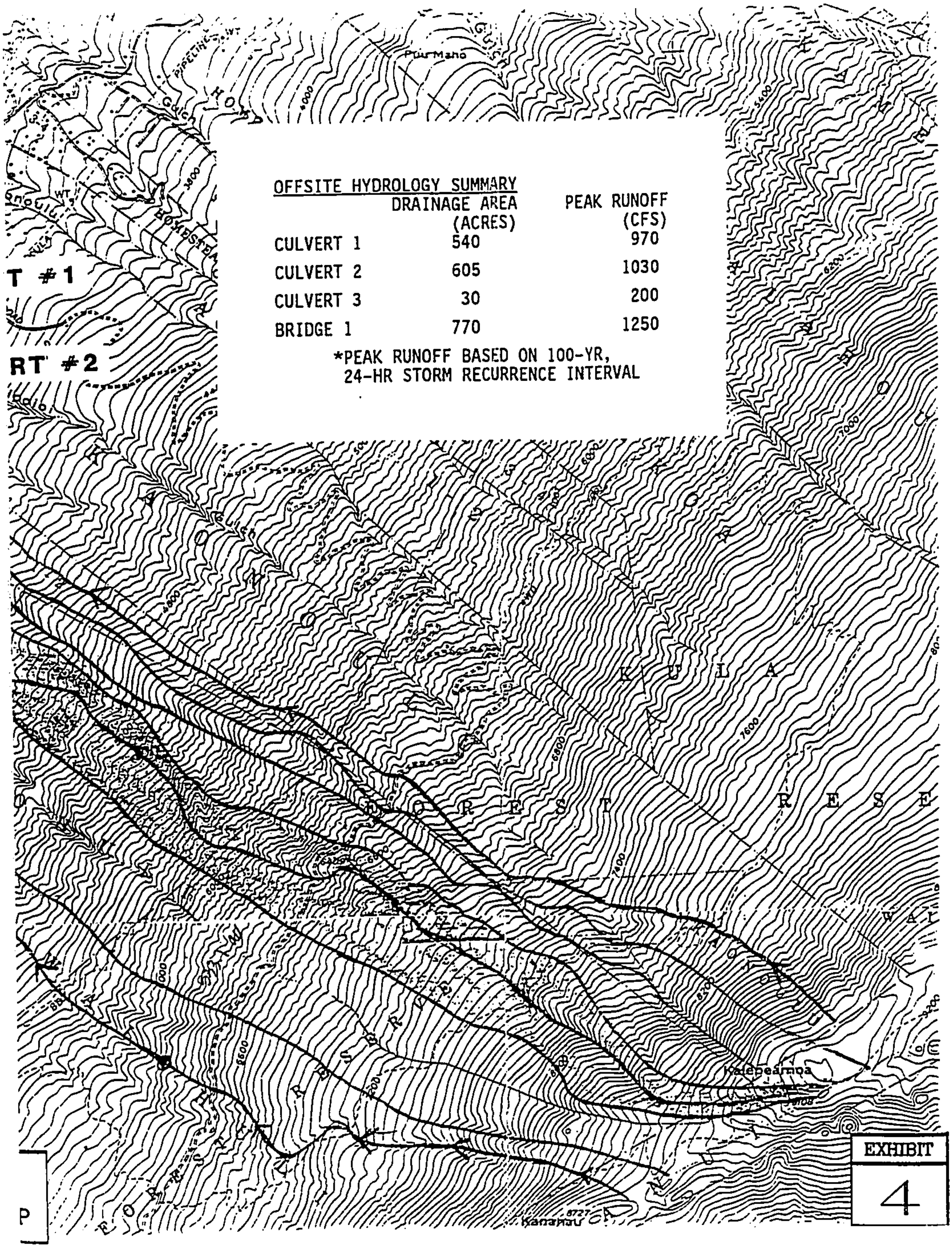

OFFSITE HYDROLOGY SUMMARY

	DRAINAGE AREA (ACRES)	PEAK RUNOFF (CFS)
CULVERT 1	540	970
CULVERT 2	605	1030
CULVERT 3	30	200
BRIDGE 1	770	1250

*PEAK RUNOFF BASED ON 100-YR, 24-HR STORM RECURRENCE INTERVAL

In general, the Rational Method will be used to determine the onsite storm water runoff quantities. The roadway and diversion swales and subsurface drainage system will be designed for the 10-year/1 hour storm recurrence interval. Detention basins and roadway culverts will be designed for the 50-year/1 hour storm recurrence interval. The Rational Method is briefly described as follows:

Q = CIA

Where:

Q = storm water runoff quantity (cfs)

C = runoff coefficient

I = rainfall intensity in inches per hour for a duration equal to the time of concentration (Tc)

A = drainage area (acres)

Applicable sections of the "Drainage Standards for County of Maui", County of Maui, Department of Public Works and Waste Management, July 1995, will be used as a reference.

The Natural Resources Conservation Service (NRCS) Hydrograph Analysis Method or the NRCS computer program TR20 will be used to determine the peak offsite storm runoff when analyzing the hydraulics for the culvert crossings at the major gulches and realignment of the existing gulch drainageway. The "National Engineering Handbook, Section 4, Hydrology, Supplement A", or latest revision will be used as reference. Preliminary calculations of peak offsite storm runoff that flow through the project site have been completed, using the method described in the "Erosion and Sediment Control Guide for Hawaii", NRCS, March 1981. The peak flows for the existing culvert crossings at Kula Highway are shown on Exhibit 4.

V. UTILITIES

A. Water System

The proposed water system will be constructed in accordance with the "Water System Standards" of the County of Maui, Department of Water Supply.

The proposed water system will be made up of four service zones. Service zone 1 will connect to the existing Upper Kula System. Service zone 2 will consist of a 1.5 MG reservoir tank with pipelines ranging in diameter from 6 to 12 inches. Service zone 3 will consist of a 0.2 MG reservoir tank with pipelines ranging in diameter from 6 to 12 inches. Service zone 4 will consist of a 0.1 MG reservoir tank with pipelines ranging in diameter from 12 to 6 inches.

Water from the existing Lower Kula System will flow into the proposed 0.2 MG tank in Service zone 3 via a new transmission line from Naalae Road. Water will then be pumped up to the proposed 1.5 MG tank in Service zone 2.

The design of the proposed water system pipelines will be based on parameters taken from the "Water System Standards," State of Hawaii, County of Maui, Volume 1, 1985 edition. Parameters used are as follows:

1. The average daily demand for a single family for Maui County will be equal to 600 gallons per day (gpd) per unit.
2. The average daily demand for the park will be equal to 1,700 gpd per acre.
3. The fire flow requirement will be based on a rural land use equal to 400 gallons per minute (gpm) for a duration of 2 hours.
4. The maximum daily flow plus fire flow will have a residual pressure of 20 psi at a critical fire hydrant.

5. The peak hour flow will have a minimum residual pressure of 40 psi.

6. The "C" values to be applied will be:

Diameter	"C"
4", 6"	100
8", 12"	110

7. The maximum velocity in mains will be:

   a. 10 feet per second for distribution mains with fire flow.

   b. 20 feet per second for transmission mains without water services or fire flow.

   c. 13 feet per second for fire line.

The average daily demand for the project is approximately 305,000 gallons per day.

B. Wastewater System

The proposed project will utilize cesspools as individual wastewater systems (IWS) for each lot. A variance will be sought from the State of Hawaii, Department of Health for the use of IWS, since the project will exceed the 50-lot limit, as described in the DOH Administrative Rules, Chapter 11-62, "Wastewater Systems".

C. Roadway System

The proposed roadway system will be based on the Maui County Codes, with the following exceptions:

1. Grass and paved swales will be used instead of curbs and gutters.

2. There will be no sidewalks.

3. The cul-de-sacs may be more than 550 feet or serve more than 20 lots.

4. Street trees will not be planted. Trees will be planted in the front of each parcel and maintained by individual lot owners.

The proposed roadway system will consist of collector streets, minor streets and cul-de-sacs. The collector streets will have a right-of-way width of 50 feet with a pavement width of 24 feet. The minor streets will have a right-of-way width of 40 feet with a pavement width of 22 feet. The cul-de-sacs will have a right-of-way width of 40 feet with a pavement width of 22 feet. All of the proposed streets will have 2-inch asphaltic concrete pavement and 6-inch crushed rock base course, with a 6-inch subbase course where required. Portland cement concrete pavement will be used for road slopes that exceed the paving limits of asphaltic concrete.

D. Electric, Street Lighting, Telephone and Cable Television Systems

Overhead lines for electrical, street lighting, telephone and cable television services will be provided by the respective utility companies.

VI. CONCLUSION

The proposed project will not have a significant short- or long-term impact on the existing community for the following reasons:

1. Five privately-owned kuleanas are located within the project site and are excluded from the proposed development, with access to these parcels being maintained.

2. The proposed project will provide the required onsite and offsite infrastructure improvements and, therefore, will not burden the existing utility systems surrounding the project.

3. Erosion control measures will be utilized during construction to minimize soil loss and erosion hazards.

4. The drainage system will be designed to minimize the impact of the project storm runoff to downstream and adjoining properties.

5. Archaeological sites, as designated by the State Historical Preservation Division, will be protected as required if data recovery is not completed before the commencement of construction. The archaeological findings on Lot 77 and the park parcel will be preserved and maintained as historical and cultural sites.